



वार्षिक प्रतिवेदन Annual Report 2013-14



राष्ट्रीय उष्ट्र अनुसंधान केन्द्र
(भारतीय कृषि अनुसंधान परिषद)

पोस्ट बैग-07, जोड़बीड़, बीकानेर-334 001, राजस्थान, भारत

NATIONAL RESEARCH CENTRE ON CAMEL
(Indian Council of Agricultural Research)
Post Bag-07, Jorbeer, Bikaner-334 001, Rajasthan, India



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National Research Centre on Camel
(Indian Council of Agricultural Research)
Post Bag-07, Jorbeer, Bikaner-334 001 (Raj.), India





Camel practice in Jaisalmer region (Rajasthan)



Camel practice in Pratapgarh



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Farmers Training under ATMA Project



Preface

It gives me pleasure to present the research achievements of National Research Centre on Camel, Bikaner for 2013-14 in this Annual Report which are noteworthy on account of focus of the Centre in recent years to project camel as an animal of alternate utility for the society. The significant achievements included—milk production characteristics study and the outcome of the milk production data is indicative of potential of all breeds of camels to be milch type. The breed differences do not exist for milk productivity but it demands concrete efforts to go for selection of breeding males both at institute as well as field/farmers level keeping in mind the milk production characteristics of the parents—both dam and the sire which belongs to better milking dam. On molecular level, the efforts are being done to identify the genes determining the milk yield. Whereas, to decide the importance of camel milk as human food the efforts to promote camel milk and its products—identification of worth of camel milk as functional food have been initiated and the benefits for activities of ACE inhibitory activity from fermented camel milk have been indicative of this.

The camel health in the field is suffering because of longstanding known problem of trypanosomiasis which has been the subject of research for scientists for past few years. However, the organisms' resistance and drug ineffectiveness warrants coordinated research efforts involving other institutes to identify new drug formulations and bring it in field for effective control. The research efforts have been initiated in this direction to look for effective indigenous plants and extracts. Similarly, the problem of fungal skin infections in camels was addressed by morphologically identifying the fungus species and isolates. For this dedicated Mycologists from Veterinary, Medical and Agricultural Sciences need be together to characterize, identify and offer solution to contain this problem of zoonotic importance. The Centre's efforts to look out for plant species to be effective mycocidal and mycostatic are on, but the other occurrence of new diseases like brucellosis, TB also warrants attention of researchers.

The solution to unresolved mystery of reproduction in camels in terms of identification of right stage of sexual cycle for best conception is being looked into by undertaking basic research and some meaningful efforts are required towards holistic research approach to know interplay of



hormones, other biochemical indicators and physical examination of gonads to know the right stage females for achieving optimum reproduction together with standardised AI protocol. These efforts will entail the future of camel as milch animal and will also lay foundation for further multiplication by adoption of suitable management tools.

The basic studies to understand gut microbiota of camels imparting functional uniqueness to camels to utilise fibrous feeds and still have low rate of methanogenesis are of significance and also applied nutrition research experiments conducted to rear camels on complete feed pellets in view of depleting feed resource base are noteworthy in view of ability of this animal species to thrive well on nutritionally poor feeds. The *in-vitro* evaluation carried out for some feed resources will further boost up the efforts to integrate these resources to formulate new economical diets having minimum but optimal required concentration of costly nutrients like energy and protein with judicious supplementation with needful required minerals.

The Centre has taken initiatives to address the problem of people engaged in camel husbandry related to health and management by conducting regular field visits by ambulatory clinic activity and regular conduct of Kisan Melas, Gosthies and Training Programmes. In addition this Centre has been imparting trainings to outside researchers for post doctoral, Ph.D. and Master's degree programmes beside some specific need based research trainings. The farmers utility programmes included free



of cost breeding services to she camels, organisation of health camps in camel inhabiting areas and also activities in TSP areas of Rajasthan and J&K.

The notable achievements regarding development include addition to infrastructure to support research and overall management of farm. The HRD of staff and enhancement of skill base through trainings has been a routine activity which helped in achieving the research and development targets. The whole hearted support of all staff of NRCC was key for these notable achievements. The direction and valuable suggestions received during RAC meetings deliberations helped the IRC meets to decide research areas and resulted in significant achievements. The development and urgent

issues were also discussed in IMC meets timely for the overall development of NRCC. The timely guidance, encouragement and support received from the Hon'ble DG, DDG(AS), ADG(AN&P), ADG(ABG), ADG(AH) are acknowledged.

It is hoped that the research achievements presented in this Annual Report meet the need of people engaged in camel research and development.

N.V. Patil
Director

1. Executive Summary

The herd strength of camels at National Research Centre livestock Farm on 1st of April 2013 was 328. During the year 6 camels of Mewari and 6 camels of Kachchhi breed were added to herd strength by purchasing it from the breeding tract. The conception rate at the centre remained 79.74% and pooled age at 1st service was 1797.13 ± 43.14 , 1st Calving 2204.33 ± 46.71 and gestation length was 384.17 ± 1.17 days.

The milk yield performance in terms of overall average two-teat daily milk production spanning 300 days' lactation period was 3.13 ± 0.15 litres and 300 days' yield was 905.18 ± 46.3 litres. The average daily yield and 300 days' yield in the four breeds was statistically similar in all breeds. The primers for amplification were designed and six 5' flanking regions of milk protein genes were successfully amplified in the dromedary.

Ultrasonography technique was used to identify females as pregnant, non-pregnant with follicles during the breeding season on the day of mating by male- natural selection and the females having follicles but not selected by male for mating and for further analysis the urine of the female camels was collected.

For evaluation of ACE inhibitory and antioxidant activities in the camel milk, samples before and after fermentation using *Lactobacilli acidophilus* and SARAS dahi starter cultures were used and these activities were observed to be significantly higher in all the fermented milk samples using *Lactobacilli acidophilus* culture. After comparative electrophoresis to evaluate profile of bioactive peptides produced by using *Lactobacilli Acidophilus* as starter culture, the variation as presence of unique band in camel milk was observed which was found missing in cattle and buffalo milk.

After examination of blood samples collected from different places of Rajasthan, 14 (9%) of camel found positive for Trypanosome infection and after its processing

for DNA for PCR amplification all these blood samples revealed specific signal of a distinct 500bp band. Besides, VSG genes of 205 and 448 kb were observed which is used for the accurate diagnosis of cameline surra. Kinetoplast DNA sequence was also exploited as "signature sequence", revealing 443 bp in the diagnosis of *T. evansi* infection (20%). The animals which showed higher ELISA value (27%) but negative by PCR might be due to recent application of trypanocidal drugs which eliminated the parasites from the peripheral circulation but not the antibodies already produced in the system as reflected in ELISA.

To investigate antifungal activity of 16 medicinal herbs, a total of 20 fungal isolates from camel skin infections were taken and maximum antifungal sensitivity observed with Eucalyptus (*Eucalyptus globulus*) aqueous extract followed by Anar (*Punica granatum*) aqueous extract and Garlic (*Allium sativum*) crude juice.

During the year 2013-14 while the causes of morbidity and mortality in camels for the year 2013-14 were investigated and of 4.02% abortions reported during this year, some were suspected for brucellosis by RBPT while some found positive in PCR were isolated and field camels are also being watched for brucellosis. After tuberculin test performed on 12 suspected camels, 4 were found reactors and 6 milk samples from the milking herd also subjected to DNA extraction and PCR revealed all samples negative

Indian Dromedary camel shared 96.1% and 96.8% identity at the nucleotide level with wild Bactrian camel and Alpaca, respectively was revealed by PCR amplification, cloning and sequencing of Poly-U binding-splicing factor of the Dromedary camel and sequence analysis of Poly-U binding- splicing factor gene. The PCR amplification, cloning and sequencing of cytokine gene IL-8 of the dromedarian camel indicated the close relationship in this chemokine gene between the



Dromedary camel and other camelids based on Phylogenetic analysis based on nucleotide and amino acid sequences. The TLR-2 gene of dromedary and bactrian camel has been amplified and cloned into pGEM-T vector and sequenced successfully.

The study of microbial/functional diversity of the gut for camels reared under different feeding patterns, having clinical/ pathological conditions and their different inhabiting locations indicated the major taxonomy of different metagenomes was bacteria as the major domain. The analysis of the faecal microbiota of camels done using the MG-RAST version 3.0 indicated that the enteritis faecal sample of camel calves below three months of age showed no archaeal domain whereas at 8 months of age *Methanobrevibacter* was the major genus.

Three microbes in pure culture were isolated from the C1 compartment fluid of dromedary camels of 3-4 years age. Based on the nucleotide homology and phylogenetic analysis, the cultures were identified as *Pseudomonas aeruginosa* strain WJQ No.1, *Pseudomonas nitroreducens* strain HP2 and *Pseudomonas aeruginosa* strain DKH-3 and the evolutionary analysis generated using MEGA 5 software. The camel, horse, donkey and mule faecal samples were studied for the taxonomic and functional diversity. In all species bacterial domain was the major domain with *Clostridium* as the major genus in camel and mule and *Streptococcus* as the major genus in horse and donkey.

The camel calves during their two growth phases fed on complete feed pellet diets having different CP found to have similar growth on lower CP diet as compared to higher CP diet during both growth phases. Similarly on assessment of nutritional status of lactating camels for improving production performance it was observed that the blood metabolite picture was similar in both group female camels fed on diets meeting 100 or 75% of nutrient requirement indicating lower nutrient

requirement of lactating Camel females. *In vitro* evaluation of crop residues and grass samples indicated that gas production was lower in case of wheat straw (20.67 ml) and maximum in case of guar phalgati (30.00 ml) and it was lower in case of sewan grass (19.0 ml) and maximum in case of Dhaman grass (28.67 ml).

Opuntia ficus indica—a thornless cactus species have been introduced at Agricultural farm of NRCC and accessions received from CSSRI, Karnal-1270 and 1271, CAZRI and ICARDA are being studied for their adaptability and growth.

During the year the activities held by centre included brainstorming meet on “Functional value of camel milk as compared to different species – cow, buffalo, goat and sheep” at NRCC Bikaner followed by field activities of organization of health camp, training, front line demonstrations and Kisan goshthies in the areas of camel habitats in Jaisalmer district of Rajasthan. Under the Tribal sub plan the camps at Pratapgarh and Udaipur districts were organised during February 2014 involving a team of experts consisting of scientists and senior technical officer of the centre organising the whole activity with the support of Animal Husbandry Officials with their mobile unit of Animal Husbandry Department of Rajasthan. During this Milking competition for cattle and Buffalo and best camel competitions were organised and prizes were given respective winner and Kisan Goshthi and Question-Answer Sessions were also organised. About 480 villagers including 127 women participated with their livestock viz. Camel-482, Buffalo-672, Cattle-708, Goat-970, Sheep-308. The extension materials and medicines were distributed to animal owners.

The team of NRCC scientists including veterinary officer also visited Leh under TSP during September to October 2013 and interacted with farmers raising double humped camel. Kisan Goshthi and treatment camps were also organised.

Brief History

The Project Directorate on Camel, Bikaner came into existence on July 5, 1984. The physical facilities and animals (149 camels of Bikaneri breed and around 824 ha land) were transferred by Government of Rajasthan. Later on it was upgraded to National Research Centre on Camel on September 20, 1995, under Indian Council of Agricultural Research.



Location

The Centre is located in the Jorbeer area of Bikaner city. It is situated at Latitude: 28° 01' North and Longitude: 73° 11' East with Time zone : GMT +05:30 hours. The soil type is loose and sandy. The climate is mostly dry and hot with annual rainfall in the range of 260-440 mm. The temperature ranges between 30-48°C in summer and between 4 to 28°C in winter season.

Mandate

The centre was established with the mandate of conservation and preservation of existing breeds of camel and to generate baseline research data on camel. The mandate was revised from time to time taking into consideration the achievements done by the scientists of the centre and development in the field across the globe. The existing mandate is:

2. Introduction

1. To undertake basic and applied research for improvement of camel
2. To provide leadership and co-ordinate camel research and training nationally and act as a national repository of information and
3. To collaborate with national and international agencies for camel research and development.

The work of the centre is being carried out in the areas concerned as in camel breeding and genetics, camel physiology, camel biochemistry, camel reproduction, camel health, camel nutrition, camel management and extension, camel products technology, camel farming and agro-forestry and AKMU and PME cell.

Infrastructure

Over the years, NRCC has developed excellent infrastructure facilities including modern laboratories, library, visitor's room, museum and a feed plant.

The NRCC has modern laboratories situated in three complexes. The laboratories are fully equipped to handle modern research in the field of camel physiology, reproduction, biochemistry, genetics and breeding, biotechnology, health, nutrition, camel management and milk products technology.

The camel farm maintains an elite herd of about 383 camels comprising of Bikaneri, Jaisalmeri, Kachchhi and Mewari breeds. An area of about 650 ha of farm land has been fenced and 45 ha of land have been brought under perennial silvi-pasture comprising of grasses, shrubs and trees. The library subscribes to about 15 Indian and 13 foreign journals and has collection of 7882 reference books.

The center is recognized as one of the important tourist place of India. The camel museum of the centre depicts historical, cultural, social, economical and scientific aspects of camel and attracts the attention of



Staff position (as on March 31, 2014)

Cadre	Number of post sanctioned	Number of posts filled
Director	1	1
Scientific	23	15
Technical	24	23
Administrative	12	9
Skilled Supporting Staff	18	18
Total	78	66

national and international researchers and tourists. The camel milk parlour at the centre serves different value added camel milk products like flavoured milk, pasteurized milk, lassi, kulfee, tea and coffee to tourists and visitors which are available as a part of ongoing research activity.

Financial statement (2013-14)

The optimal utilization of funds allocated to the Centre was ensured during the year and actual utilization of the budget under plan and non plan head was as under during the year 2013-14.

Financial statement and revenue receipt (2013-14)

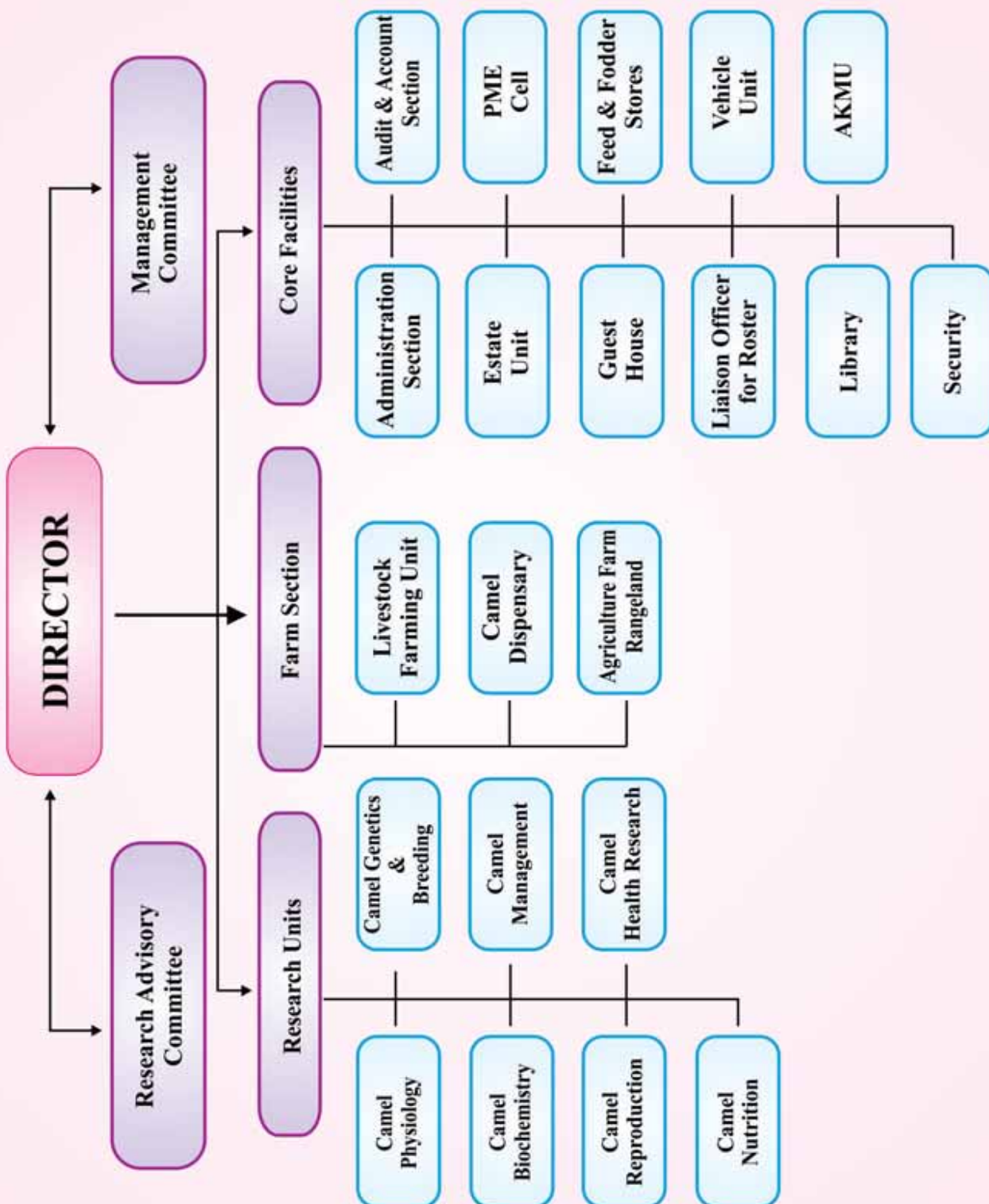
(Rs. In Lakh)

Head of Account	Plan		Non Plan	
	Budget	Expenditure	Budget	Expenditure
Pay & allowances	-	-	545	524.77
Wages	-	-	45.00	40.00
T. A.	4.00	4.00	2.00	2.00
O.T.A.	-	-	0.20	0.17
H. R. D.	3.00	2.84	-	-
Other charges including Equipments	232.28	232.09	68.23	64.68
Works	20.72	20.72	24.81	24.80
Total	260.00	259.65	685.24	556.42
Revenue Received : 39.97				

Financial statement (2013-14) of external funded projects (Rs in Lakhs)

Sl.No.	Head	Sanctioned Budget	Expenditure
AICRP			
1	TA	0.67	0.06
2	Contingencies	5.81	5.62
	Total	6.48	5.68
VTC			
1	TA	0.45	0.00
2	Recurring Contingencies	3.00	2.56
	Total	3.45	2.56
IPR			
1	Contractual Staff Cost	4.00	3.28
2	Library Book and Journals	-	-
3.	TA	0.12	0.02
4.	Operational Costs	0.08	0.07
	Total	4.20	3.37
NAIP			
1	TA	0.50	0.50
2	Contractual Service	3.46	3.09
3	Operational Costs	13.38	3.53
4	Institutional Charges	0.87	-
	Total	18.21	6.67

Organization Setup





Camel Festival 2014



Krishi Vasant 2014



3. Research Achievements

Camel Genetics and Breeding

Genetic evaluation of performance of Indian Camel

The herd strength of camels at Livestock Farm at the centre on 1st of April 2013 was 328. During the year 56 calves were born, 6 camels of Mewari and 6 camels of Kachchhi breed were purchased from the tract. During the year 22 camels were auctioned and 25 camels died due to different ailments. The herd strength of camels as on 31st March 2014 remained 348. (Table-1 and Fig.-1 and 2).

Growth Performance

The data of body weight at birth, 6 months, 12 months, 18 months, 24 months, 30 months, 36 months and 48 months of age groups were analyzed and their respective least squares means were 34.69 ± 1.05 , 155.94 ± 2.32 , 234.59 ± 3.21 , 295.80 ± 4.05 , 322.16 ± 4.15 , 350.31 ± 4.25 , 390.53 ± 5.70 and 454.28 ± 7.85 (Table-2). The effect of the year was found highly significant from birth to 36 months of age group where body weights were heavier in camels which were born in the year 2009. The effect of breed was also found significant at the age of 36 and 48 months where Kachchhi camels were heavier.

Reproductive performance

This year the conception rate at the centre was 79.74%. Total 79 females from four breeds were given service out of them 63 were conceived. Last year 126 females were given service out of which 96 were conceived (76.19%) and 56 (58.33%) calves were born (Table -3). During the year 16 abortions took place, there was one case of still birth, 4 cases of premature death and there was one case of dystokia. The data for age at first service, age at first calving and gestation length were analyzed for the period 1986 to 2013. The pooled age at 1st service was 1797.13 ± 43.14 , 1st Calving 2204.33 ± 46.71 and gestation length was 384.17 ± 1.17 days.

Mortality

During the period mortality of 25 camels occurred at the centre. The highest mortality was in 0-1 yr age group (14.88%). The breed wise and age group wise mortality with specific death rate percent are presented in table-4. Overall specific death rate mortality was 6.96%.

Breeding Plan

In the month of September biometry of 44 camels was done for body length, height at wither, heart girth. The criterion of selection was body length for preparation of breeding plan. Independent culling levels were fixed for heart girth, height at wither. Out of 44 camels, 13 camels in different breeds were selected for 79 she camels of farm. The breeding plan was prepared to avoid inbreeding with care that farm born stud should not be used on a female related to it either through sire or dam. Four Bikaneri camels were selected for providing natural service to the she camels of villagers. This year 30 she camels of villagers were brought for breeding services at centre. Last year 90 she camels were brought at the centre for service out of which 85 she camels were checked and it was found that 43 delivered calves. Among the result of the villages the percent of calving was found as about 50%.

The following databases were maintained /updated:

1. **Inventory of the Centre's camel herd involving** pedigree information on all available animals of Bikaneri, Jaisalmeri, and Kachchhi and Mewari camels.
2. **Database for growth** in terms of birth weight and body weights at different ages.
3. **Reproduction database having** information on all reproductive parameters.
4. **Database on biometry for selection of studs** were updated for preparation of breeding plan.
5. **Health database of** information on mortality, disease conditions etc.



Table 1. Camel Herd Strength (20013-2014)

Breed	Herd strength on 1-04-13		Calving		Purchased		Died		Auction		Raj. Govt.		Herd strength on 31.03.14	
Age	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Bikaner														
0-1 Yr	1	1	7	3	-	-	-	1	-	-			7	3
1-2 Yr	5	4											1	-
2-3 Yr	10	7					-	1	2	-			5	4
3-4 Yr	6	5					1						8	6
>4Yr	15	46					1	4	1	2	1	-	17	45
Total	37	63	7	3			2	6	3	2	1	-	38	58
Jaisalmeri														
0-1 Yr	-	-	5	9			1	-					4	9
1-2 Yr	6	10					1	1					-	-
2-3 Yr	2	4											5	9
3-4 Yr	3	3											2	4
>4Yr	9	27							1	2			11	28
Total	20	44	5	9	-	-	2	1	1	2	-	-	22	50
Kachchhi														
0-1 Yr	5	3	7	9			4	3					4	6
1-2 Yr	6	3			2	1			-	1			4	3
2-3 Yr	5	6			1	-			2	-			8	3
3-4 Yr	2	1			-	2			1	-			4	6
>4Yr	15	37					2	1	4	2			10	37
Total	33	50	7	9	3	3	6	4	7	3	-	-	30	55
Mewari														
0-1 Yr	3	1	8	7									8	7
1-2 Yr	4	3											3	1
2-3 Yr	6	9							3	-			4	3
3-4 Yr	1	3			1	-							3	9
>4Yr	8	40			2	3	-	2	1	-			11	44
Total	22	56	8	7	3	3	-	2	4	-	-	-	29	64
A*B														
0-1 Yr			-	1									-	1
1-2 Yr														
2-3 Yr														
3-4 Yr														
>4Yr	-	3					-	2					-	1
Total	-	3	-	1	-	-	-	2	-	-	-	-	-	2
Grand Total	112	216	27	29	6	6	10	15	15	7	1	-	119	229

Total Herd Strength – 348

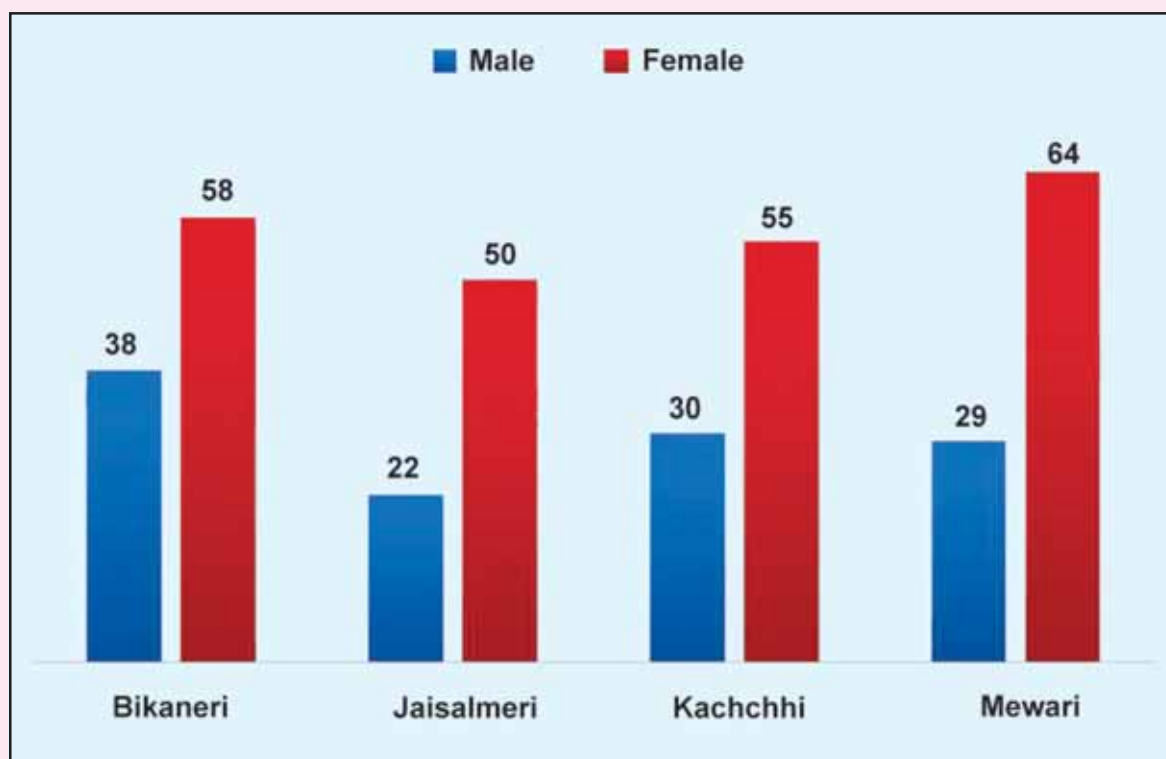


Fig. 1. Breed wise and sex wise herd strength

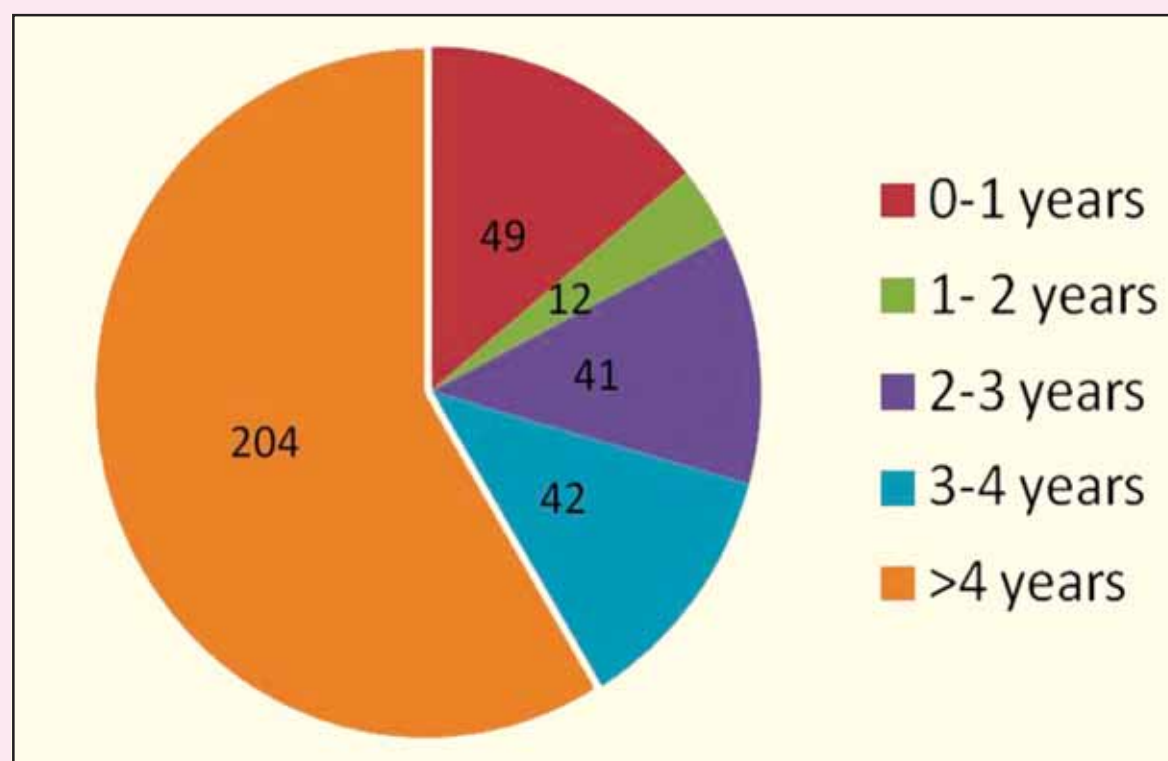


Fig. 2. Age group wise herd strength (2013-2014)



Table 2. Growth performance of camels at centre (2013-14)

	Birth	6 months	12 months	18 months	24 months	30 months	36 months	48 months
Overall	34.69±1.05 -247	155.94±2.32 -187	234.59±3.21 -179	295.80±4.05 -161	322.16±4.15 -155	350.31±4.25 -112	390.53±5.70 -97	454.28±7.85 -46
Breed	NS	NS	NS	NS	NS	NS	*	*
Bikaner	36.60±0.63 -74	159.04±3.82 -62	232.23±5.49 -55	293.67±6.76 -55	319.93±7.06 -51	348.57±6.72 -41	389.03±9.01 -35	467.92±11.46 -19
Jaisalmeri	36.46±0.68 -61	158.99±4.35 -45	232.72±5.89 -46	288.42±7.48 -42	319.59±7.63 -41	340.24±8.90 -23	366.05±11.89 -20	442.60±18.98 -7
Kachchhi	36.14±0.66 -58	157.94±4.14 -44	244.47±5.73 -43	311.80±8.48 -34	333.21±8.75 -33	363.77±8.85 -24	418.52±12.25 -20	482.77±17.87 -8
Mewari	35.43±0.70 -54	147.78±4.59 -36	228.92±6.37 -35	289.33±8.97 -30	315.91±9.12 -30	348.64±8.95 -24	388.51±11.62 -22	423.82±14.29 -12
Sex	NS	*	NS	NS	NS	NS	*	NS
Male	34.97±1.11 -136	151.22±2.88 -107	230.54±3.98 -102	290.51±5.38 -90	319.42±5.54 -85	358.48±5.82 -60	403.99±8.26 -48	465.70±10.52 -23
Female	34.42±1.10 -111	160.65±3.28 -80	238.63±4.58 -77	301.10±5.93 -71	324.90±6.06 -70	342.13±6.11 -52	377.06±7.92 -49	442.86±11.3 -23
Year	**	**	**	**	**	**	**	NS
2009	38.77±1.23 -53	182.14±3.85 -53	284.10±5.31 -52	319.53±7.43 -47	357.38±7.59 -45	389.55±6.88 -42	439.56±8.94 -38	447.82±11.02 -24
2010	35.46±1.35 -32	155.40±4.97 -30	228.62±6.70 -31	300.57±8.97 -30	314.73±9.55 -27	348.54±8.43 -26	362.27±11.40 -23	460.73±10.81 -22
2011	33.25±1.22 -55	143.73±3.67 -55	233.01±5.09 -53	278.10±6.72 -53	280.56±6.93 -51	312.82±6.57 -44	369.9.12±9.12 -36	- -
2012	34.74±1.31 -36	148.07±4.43 -37	221.70±6.64 -31	285.02±8.74 -31	335.98±8.67 -32	- -	- -	- -
2013	31.80±1.66 -15	150.36±8.01 -12	205.49±10.95 -12	- -	- -	- -	- -	- -
2014	34.14±1.14 -56	- -	- -	- -	- -	- -	- -	- -

** (P<0.01), * (P<0.05), NS-Non-significant



Table 3. Reproductive performance of the herd (2010-14)

Year	Trait	Bikaneri	Jaisalmeri	Kachchhi	Mewari	Pooled
2010-11	Mating	17	20	18	17	72
	Conception	13	18	13	11	55 (76%)
	Calving	9	12	8	7	36 (65.5%)
2011-12	Mating	18	10	22	23	73
	Conception	12	8	16	12	46 (63%)
	Calving	2	-	8	5	15 (32.6%)
2012-2013	Mating	37	26	32	31	126
	Conception	26	20	22	28	96 (76.19%)
	Calving	11	14	16	15	56 (58.33%)
2013-14	Mating	24	13	19	23	79
	Conception	17	11	16	19	63 (79.74%)

Table 4. Breed, sex and age group wise mortality and SDR % (2013-14)

Breed	Sex		Age group			Pooled
	M	F	0-1 year	1-4 years	Above 4 years	
Bikaneri	2	8	1	2	7	10 (9.65 %)
Jaisalmeri	2	1	1	2	-	03 (4.12 %)
Kachchhi	6	4	7	-	3	10 (11.35 %)
Mewari	-	2	-	-	2	02 (2.12 %)
Total	10	15	9 (14.88 %)	4 (3.65 %)	12 (6.35 %)	25 (6.96 %)

Table 5. Means and selection differential of body parameters in selected male camels for breeding (cm)

Breed	Selection	N	BL	HG	HW
Overall	Selected	13	163.06±1.80	224.69±2.34	210.76±2.66
	Total	44	158.97±1.00	217.24±1.26	206.66±1.43
	S.D.		4.09 *	7.45 **	4.1
Bikaneri	Selected	3	168.66±2.68	234.33±3.94	218.33±3.94
	Total	14	161.92±1.24	222.42±1.82	213.64±1.82
	S.D.		6.74*	11.91*	4.69
Jaisalmeri	Selected	3	164.66±3.11	226.66±3.76	215.66±15.16
	Total	7	160.42±2.03	220.00±2.46	208.57±3.38
	S.D.		4.24	6.66	7.09
Kachchhi	Selected	4	163.50±3.53	221.50±4.38	210.00±4.59
	Total	15	155.86±1.82	213.13±2.26	202.00±2.37
	S.D.		7.64	8.37	8.00
Mewari #	Total	8	156.25±2.51	213.00±2.22	201.25±2.55

** (P<0.01), * (P<0.05), # No selection was possible in Mewari breed.



Average Daily Milk Production and 300 days' Yield

The overall average two-teat daily milk production spanning 300 days' lactation period was 3.13 ± 0.15 litres and 300 days' yield was 905.18 ± 46.3 litres (Table 6). The average daily yield in the four breeds ranged from 2.94 ± 0.58 to 3.41 ± 0.15 litres and 300 days' yield ranged from 839.81 ± 173.3 to 994.05 ± 43.5 litres with non-significant ($P > 0.05$) effect of breed. However, the effect of parity on milk production was significant ($P < 0.05$) with highest average daily milk production (3.54 ± 0.24 litres) and 300 days' yield (1023.59 ± 71.9 litres) in third parity followed by fourth, second and first.

Estimation of Breeding Values of the dromedary Sires

In order to utilise the performance record in subsequent selection programme, the sires were

evaluated on the basis of performance of their progeny. Of the 74 record, only 29 records associated with seven sires could be utilized for the estimation of the breeding values for subsequent use in the breeding programme. In rest of the cases, either the sire was not known due to the purchase of the animal from the breeding tract or the number of progeny per sire was less than two. The unadjusted two-teat average daily milk yield and the 300 days' milk yield from 29 records, after deleting records of progeny of unknown sires, was utilized considering the random effect due to sire and fixed effects due to parity and year. After analysis of this subset of data the overall means for the two-teat average daily yield was 3.03 litres with standard deviation 0.75 litres and that for 300 days' yield was 875.77 litres with standard deviation 228.99 litres. The estimated breeding value of sires, variance components and repeatability are presented in Table 2.

Table 6. Milk production potential of dromedary breeds in different parities and years

Class	Number of Records	Two-teat Milk Yield (in litres)	
		Daily Yield	300 days' Yield
Pooled	74	3.13 ± 0.15	905.18 ± 46.3
Breed	NS		
Bikaneri	28	3.01 ± 0.14	871.67 ± 42.7
Jaisalmeri	2	2.94 ± 0.58	839.81 ± 173.3
Kachchhi	26	3.41 ± 0.15	994.05 ± 43.5
Mewari	18	3.15 ± 0.20	915.16 ± 58.5
Parity	*		
First	16	2.64 ± 0.24	760.81 ± 71.0
Second	27	3.07 ± 0.21	886.60 ± 63.1
Third	17	3.54 ± 0.24	1023.59 ± 71.9
Fourth	14	3.27 ± 0.22	949.70 ± 64.6
Year	**		
2008	10	4.02 ± 0.28	1177.44 ± 85.0
2009	14	3.47 ± 0.25	1017.93 ± 75.4
2010	18	3.41 ± 0.23	990.32 ± 68.5
2011	20	2.30 ± 0.22	657.35 ± 66.8
2012	12	2.44 ± 0.23	682.84 ± 67.4

* $P < 0.05$, ** $P < 0.01$, NS-Non-Significant

Table 7. Breeding values of the Indian dromedary sires for milk yield

Sire ID	Number of Progeny	Two-teat Milk Yield (in litres)	
		Daily Yield	300 days' Yield
Bikaneri - 416	3	3.42±0.23	975.93±67.13
Kachchhi - 72	3	3.26±0.24	944.57±70.94
Bikaneri - 346	4	3.24±0.25	933.03±72.00
Bikaneri - 528	10	3.19±0.15	932.47±42.63
Bikaneri - 530	4	3.06±0.20	894.21±57.78
Bikaneri - 365	2	2.95±0.23	841.53±73.42
Kachchhi - 114	3	2.88±0.25	828.78±72.00
Variance Components and Repeatability			
Variance (A)		0.1201745	10060.017
Variance (E)		0.1788212	15458.595
Repeatability		0.4019	0.3942

Selection of female dromedary for milk production

It is essential to select and retain the dams for milk production based on their own performance. Since, the analysis of average daily milk production and 300 days' yield indicated significant effect due to parity of the animal and year of recording (Table 6), the data was adjusted for both the significant effects and the mean and standard deviation was calculated to rank the individuals for their performance above or below the mean. The mean and standard deviation of the average daily milk production and 300 days' yield of this adjusted data was 3.180±0.704 litres and 922.9±211.2 litres. The average daily milk yield and 300 days' milk yield data was standardized with respect to the respective mean and the standard deviation. Since the two parameters, average daily milk yield and 300 days' milk yield, were highly correlated, so the representative plotting of individual record with respect to average daily yield has been presented in Fig. 3. It is very much evident that there were 7, 3 and 2 records respectively above mean plus one, two and three standard deviation. Similarly, there were 9 and 2 records respectively below mean minus one and two standard deviation.



Fig. 3. Standardised average daily milk yield of dromedary females with respect to mean (3.180) and Standard Deviation (0.704)

Structural analysis of 5' flanking region of dromedary milk protein gene(s)

Four 5' flanking regions and partial coding sequences were annotated and submitted in the NCBI GenBank. The status regarding length, location of bound moiety, CAAT and TAAT signals and translation initiation site along with gene bank accession numbers is presented in Table 8.

The primers for amplification were designed and six 5' flanking regions of milk protein genes were



Table 8. Transcriptional elements and their location in four dromedary milk protein promoters.

GenBank Accession	Gene Name	Length	Bound Moiety MGF/STAT5	CAAT Signal	TATA Signal	mRNA
KF648560	a-S2 Casein Gene, promoter region.	1..1181	1072..1084		1142..1148	1169..>1181 Product = "alpha s2 casein"
KF648561	a-Lactalbumin Gene, promoter region and partial cds.	1..1110	763..771		1010..1016	<1068..>1110Product = "alpha lactalbumin" Protein_id="AGZ95684.1" Translation="MMSLVSLLLVGILS"
KF648562	Lactophorin Gene, promoter region	1..1075	928..936	948..953	1051..1057	1074..>1075 Product = "lactophorin"
KF648563	k- Casein Gene, promoter region	1..>1098	87..95258..266		1073..1080	

Table 9. Amplification of 5'flanking region of dromedary milk protein genes

Promoters	Product	Status
â- Casein (bridging seq.)	571 bp	Specific sequence
k- Casein	1184 bp	Another Sample
Lactoferrin	1085 bp	Non-specific
Whey Acidic Protein	1310 bp	Non-specific
Lactoperoxidase	1205 bp	Specific sequence
Peptidoglycan RP (Promoter)	1866 bp	Specific sequence
Peptidoglycan RP (Exon 1-2)	2000 bp	Not cloned
Peptidoglycan RP (Exon-3)	1587 bp	Non-specific

successfully amplified in the dromedary. The amplified fragments were characterized by RFLP using suitable restriction enzyme. The amplicons were eluted using EZNA gel extraction kit of Omega Bio-Tek, USA. The eluted products were cloned in pGEM-T easy cloning vector. Full length sequencing was carried out (ABI). Uniqueness of the three sequences were established by online software and public databases and the results of primer walking and paired end sequencing are awaited (Table 9)

Camel Physiology

A Comparative Study on the Physicochemical Parameters of Camel and Buffalo Milk

The study was carried out to compare the various physicochemical parameters of two species, camel and buffalo. Camel milk samples were collected at National Research Centre on Camel, Bikaner and buffaloes milk samples were collected from the surroundings villages of Bikaner. After collection, milk samples were brought

to the laboratory of NRCC Bikaner and they were analyzed for fat, Solid Not Fat (SNF), protein, lactose, total ash and pH. Camel milk had 2.71 ± 0.11 fat, 6.91 ± 0.03 SNF, 2.23 ± 0.02 protein, 3.86 ± 0.02 lactose, 0.79 ± 0.004 total ash and 6.95 ± 0.01 pH while buffalo milk had 8.71 ± 0.82 fat, 8.44 ± 0.19 SNF, 4.11 ± 0.02 protein, 4.46 ± 0.15 lactose, 0.98 ± 0.05 total ash and 7.59 ± 0.02 pH. Fat, SNF, protein and pH of buffalo milk was significantly ($P < 0.001$) higher than camel milk. Lactose and total ash in buffalo milk was also higher than camel milk but at $P < 0.05$. So it can be concluded that all the studied parameters were high in buffalo milk than camel milk.

Analysis of milk constituents of sheep, goat, camel and buffalo

Milk constituents of different species viz. dromedary camel ($n=35$), goat ($n=32$), sheep ($n=31$) and buffalo ($n=17$) were evaluated. Camel milk samples were

collected from National Research Centre on Camel, Bikaner and goat, sheep and buffalo milk samples were collected from the surrounding villages of Bikaner. Milk samples were analyzed for fat, protein, lactose, ash and pH. It was observed that buffalo milk had highest fat (8.36 ± 0.52) and protein (3.56 ± 0.24) concentration whereas sheep milk had highest lactose (4.34 ± 0.09) and ash (0.87 ± 0.02) content. The pH (6.96 ± 0.05) values of camel milk were lowest in comparison to other species (Table-10).

Comparative serum biochemical parameters showed elevated levels ($P < 0.05$) in total protein, albumin, cholesterol, urea and calcium between early pregnancy and late pregnancy of body condition score (BCS) between 3-3.5 as presented in the Table below. However, no significant difference ($P < 0.05$) in blood biochemical parameters in early and late lactation was recorded except in albumin of body condition score (BCS) between 3-3.5 as presented in the Table-11.

Table 10. Milk parameters (Mean \pm SE) of camel, goat, sheep and buffalo.

Milk Parameters	Camel	Goat	Sheep	Buffalo
Fat(%)	2.63 ± 0.08	3.12 ± 0.14	7.90 ± 0.42	8.36 ± 0.52
Protein(%)	2.10 ± 0.02	2.38 ± 0.07	3.22 ± 0.06	3.56 ± 0.24
Lactose(%)	3.61 ± 0.03	4.04 ± 0.14	4.34 ± 0.09	3.70 ± 0.27
Ash(%)	0.75 ± 0.01	0.84 ± 0.03	0.87 ± 0.02	0.82 ± 0.07
pH	6.96 ± 0.05	7.34 ± 0.02	7.45 ± 0.02	7.45 ± 0.02

Table 11. Pregnant and Lactating Camels biochemical parameters

Parameter	Pregnant		Lactating	
	Early Stage	Late Stage	Early Stage	Late Stage
Total Protein (g/dl)	6.72 ± 0.14	7.18 ± 0.10	6.34 ± 0.11	6.45 ± 0.16
Albumin (g/dl)	3.91 ± 0.10	3.17 ± 0.11	3.78 ± 0.13	2.89 ± 0.09
Cholesterol (mg/dl)	29.54 ± 2.11	33.48 ± 1.21	30.98 ± 2.35	28.7 ± 1.08
Urea (mg/dl)	23 ± 1.12	32.04 ± 1.27	26.97 ± 1.78	24.38 ± 0.69
Calcium (mg/dl)	10.72 ± 0.35	10.18 ± 0.13	10.79 ± 0.60	9.46 ± 0.34



The levels of hemoglobin, glucose, total protein, albumin, urea, Creatinine, TAG, calcium and phosphorus in double humped bactrian camels from Leh were on the higher side in comparison to Dromedary camels reared in Bikaner having similar body condition score (BCS) of 3.5 and data are presented in Table 12.

Table 12. Double Hump biochemical parameters.

Parameters	Normal Values
Hb (g/dl)	14±0.57
Glucose (mg/dl)	143±0.99
Total Protein (g/dl)	6.2±0.30
Albumin (g/dl)	4±0.18
Urea (mg/dl)	57±3.72
Creatinine (mg/dl)	2.2±0.07
Cholesterol (mg/dl)	46±6.79
TAG (mg/dl)	42±1.09
Phosphorous (mg/dl)	7.5±0.76
Calcium (mg/dl)	11±0.48

Camel Reproduction

Phero-Chemical analysis in the urine of dromedary camel (*Camelus dromedarius*)

The experiment was conducted once again to try another protocol of GC-MS. The ultrasonography was performed and females were identified as (i) pregnant, (ii) non-pregnant with follicles during the breeding season on the day of mating by male- natural selection. (iii) The females having follicles but not selected by male for mating. The urine of the female camels was collected in natural condition with least disturbance to animal.

Improving the efficiency of artificial insemination in camel using existing and emerging technologies

The sera samples preserved from the previous year were sent for hormonal assay to Division of Dairy Cattle

Physiology, NDRI Karnal. The RIA analysis for progesterone could not reveal conclusive result.

Camel Biochemistry

Production and evaluation of bioactive compounds from camel milk and milk products

The periodical milk samples from day 1 to 28 day of postpartum were collected from four healthy she camels. Further, four milk samples from each Rathu cattle and buffalo, sheep, equine and goat of late lactating stage were also collected and processed for further analysis.

Production of bioactive peptides using starter cultures

The camel milk samples were analyzed for its chemical composition and skimmed samples followed by fermentation using *Lactobacilli Acidophilus* and SARAS dahi starter cultures to produce bioactive peptides. All the samples were processed for the 10000 rpm at 4°C for 30 minutes. The transparent supernatants were kept at -20 °C for further analysis to evaluate bioactive properties.

Determination ACE inhibitory and antioxidant activities

The ACE inhibitory and antioxidant activities were evaluated in the camel milk samples before and after fermentation using *Lactobacilli Acidophilus* and SARAS dahi starter cultures. It was observed ACE inhibitory and anti-oxidative property were recorded significantly higher in all the fermented milk samples using *Lactobacilli Acidophilus* culture while no significant change was determined in before and after fermented milk samples using SARAS dahi as a starter culture.

The comparative SDS PAGE electrophoresis was performed using Tris-glycine buffer, pH 8.3 using 6% gel to evaluate profile of bioactive peptides produced by using *Lactobacilli Acidophilus* as starter culture, there were variation in presence of unique band in camel milk

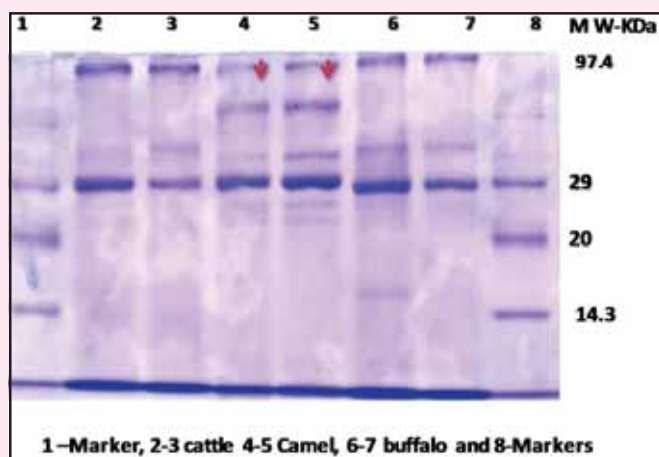


Fig. 4. Comparative electrophoretic pattern of bioactive peptides of cattle, camel and buffalo

as it was found missing in cattle and buffalo milk samples represent different digestive pattern of camel milk as compared to cattle and buffalo (Fig.-4). There were no variations recorded in electrophoretic pattern of bioactive peptides among the different breeds of camel (Fig.-5).

Production of bioactive peptides using peptic digestion

Whole milk samples of camel, cattle, buffalo, sheep, equine and goat were digested with optimum amount of pepsin A at pH 3.0, temperature 37°C for three hour at 50 rpm. The digestion was terminated by placing the samples in water bath at 80 °C for 15 minutes. All the samples were processed for the 10000 rpm at 10 °C for 30 minutes. The transparent supernatants were kept at -20 °C for further analysis to evaluate bioactive properties.

Fractionations of milk protein/peptides

Fractionations of milk proteins/peptides were carried out using different molecular weight cut UF membrane i.e. 5KD, 10KD, 30KD, 50KD and 100KD in digested and without digested milk samples of different milk species. Protein/peptide concentration was determined in each fraction in the filtrate and retentate of the milk samples.

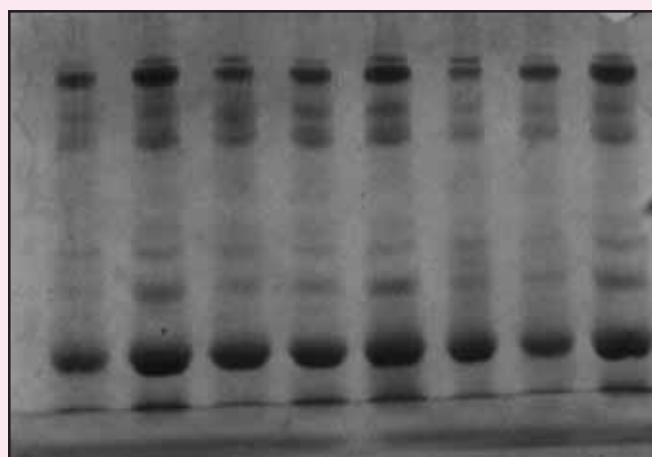


Fig. 5. Comparative electrophoretic pattern of bioactive peptides of different breeds of camel

Assessment of commercial viability of camel milk and its value added products

Camel milk and milk products developed and to popularize and assess their commercial viability viz., kulfi, flavored milk, pasteurized milk, tea and coffee were sold in the Centre's camel milk parlour. Sale from the camel milk and milk products was highest in January 2014 (Fig. 3). Camel milk and milk products were sold for Rs. 3, 54, 354/- during the year.

Camel Health

PARASITIC DISEASES

Different biological samples of camels (blood, faecal samples and skin scrapping) from different places of Rajasthan were collected for screening of Blood Protozoa, G.I. helminthes and other G I Protozoa and mange infection. These blood samples were used for a number of parasitological, serological tests to detect the trypanosomiasis in camel. Besides, PCR was also under taken for confirmatory test. The blood samples collected were checked for Hb% and buffy coat examination along with wet smear examination for presence of trypanosome infection in camel. 14(9%) out of 155 blood samples of camel found positive for Trypanosome infection on parasitological examination. The Hb% ranged from 6.5-



7.5 in case of trypanosome infected camel. Both wet smear and buffy coat examination revealed no persistence of infection.

All these blood samples were processed for DNA for PCR amplification. Typical PCR amplification using primers pair designed from internal transcribed spacer region of ribosomal DNA of trypanosomes revealed specific signal of a distinct 500bp band on ethidium bromide stained 1.8% agarose gel. Besides, VSG genes of 205 and 448 kb have been used for the diagnosis of cameline surra. Kinetoplast DNA sequence was also exploited as “signature sequence”, revealing 443 bp in the diagnosis of *T. evansi* infection (20%).

The sera samples collected in the field were used for sero-prevalence of trypanosomes. During the period, all serum samples have been analysed in duplicate for the presence of antibody against trypanosomes by indirect ELISA and these values are expressed in terms of mean ELISA value. The S/P value calculated, in this regard when found 2-times greater or more considered as positive results. Thus, mean ELISA values have been found highly variable. The animals which showed higher ELISA value(27%) but negative by PCR might be due to recent application of trypanocidal drugs which eliminated the parasites from the peripheral circulation but not the antibodies already produced in the system as reflected in ELISA. These animals may not have the active carrier state of infection.

A number of biochemical parameters were also studied in serum from trypanosome infected camels. These include Cholesterol (17.71 ± 1.80 mg/dl in healthy camel vs 31.92 ± 0.94 mg/dl in infected camel), Billirubin (2.13 ± 0.07 mg/dl vs 3.65 ± 0.16 mg/dl), BUN (8.89 ± 0.58 mg/dl vs 19.36 ± 0.83 mg/dl) and Creatinine (1.23 ± 0.04 mg/dl vs 2.54 ± 0.15 mg/dl). There were significant changes, i.e. increases of values were recorded in such markers which further addressed the assessment of the hepato-renal or further consequences due to trypanosome infection in camel.

Management of Trypanosomiasis in Camel under Farm and Field Condition

Plant materials collected from selected indigenous medicinal for preparation of methanolic/ethanolic extract from plant material. Preparation of plant extract from Neem leaves and Pomegranate leaves is under process. *T. evansi* infection in Swiss albino mice is established from naturally infected camel. Herd screening for *T. evansi* infection of Camel of NRCC farm was done.

BACTERIAL AND FUNGAL DISEASES

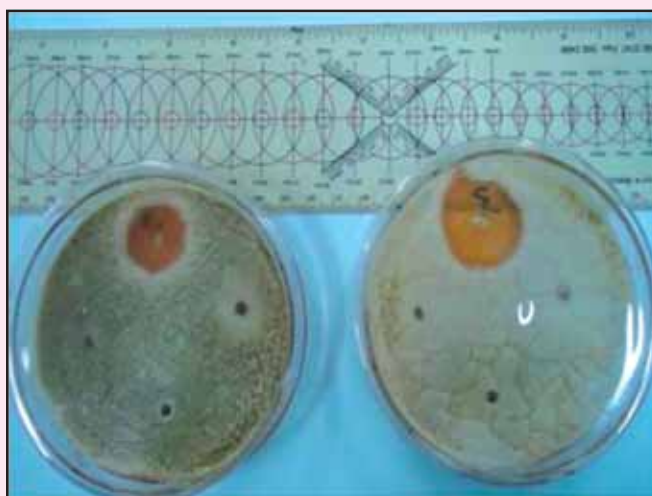
Validation of suitable treatment formulation for dermal mycoses in camel

A total of 20 fungal isolates from camel skin infections, which comprised of *Microsporum canis* (1); *M. nanum* (1); *M. audouinii* (1); *Trichophyton soudanense* (1); *T. equinum* (1); *T. tonsurans* (1); *Scopulariopsis brevicaulis* (1); *S. brevicaulis*, dark tan pigment (1); *Basidiobolus ranarum* (1); *Paracoccidioides* spp (1); *Absidia corymbifera* (1); *Penicillium marneffe* (1); *Aspergillus flavus* (1); *A. versicolor* (1); *A. terreus* (1); Other aspergilli (5) were taken to investigate antifungal activity to methanol, hexane, petroleum ether and either aqueous or crude juices of 16 medicinal herbs viz, Babool (*Acacia nilotica* Lam. Willd.) bark; Eucalyptus (*Eucalyptus globulus* Labill) leaves; Henna (*Lawsonia inermis* L.) leaves; Siris (*Albizia lebbek* L. Benth) leaves; Fenugreek (*Trigonella foenum-graecum* L.) seed; Kair (*Capparis decidua* Forsk. Edgew) branches; Aloe vera (*Aloe barbadensis* Mill.) leaves; Anar (*Punica granatum* L.) leaves; Ginger (*Zingiber officinale* Ros.) rhizomes; Garlic (*Allium sativum* L.) bulb; Datura (*Datura metal* L.) leaves; Onion (*Allium cepa* L.) Bulb; Cactus (*Astrophytum* spp.) pods; Colocynth (*Citrullus colocynthis* L. Schrad) fruit; Turmeric (*Curcuma longa* L.) rhizomes and Pearl millet (*Pennisetum glaucum* L.) seed.

Antifungal sensitivity testing: Culture inoculums of various fungi were made in 10 millilitres of Sabourauds dextrose broth and were incubated at 28°C for 48 hours for appearance of turbidity. These cultures were then spread over antifungal sensitivity test agar plates. The plates were divided into 4 parts and into the centre of each part, a well was punched and 10 µl of methanol extract / hexane extract / Petroleum ether extract / crude juice / aqueous extract was pipetted into the wells. Plates were kept at room temperature for 1-hour to facilitate diffusion and were then incubated at 28°C for 48 hours. The Diameter of zone of inhibition was measured. Screening of 16-medicinal herbs revealed very good antifungal activity with aqueous and methanol extract of Eucalyptus (*Eucalyptus globulus*) and Anar (*Punica*

granatum) and crude extract of Garlic (*Allium sativum*). Where as some antifungal activity observed with other types of extracts and or plants against some of the fungi are also giving sensitivity with these three plants. So these three plants may be exploited for further studies.

Comparison with the standard antifungal antibiotics: Standard antifungal sensitivity discs of Amphotericin B (50-µg), Clotrimazole (10-µg), Fluconazole (10-µg), Itraconazole (30-µg), Ketoconazole (50-µg) and Nystatin (NS-100 iu) were tested by the standard antibiotic sensitivity method. These antifungal antibiotics were active against majority of the fungal isolates tested in the desired concentrations as recommended by the manufactures.



In vitro minimum inhibitory concentrations of the effective extracts and comparison with the standard antifungal antibiotics

Maximum antifungal sensitivity observed with Eucalyptus (*Eucalyptus globulus*) aqueous extract, Anar (*Punica granatum*) aqueous extract and Garlic (*Allium sativum*) crude juice were evaluated in vitro for MIC against various fungal isolates and were compared with amphotericin-B and nystatin in Sabourauds dextrose broth by the dilution method, all these products were tested from 1 µl /1u µg to 9µl/9µg/ ml. In vitro minimum inhibitory concentrations tested from 1 to 9 µl/ml with the aqueous extract of Eucalyptus (*Eucalyptus globulus*) and Anar (*Punica granatum*) and crude extract of Garlic (*Allium sativum*) and compared with Nystatin and Amphotericin-B in concentrations of 1- 9 µg / ml, showed some promise of the comparable activity.

Clinco-Pathological investigations in diseased camels for overall health improvement of camel herd

The causes of morbidity and mortality in camels for the year 2013-14 were investigated from herd of NRCC. The major causes of morbidity were found to be - diarrhoea, pyrexia, lameness, dermatitis, thikria, trypanosomiasis, abortions, dystokia, still birth, premature birth, mastitis, calf diarrhoea, mange/ dermatitis, choking of esophagus, brucellosis and tuberculosis. The major causes of mortality were identified as enteritis, tuberculosis, pneumonia, choking of esophagus and accidental death. A total of 489 clinical samples collected from ailing camels which included blood (479), milk (6) and faeces (4).

Pathological and diagnostic studies were conducted on abortions due to brucellosis. Total 14 (4.02%) abortions reported during this year, of which 8 were detected positive for brucellosis by RBPT. The DNA was extracted from all 14 placental and fetal tissues and subjected to PCR for amplification of *Brucella abortus* 18 kDa immunoreactive antigen gene using the primer sequence: BA1 (5' CTG CAG TCA TGC CCC

AGA AC 3') and BA2 (5' GTC ATC GTT TCC GGG TCA GA 3'). Out of 14 cases, 10 were found positive for brucellosis in PCR (Fig. 6). The abortions from brucellosis were reported from mid to last trimester (5th

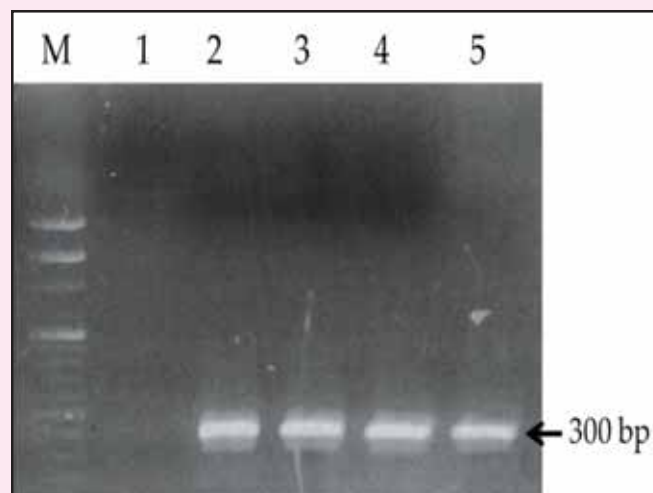


Fig. 6. PCR amplification of *Br. abortus* 18 kDa immunoreactive antigen gene. Lane: M- 100bp marker, Lane 1- negative control, 2- 5 aborted fetal lung

to 11th month). The gross pathological lesions in aborted fetuses were subcutaneous edema, dark hemolysed blood inside body cavities, pneumonia, enlarged liver with pale necrotic patches and severe congestion in all visceral organs. The placentas were edematous and inflamed (Fig. 7). The smear from stomach content of fetus showed gram negative *Brucella abortus* bacteria.



Fig. 7. Placenta showing edema and inflammation.

The histopathological findings in aborted fetuses were infiltration of mononuclear cells and thickened alveolar and bronchial wall of lungs (Fig. 8), severe congestion and mononuclear infiltration in kidneys, coagulative necrosis and vacuolar degenerative changes in liver and congestion of capillaries of brain. The placenta showed necrosis and mononuclear infiltration.

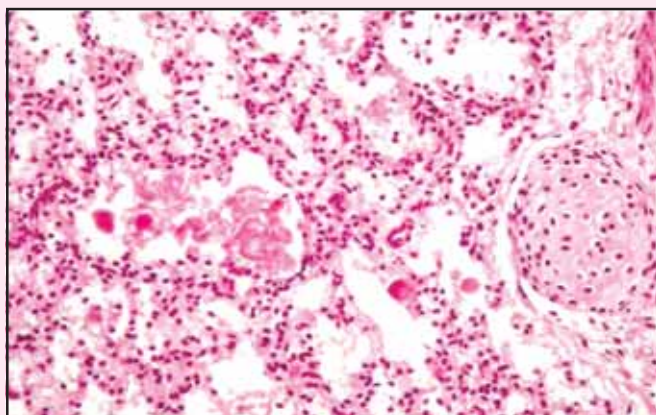


Fig. 8. Fetal lung showing infiltration of mononuclear cells and thickened alveolar and bronchial wall along with necrotic debris. H & E x 400

Pathological and diagnostic studies conducted in tuberculosis cases. Tuberculin test performed on 12 suspected camels, of which 4 were found reactors. Total 10 mortalities reported due to tuberculosis of which 2 were tuberculin reactors. Positive cases showed clinical symptoms of progressive emaciation, enlarged superficial lymph nodes, anorexia, mild fever and coughing. The histopathology of lungs revealed typical changes of granulomatous inflammation with caseous necrosis and calcification. The DNA from lungs of all tuberculosis cases were found positive in *hupB* gene PCR. The 6 milk samples from the milking herd were also subjected to DNA extraction and PCR which revealed all samples to be negative.

Molecular cloning and characterization of cameline cytokine gene (s)

PCR amplification, cloning and sequencing of Poly-U binding-splicing factor of the Dromedary camel were carried out successfully. Primers used for the amplification of Poly-U binding- splicing factor of the

Indian Dromedary camel were; Forward – Poly-U ; 5' ATGTGGCTGC AGAACCTGCTTCTC 3'; Reverse – Poly-U - 5'TCACTT CTGGACTGGC TCCCAGCAG 3'. The partial sequence of Poly-U binding- splicing factor gene obtained from Indian Dromedary camel is 578 bp. Sequence analysis of Poly-U binding- splicing factor gene revealed that the Indian Dromedary camel shared 96.1% and 96.8 % identity at the nucleotide level with Wild Bactrian camel and Alpaca, respectively. Whereas it share 94.2 % and 93.5% identity at nt level with Killer whale and weddel seal, respectively.

Epidemiology of viral diseases of camels

One camel pox viral infection was observed and noted in a male camel aged four years. The animal was belonging to the BSF, Jaisalmer. Scab materials were collected from the infected camel at Clinics of Bikaner veterinary college on 29th November 2013. Total genomic DNA was collected from the scab materials and the camel pox viral infection was ascertained by conventional PCR using the primers of haemagglutinin gene of Camel pox virus.

Bioprospecting of genes and allele mining for abiotic stress tolerance (Dromedary Camel- Heat and cold stress tolerance)

The biochemical parameters such as cortisol, T3 and T4 levels of dromedaries present in sera collected during extreme summer and extreme winter months of the year were estimated. PCR amplification, cloning and sequencing of cytokine gene IL-8 of the dromedarian camel was carried out successfully. Interleukin-8 (IL-8) is an important pro-inflammatory cytokine, and good marker of inflammatory responses. IL-8 is a CXC chemokine, and the first known chemokine, produced by monocytes/macrophages, fibroblasts, vascular endothelial cells, mast cells, epithelial cells, and a wide variety of tissue cells, upon exposure to inflammatory stimulants. Camel IL-8 cDNAs were amplified using mRNAs from Con A stimulated peripheral blood mononuclear cells of healthy camel by PCR with the primers designed based on cattle (*Bos taurus*) IL-8 gene



sequences. Primer sets used for the amplification of camel IL-8; forward 5' CACCATGACTTCCAAGCTGGCTGTTGC 3' and reverse 5' TCATGGATCTTGCTTCTCAGCTCTC 3'. The GenBank accession number of the Dromedary camel IL-8 gene is KF843702. The open reading frame (ORF) of dromedarian camel IL-8 is 300 bp in length, encoding 99 amino acid polypeptide. Relationship based on amino acid sequences revealed that Dromedary camel IL-8 shared 89.11% and 88.12% identity with wild bactrian and alpaca, respectively. Phylogenetic analysis based on nucleotide and amino acid sequences indicated the close relationship in this chemokine gene between the Dromedary camel and other camelids.

Blood was collected from 3 animals. PBMCs were separated from pooled blood sample. Further, half portion of PBMCs were subjected to incubation at 37°C for one hour and simultaneously remaining half portion of PBMCs were subjected incubation at 45°C for one hour. Subsequently total RNA was isolated and transcriptome analysis was carried out.

Characterization of Toll like receptors in camel

The TLR-2 gene of dromedary and bactrian camel has been amplified and cloned into pGEM-T vector and

sequenced successfully. The respective TLR-2 gene sequences have been submitted to NCBI (GenBank accession no. JQ979305 and JX453495). Partial amplification of TLR-1 and TLR-5 gene of dromedary camel has been achieved and cloned into pGEM-T vector and sent for sequencing.

Camel Nutrition

A pilot study on the gut/digestive tract metagenomes of camel

The study of the microbial/functional diversity of the gut under different a) feeding patterns b) clinical/pathological conditions and c) camel inhabitations was studied. Table 13 depicts the district, type of management and feeding given to camels of different groups from which the faecal samples were collected. Table 14 shows the various clinical conditions from which the faecal samples were collected and analysed. The analysis of the faecal microbiota of camels was done using the MG-RAST version 3.0 after subjecting the faecal samples for shot gun sequencing using Ion Torrent PGM, in order to identify the microbial diversity and metabolic potential of the digestive tract. The data was analysed using M5RNA for taxonomic and SEED subsystems for functional categories with an e-value of 1×10^{-5} , minimum identity of 80% and minimum alignment length of 50 bp

Table 13. District, type of management and feeding in camels

Group(n=2)	District	System of Management	Feed given
Adult Camels			
1	Bikaner	Intensive	Moth (<i>Phaseolous aconitifolius</i>) chara and Groundnut (<i>Arachis hypogea</i>) fodder
2	Bikaner	Intensive	Guar phalgati (<i>Cyamopsis tetragonoloba</i>)
3	Bikaner	Extensive	Locally available tree leaves viz., Khejri, Neem, Ker, Beri, Sewan, Mung, Chana, Bajra, Moth, Ground nut.
4	Jaisalmer	Intensive	Guar phalgati (<i>Cyamopsis tetragonoloba</i>)
5	Jaisalmer	Extensive	Tree leaves, shrubs locally available in Jaisalmer region viz., Khejri, Mithi Jal, Ker, Beri, Kumat, Lana, Sewan and Baroot
Camel Calves			
6	Bikaner	Extensive	Dam's milk and consume green fodder and tree leaves
7	Jaisalmer	Extensive	Dam's milk along with locally available tree leaves

Table 14. District, type of management and clinical condition in camels

S.No.	District	System of Management (n=2)	Clinical condition
Adult Camels			
1.	Bikaner	Intensive	Indigestion
2.	Bikaner	Intensive	Indigestion
Camel Calves			
3.	Bikaner	Intensive	Enteritis
4.	Bikaner	Intensive	Enteritis and Pneumonia
5.	Jaisalmer	Extensive	Enteritis

for taxonomic and 30 bp for functional categories. The results of the major taxonomy of different metagenomes showed bacteria as the major domain.

Under the extensive and intensive system of management of camels in Bikaner district, Firmicutes was the major phylum with *Clostridium* as the major genus. The archaeal genus showed *Methanobrevibacter* as the major genus in group 1, whereas in groups 2 and 3 *Methanocorpusculum* was the major genus. The protein metabolism was the major functional metabolism observed in all three groups of adult camels of Bikaner district.

In Jaisalmer district, camels managed under the intensive and extensive system of management, Firmicutes and Proteobacteria were the major phyla, respectively. In group 4 *Akkermansia* is the abundantly found bacterial genus and in group 5 *Escherichia* is the major genus. The archaeal genus showed *Methanobrevibacter* as the major genus in camels managed under both systems of management. The protein metabolism was the major functional metabolism in group 4 where as carbohydrate functional category was abundant in group 5.

In groups 6 and 7 camels, Firmicutes was the major phylum with *Clostridium* as the major bacterial genus. The archaeal domain showed *Methanobrevibacter* as the major genus in both these groups of camel calves. The protein metabolism was the major functional metabolism in camel calves of Bikaner and Jaisalmer districts.

The adult camel faecal samples of Bikaner district, showing simple indigestion revealed Firmicutes as the major phylum with *Clostridium* as the major genus. The archaeal genus *Methanobrevibacter* is abundant with the protein metabolism as the major functional metabolism.

Streptococcus and *Escherichia* were the major genera in calves below 3 months of age suffering from enteritis. *Escherichia* was the major genus in enteritis in calf at 8 months of age in Jaisalmer district. The enteritis faecal sample of camel calves below three months of age showed no archaeal domain where as at 8 months of age *Methanobrevibacter* was the major genus.

Veterinary Type Culture-Rumen Microbes

The C1 compartment fluid was collected from adult dromedary camels of 3-4 years age and cultured in an anaerobic jar using standard protocol. Isolated 3 microbes in pure culture and were given accession numbers KJ789925, KJ789926 and KJ789927. The morphological characteristics of 3 isolates revealed pale, glistening, opaque, eye shaped colonies with irregular edges. The biochemical characteristics revealed gram negative, non motile rods. The gelatin liquefaction, oxidase and catalase tests were positive with no gas production for the three isolates. All the three isolates showed utilization for the sugars of mannose, D-mannitol, raffinose, trehalose, sucrose and galactose. Based on the nucleotide homology and phylogenetic analysis, the cultures were identified as *Pseudomonas aeruginosa*

strain WJQ No.1, *Pseudomonas nitroreducens* strain HP2 and *Pseudomonas aeruginosa* strain DKH-3 and

the evolutionary analysis generated using MEGA 5 software are shown in Figures 9, 10 and 11 respectively.

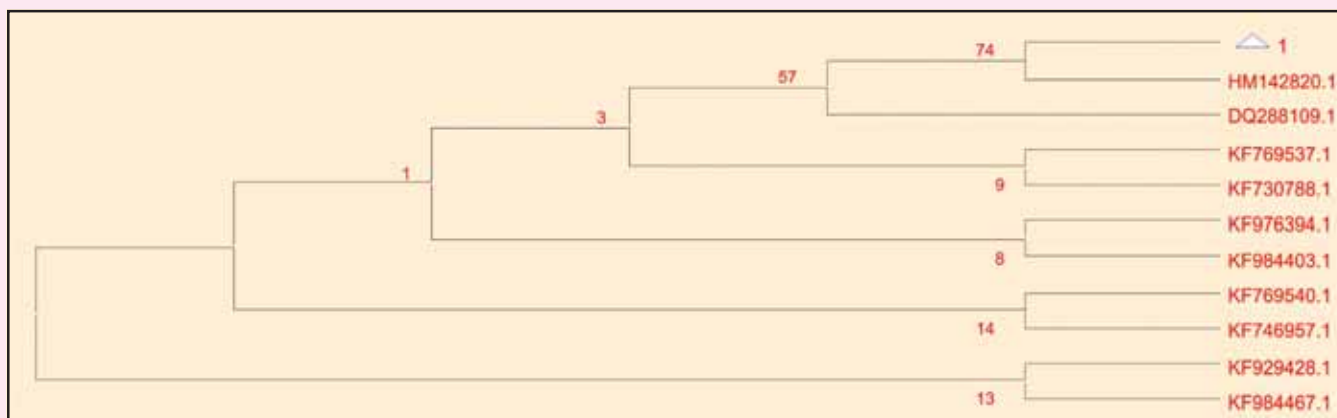


Fig. 9. Phylogenetic tree of Isolate 1 with accession no. KJ789927 is similar to *Pseudomonas aeruginosa* strain WJQ No.1 (HM142820.1)

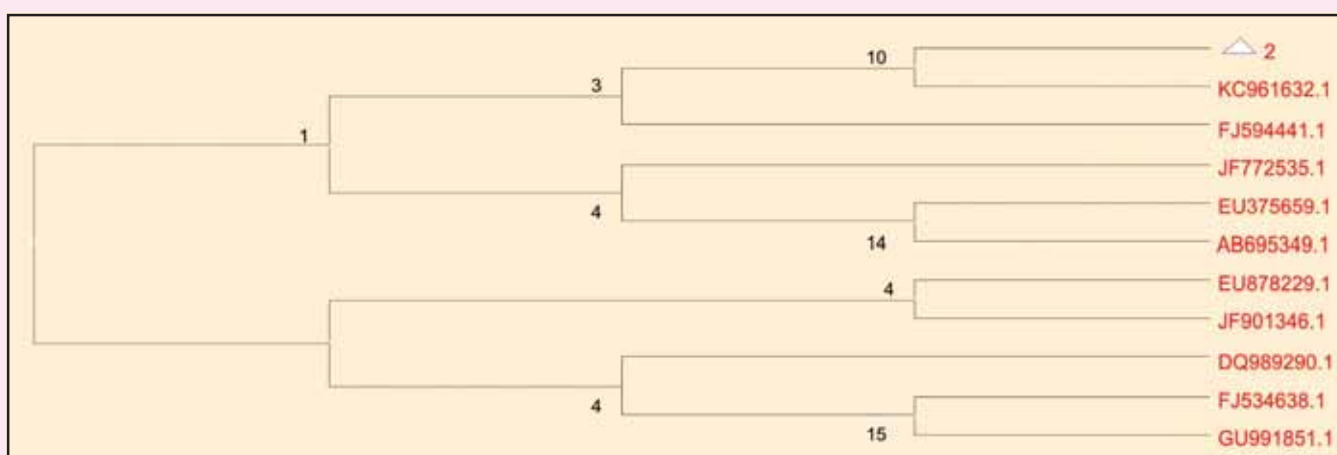


Fig. 10. Phylogenetic tree of Isolate 2 with accession no. KJ789925 is similar to *Pseudomonas nitroreducens* strain HP2 (KC961632.1)



Fig. 11. Phylogenetic tree of Isolate 3 with accession no. KJ789926 is similar to *Pseudomonas aeruginosa* strain DKH-3 (JQ773433.1)

Metagenomics Study

The faecal samples from camel, horse, donkey and mule were collected and studied for the taxonomic and functional diversity. The data generated on Ion torrent PGM sequencer and uploaded on MG-RAST was analysed using M5RNA database for the taxonomic and subsystems for the functional categories. The data was analysed with an e-value of 1×10^{-5} , minimum identity of 80% and minimum alignment length of 50 bp for taxonomic and 30 bp for functional categories. In all species bacterial domain was the major domain with *Clostridium* as the major genus in camel and mule and *Streptococcus* as the major genus in horse and donkey. The top most genera in the archaeal domain was *Methanocorpusculum* in all the species. Protein metabolism was the major functional group in all these species.

Assessment of nutritional status of lactating camels for improving production performance

In camel calves fed on *ad libitum* diets (GR100) and restricted diets (GR75) the values of blood

Table 15. Allantoin and uric acid concentration of different groups of treatments

Parameters	GR100	GR75
B. Wt (kg)	580.75±15.36	580.16±12.44
DMI (Kg/D)	8.21±0.62	6.39±0.42
Blood Metabolites		
1. Allantoin (mg/l)	38.21±2.58	32.0±2.0
2. Uric acid (mg/l)	45.95±6.08	43.34±5.40
3. Creatinine (mg/l)	855.23	652.79
4. Glucose (mg/dl)	94.25±3.5	92.47±4.0
5. Cholesterol (mg/dl)	44.00±2.5	38.92±2
6. Urea (mg/dl)	18.40±0.7 ^a	16.37±0.6 ^b
7. Creatinine (mg/dl)	1.41±0.05	1.29±0.05

metabolites such as glucose, urea, creatinine and cholesterol in both groups were within normal range however the values of urea in group GR75 diet were significantly lower than GR100 calves and similarly hormonal profiling of thyroid hormones T4 and T3 at different time intervals similar results of low values for GR75 than GR100. Urine samples were also analyzed for allantoin and uric acid and presented in table 15.

Performance in camel calves fed during two phases of growth

Camel calves after 3 months of suckling were put under a long term growth study conducted in two phases in which in first phase the calves were fed *ad-lib* on isocaloric (62% TDN) complete feed pellets having 13 % (T1) and 15 % (T2) CP up to 6 months in addition to dam milk and thereafter in second phase after 6 months the calves were fed individually on isocaloric (64% TDN) complete feed pellets having 11 % (T1) and 13 % (T2) CP up to 17.4 months. The Daily milk consumed by calves on two times suckling of two teats daily till 3 months of age was also recorded. No significant differences were observed in blood bio-chemical parameters between two groups (table 16). Overall final body weights (372.75±17.70 and 361.88±10.44 kg) and body weight gain (325.05±14.25 and 303.70±11.30 kg) respectively in T1 and T2 groups over 524 days of study period was non significantly higher in T1 (table 17). The calculated feed efficiency (feed intake/ kg gain) in first phase of 2.58 and 2.41 at 6 month of age was significantly ($p < 0.01$) different than it was observed in later growth phase as 6.67±0.23 and 8.09±0.52 indicating higher FCE in calves in early growth phase. In later phase the calves fed on diets with lower (11 %) protein than higher level of 13 % CP was sufficient and better for the support of good growth. Calculated feed cost per kg gain was 83.37 and 107.74 respectively in T1 and T2 groups suggesting that T1 rations both at early and late phase were more economical and sufficient to meet requirement of calves during growth period after 3 months age.



Table 16. Blood biochemical profile of experimental groups

Parameters	6 month		10 month	
	TI	TII	TI	TII
Glucose (mg %)	131.65±26.40	129.90±5.95	101±0.40	105±0.60
Total protein (g %)	5.73±0.68	5.86±0.24	6.86±0.30	7.39±0.60
Albumin (g %)	3.51±0.24	3.05±0.24	3.14±0.31	3.02±0.17
Globulin (g %)	2.22±0.62	2.80±0.23	3.70±0.31	4.35±0.56
Urea (mg %)	42.19±3.49	39.55±2.30	21.02±1.91	22.24±1.27
Creatinine (mg%)	1.52±0.12	1.49±0.07	1.60±0.05	1.54±0.08
Cholesterol (mg %)	47.19±5.68	50.32±5.74	29.76±4.37	29.08±4.32
Calcium (mg %)	10.67±0.83	10.86±0.22	11.04±0.61	11.30±0.39
Phosphorus (mg %)	7.20±0.44	7.61±0.25	6.90±0.30	6.75±0.59

Table 17. Growth and feed efficiency of camel calves as affected by different diets.

Parameters	T1	T2
Body weight(Kg)		
a)Initial	47.6±4.62	58.17±5.98
b)Final	372.75±17.70	361.88±10.44
c)Total gain	325.05±14.25	303.70±11.30
d) Avg. daily gain	0.620±0.021	0.620±0.021
Feed Efficiency(Kg/Kg gain)		
a) DMI in Early Phase (3-6 months)	2.58	2.41
b) DMI in Late Phase (6-17.4 months)	6.67±0.023	8.09±0.52
Total Feed intake(Kg)	13803.36	14319.36
Cost per kg gain(Rs)	83.37	107.74

Enhancing nutrient utilization and reducing methane emission

In a gas production study crop residue samples Viz. Gaur phalgati, Groundnut haulms, Gram straw, Bajra straw, Oat straw, Wheat straw and grass samples Viz. Anjan, dhama, doob, ganthia, gramma and sewan were collected from the field. Proximate analysis and detergent fibre components were estimated as per the standard methods of AOAC, 1995 and Von Soest et al

(1991). The in-vitro fermentation study on these feed samples was conducted by collecting rumen liquor from 3 years old camel calf maintained on guar phalgati and processed as described by Menke and Steingass (1988) modified by Dutta (2008) and total gas production was measured by 24 hours incubation of 0.2 g dry sample of each feed ingredient with 30 ml medium in 100 ml glass bottles and IVDMD, VFA, total and ammonia nitrogen were also estimated (Table 18).

Table 18. Chemical analysis of crop residues and grasses

	CP	EE	CF	TA	NFE	NDF	ADF
Crop residues							
1.Guar (<i>Cymopsis tetragonoloba</i>) phalgati	7.28	1.04	28.40	11.66	51.62	42.85	36.69
2.Ground nut (<i>Arachis hypogea</i>) haulms	12.07	2.54	21.45	11.66	52.25	35.71	28.39
3.Gram (<i>Cicerarietinum</i>) straw	4.96	0.52	29.65	15.42	49.95	48.51	36.99
4.Bajra (<i>Pennisetumglaucum</i>) straw	5.25	1.15	25.32	16.64	51.64	64.41	40.45
5.Oat (<i>Avena sativa</i>) straw	4.56	1.23	32.52	9.82	51.87	68.90	40.21
6.Wheat (<i>Triticumaestivum</i>) straw	3.49	0.66	37.56	11.05	47.24	78.23	52.50
Grasses							
1.Anjan (<i>Cenchrus ciliaris</i>)	13.17	2.75	27.47	14.56	42.05	61.77	28.33
2.Dhaman (<i>Cenchrusse tigerus</i>)	11.05	2.35	30.58	9.29	46.73	63.10	36.39
3.Doob (<i>Cynodonactylon</i>)	14.94	3.31	23.28	10.16	48.31	67.26	36.61
4.Ganthia (<i>Dactyloctenium indicum</i> Boiss)	15.75	2.45	22.73	14.64	44.43	57.62	26.43
5.Grammna (<i>Panicum antidotale</i>)	15.92	3.39	22.49	11.68	46.52	60.05	28.26
6.Sewan (<i>Lasiurus indicus</i>)	8.72	1.76	33.81	8.65	47.06	75.58	39.50

In-vitro study (Table 19) revealed that gas production in crop residues varied between 20.67 to 30.00 ml/ 0.2 g dried sample which was lower in wheat straw (20.67 ml) and maximum in guar phalgati (30.00 ml). The % IVDMD ranged between 28.15 and 60.36 and was lower in wheat straw (28.15) and higher in groundnut haulms (60.36) . The yield of SCFAs ranged between

4.45 and 7.55 mmol/100 ml , the lower value in guar phalgati and higher value in groundnut haulms was observed. Total nitrogen contents varied between 9.98 mg/100 in case of wheat straw to 15.05 mg/100 ml in guar phalgati. The concentration of NH₃-N ranged between 8.48 mg/100 in wheat straw to 9.76 mg/100 ml in gram straw. In grasses the gas production (ml/ 0.2

Table 19. In-vitro fermentation study of feeds

	Gas production	%IVDMD	SCFAs mmol/ 100 ml	Total-N mg/ 100 ml	NH ₃ -N/ 100 ml
Crop residues					
Control	4.00±1.15	0	3.65±0.60	15.87±1.02	14.77±0.21
Guar phalgati	30.00±1.15	54.70±0.84	4.45±0.22	15.05±1.40	8.51 ±0.25
Ground nut haulms	27.00±1.00	60.36±1.79	7.55±0.47	13.53±0.31	9.02 ±0.58
Gram straw	27.33±2.40	35.86±1.95	7.43±0.20	14.00±0.88	9.76±0.33
Bajra straw	24.67±0.67	40.84±0.87	4.55±0.20	14.12±0.85	9.61±0.43
Oat straw	21.00±0.58	39.04±2.12	5.63±0.25	14.47±0.62	8.77±0.55
Wheat straw	20.67±4.00	28.15±1.55	5.42±0.33	9.98±0.44	8.48±0.49
Grasses					
Control	3.67±1.20	0	5.00±0.32	17.85±0.93	9.67±0.32
Anjan	25.33±0.67	42.91±2.05	5.32±0.19	20.18±0.42	10.57±0.10
Dhaman	28.67±0.67	47.13±0.55	5.35±0.08	17.15±0.70	9.05±0.11
Doob	21.33±1.33	24.73±2.40	5.13±0.03	17.62±0.51	8.97±0.01
Ganthia	24.00±0.58	24.09±1.34	4.58±0.14	18.67±0.12	10.77±0.24
Grammna	25.00±1.53	39.16±1.19	5.85±0.26	18.67±0.31	12.15±0.24
Sewan	19.00±1.53	26.63±1.00	4.33±0.13	12.48±0.42	7.67±0.14



g DM) varied between 19.0 to 28.67 ml in 6 grass species which was lower in sewan grass (19.0 ml) and maximum in Dhaman grass (28.67 ml). The % IVDMD ranged between 24.09 to 47.13 and ganthia grass had low (24.09) and dhaman grass showed high digestibility of DM *in vitro*. (47.13). The yield of SCFAs ranged between 4.33 to 5.85 mmol/100 ml, which was low in case of sewan grass and high in grammna grass whereas total nitrogen contents varied between 12.48 in sewan grass to 18.67 in ganthia and grammna grasses and ammonia nitrogen levels ranged between 7.67 to 12.15 mg/100 ml, with minimum in sewan grass and maximum observed in case of grammna grass.

Agriculture Farm Unit

Cactus pear accessions 1270, 1271 and those received from CAZRI Jodhpur and ICARDA, Delhi were introduced in the agriculture farm of the center considering high water conservation ability and drought tolerance, and its potential of being used as feed which also can greatly reduce the water needs of livestock. The performance in respect of survivability and growth indicated that the survivability was better (85-95%) with better adaptability shown by these accessions showing better sprouts and growth when planted in association with perennial trees in silvipasture field and also with traditional native grass species of the region viz. *C. ciliaris*, *L. indicus* and *P. antidotale*.

Beside this the agriculture section was engaged in fodder production during Kharif and rabi season and management of grazing resources.

Camel Management and Extension Activities

1. Revenue Generation

- Total revenue collected from tourism activity during the year was Rs. 25,32,870/- .
- Participated in “Krishi Vasant 2014 and Kisan gosthi” for exhibition of NRCC activities at Nagpur, Maharashtra during 8-13 February 2014.

- Participated in Farmer’s Fair at CAZRI, Jodhpur on 19th September 2013, in exhibition held in Camel festival at Karni Singh stadium, Bikaner on 15th and 16th January 2014 and State level National Science Day exhibition from February 26- 28, 2014 at Science Park, Shastri Nagar, Jaipur with NRCC stall.
- Visit of 400 farmers (approx.) including 80 female farmers from Nagaur, Jodhpur, Bikaner, Churu, Jhunjhunu and Ganganagar district of Rajasthan under ATMA.

2. ATMA training programme for farmers

The farmers of Jhunjhunu (no.30) and Hanumangarh districts (30 no.) in two batches on 06.01.2014 to 10.01.2014 and 17.01.2014 to 21.01.2014 were trained on various aspects of camel husbandry covering camel breeding, health, nutrition and management and utilization of camels for draft and milk production as well as value addition to camel milk. Exposure visits and interaction visits were also arranged on equine and sheep husbandry practices and dry land farming activities with the support of sister ICAR institutes of Bikaner.

3. TSP Activity

Under the Tribal sub plan the camps at Pratapgarh and Udaipur districts were organised on 17th to 20th Feb., 2014. Total 480 villagers including 127 women participated with their livestock viz. Camel-482, Buffalo-672, Cattle-708, Goat-970, Sheep-308. The extension materials and medicines were distributed to animal owners. Milking competition for cattle and Buffalo and best camel competitions were organised and prizes were given respective winner. Kisan Gosthi and Question-Answer Sessions were also organised. A team of experts consisting of scientists and senior technical officer of the centre organising the whole activity with the support of Animal Husbandry Officials with their mobile unit of Animal Husbandry Department of Rajasthan. Team of NRCC scientists including veterinary officer also visited Leh under TSP from 29.09.2013 to 07.10.2013 and interacted with farmers raising double humped camel.



Kisan Goshthi was organised with camel breeders at Hundar, Nubra valley. Treatment camps were organised at Hundar, Nubra valley and Sumur village near Siachin base camp.

MVSc and Ph.D. Thesis

Studies on sexual behaviour, follicular and corpus luteum dimensions in relation to conception in dromedary camel

Dr. Ajit Singh Mahla

Guide: Dr. Sumant Vyas

Abstract

The present study was undertaken to characterise the sexual behaviour in dromedary camel before and during mating, to detect follicular diameter on the ovaries of the female camel selected by the male for mating and to investigate effect of follicular and corpus luteum dimensions on conception. Total ten dromedary female camels ($n=10$), free from any uterine and ovarian abnormalities, were maintained under intensive management system in a barn at NRC on Camel, Bikaner. A virile male camel was left in the barn of female camels from 08:00 to 16:00 hours daily and females were observed for sexual behaviours before and during mating. Various sexual behaviours were graded into weak,



moderate and intense according to frequency and intensity of the expression. Out of ten females ($n=10$), eight females ($n=8$) were selected for mating by the male. Two females ($n=2$) were mated more than once during the study period. Total ten matings in eight females were included for the ultrasound examinations and hormone assays. Ultrasound examination of ovaries was conducted on Day 0 of mating for follicular dimension and on Day 7 of mating for CL dimension. Blood samples were collected on Days 0, 7, 15 and 30 of the mating for progesterone and oestradiol estimation. The females remained sexually active most of the days of study without any definite period of receptivity, but intensity of various behaviours was weak on most of occasions. No behaviour could be related to selection of female by the male for mating, however, approached by the male, coming closer to the male and restlessness were the behaviours, most frequently observed on the day of mating in selected females. Swelling of vulva, vaginal mucus discharge and frequent micturition could not be observed distinctly. All the mated females, except one female, carried 'ovulatory sized' follicle of ~ 0.9 cm ($0.9-2.3$ cm), at least on one ovary. A female having multiple follicular cysts on ovaries expressed abnormal behaviour and showed 'cocking of tail', a behaviour commonly expressed by pregnant camels. All the females having 'ovulatory sized' follicle ovulated in response to mating. Four females that had serum P4 concentration ~ 2 ng/ml



and showed 'cocking of tail' behaviour were considered pregnant. In pregnant females serum P4 level was found significantly ($p < 0.05$) increased on Day 7 and 15 of the mating. Serum E2 level in pregnant females was detected significantly ($p < 0.05$) higher on Day 15. The females that had pre-ovulatory follicles of size 9- 16 mm on the day of mating and CL sizes of ~20 mm resulted in more conception.

Characterization of methanogenic bacterial population from the gastro intestinal tract of camels (*Camelus dromedarius*) from India

Farah Naz Faridi

Co-Guide: Dr. D. Suchitra Sena

To understand the gut microbial diversity and to characterize its microbial population the DNA isolation method was standardized using manual and kit protocols. Protocols were optimized for rapid, reliable and efficient DNA extraction from faeces of camels as purity of isolated DNA and sensitivity of the method applied is a key issue in determining the protocol's effectiveness for isolating DNA. A total of 4 fresh and 4 frozen camel faecal samples were subjected to DNA isolation and evaluated from three different published protocols and one commercial kit protocol - QIAamp®DNA stool mini kit (Qiagen, GmbH, Hilden, Germany). Camel faecal DNA isolation using QIAamp®DNA stool mini kit was found the best method in terms of its efficiency, easiness and rapidity of the method and it can be effectively used for isolation of community DNA.

COLLABORATIVE RESEARCH ACHIEVEMENT

Validation of Health Benefit Claims of goat, camel, cow and buffalo milk – NDRI, Karnal

Three months in vivo study was conducted for the evaluation of cholesterol lowering potential of goat, camel,

cow and buffalo milk. In this study, effect of feeding milk from different species (goat, camel, cow and buffalo milk) along with cholesterol enriched diet (CED) on cholesterol levels in plasma, liver, aorta and faeces of rats was studied. Additionally, the antioxidative enzyme status and oxidative damaged products in liver, RBC and plasma were also checked. After 3 months of study, plasma cholesterol level was found to be significantly lower in all the groups fed with CED + milk (3% fat) as compared to CED group but there was no significant difference between CED and CED+ buffalo milk (full fat). In liver, antioxidative enzyme activity (Catalase, GPx and SOD) was increased significantly in the groups fed with CED + Goat milk (3% fat) and CED + Camel milk (3% fat) group as compared to CED group. Study 2 of objective 2 of the project was also carried out. Three months in vivo study was conducted for the evaluation of cholesterol lowering potential of goat, camel, cow and buffalo milk in hypercholesterolemic rats. In liver, Protein carbonyls levels were lower in CED + Goat milk (3% fat), CED + Camel milk (3% fat), and CED + Cow milk (3% fat) as compared to CED group. In plasma, Protein carbonyls levels were significantly lower in all the groups fed with CED + milk (3% fat) as compared to CED group.

Assessment of camel milk potential in SAM children –S.P. Medical College, Bikaner

The collaborative project is developed and technical programme is finalized. The pasteurized camel milk is given to SAM children as a supplement to study the effect of replacement of cow milk in UNICEF diet (F-75 and F-100) with camel milk in SAM children so that the value of camel milk for benefits of malnutrition children by preparation of energy dense child food using camel milk can be established which is locally available and affordable food items.

4. Technology Assessed and Transferred

Camel Milk products like Kulfi, Flavoured milk and Pasteurized milk which were developed and assessed by NRCC, kept for sale in “Camel Festival 2014” at Bikaner, Kisan Mela at CAZRI, Jodhpur and Tribal sub

Plan (TSP) programme at Leh, Ladakh, Pratapgarh and Udaipur district. These milk products relished by many foreign and Indian tourists, farmers and local people.



Camel leather, hair, bone products and camel milk powder were exhibited in “Krishi Vasant 2014” at Nagpur, State level National Science Day exhibition at Jaipur, “Camel Festival 2014” at Bikaner and Kisan Mela

at CAZRI, Jodhpur for popularization of these products. People were made aware about utilization and manufacturing of these camel products.





Complete feed pellet, complete feed block and area specific mineral mixture for camel were put for exhibition in “Krishi Vasant 2014” at Nagpur, State level National Science Day exhibition at Jaipur, “Camel Festival 2014” at Bikaner, Kisan Mela at CAZRI, Jodhpur and Tribal



sub Plan (TSP) programme at Leh, Ladakh, Pratapgarh and Udaipur districts for awareness of people about these camel feed products. Camel keepers were made aware about production, utilization and benefits of these products.



5. Education, Training and Awards

National

Dr. Nirmala Saini attended one day training on Knowledge disseminated on NIR technology for feed researchers and manufacturers. SDS Company presentation and demonstration of Diode Array (DA) NIR feed analysis, IDA, New Delhi on 8 April-2013.

Dr. Raghvendar Singh attended Management Development Programme (MDP) on Biotechnology and IPR at NAARM, Hyderabad from 8-12 July, 2013

Dr. Sanjay Kumar attended National Training Programme on Advances in Stem Cell Therapy in Livestock and Pets and its Business Potential held on dated, at Division of Physiology and Climatology IVRI, Izatnagar from 16-29 July, 2013.

Dr. F.C. Tuteja attended MDP training on Consultancy Projects Management at NAARM, Hyderabad from 1-7 August, 2013

Dr. S. Vyas attended Management Development Programme (MDP) on leadership development (Pre-RMP Cadre) at NAARM, Hyderabad from 26th Aug to 7th September, 2013.

Dr. A. K. Nagpal attended a training program on Leadership for Innovation in Agriculture at National Institute of Agricultural Marketing, Jaipur, Rajasthan from 04—07 November, 2013

Awards

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Dr. F. C. Tuteja received III prize in Session VIII on Equine and Pack Animal Medicine at 32nd Annual Convention of ISVM & International Symposium on 'The 21st Century Road Map for Veterinary Practice, Education & Research in India & Developing Countries held at R.S. Pura, Jammu from 14-16 February, 2014.

Sh. Mohan Singh (T-5) won Gold medals in Shot put and discus throws respectively in Rajasthan state Master Athletics Championship, held during from 22.04.2013 to 26.04.2013 at Bandikui, Rajasthan, India.

Sh. Mohan Singh (T-5) won Silver medals in Shot put and discus throws respectively in the Master Athletics Championship held during 28.05.2013 to 02.06.2013 at Bangalore, India.

In ICAR Inter Zonal Sports Tournament held at Bikaner from December 17-20, 2013 by NAARM, Hyderabad following awards were received by NRCC:

Discus throws	: 1 st Prize Sh. Mohan Singh
Shot put	: 1 st Prize Sh. Mohan Singh
Volley Ball Shooting	: Runner Trophy

Brain Storming Meet on 3-4 January, 2014





6. Linkages and Collaborations

National

Collaborative University/Institute	Programme
AIIMS, New Delhi	Identification characterization and structural studies of proteins from camel milk
Anand Agricultural University, Gujarat	Metagenomics of rumen microbes
Bansathali University, Banasthali Vidyapith	Research work of Ph.D. students
Bhabha Atomic Research Centre, Mumbai	Development of single domain antibodies (SDA) for <i>in vivo</i> diagnosis/therapy
Calcutta University, Kolkata	Collaborative research project
Guru Angad Dev University of Animal and Veterinary Sciences, Ludhiana	Research work of Ph.D. students
Institute of Pesticide Formulation Technology, Gurgaon	Collaborative research project
Lokhit Pashupalan Sansthan, NGO at Sadri, Pali	Extension of camel husbandry practices
Maharaja Ganga Singh University, Bikaner	Research work of Ph.D. students
National Dairy Research Institute Karnal	Validation of health benefit claims of goat, camel, cow and buffalo milk
Rajasthan University of Veterinary, and Animal Science, Bikaner	Research work of M.V.Sc. and Ph.D. students
Sardar Patel Medical College, Bikaner	Development of anti-snake venom.
Sahjeevan, Bhuj, Gujarat	Extension of camel husbandry practices
Sardarkrushinagar Dantiwada Agricultural University, Sardar Krushinagar	Research work of Ph.D. students
Sher-e-Kashmir University of Agriculture and Technology, Srinagar	Conservation of double humped camel
Sahjeevan, Bhuj, Gujarat	Extension of camel husbandry practices
Urmul Dairy, Bikaner	Marketing of camel milk
Rajasthan State Government	Training of farmers through ATMA

International

Collaborative University/Institute	Programme
Sardarkrushinagar Dantiwada Agricultural University, Sardar Krushinagar	Ph.D. research work of Ethiopian student Ntiranyibagira Emmanuel
University of Khartoum, Sudan	Post-Doctoral Fellowship under C. V. Raman International Fellowship Program for African candidate Dr. Atif Elamin Abdelgadir, Associate Professor, Faculty of Veterinary Medicine (From 03/10/2013 to 07/03/2014)



Dr. Atif Elamin Abdelgadir, Associate Professor, Faculty of Veterinary Medicine, University of Khartoum, Sudan for Post Doctoral Fellow under C. V. Raman International Fellowship Program for African candidates (From 03/10/2013 to 07/03/2014)

7. List of Publications

Papers in Research Journals

- Archana, Kumar, N., Gond, V.K., Kumar, S., Singh, S.D. and Jayachandran, C. (2013). Clinico-haematobiochemical profile after repeated subcutaneous administration of ivermectin in goats *Journal of Veterinary Pharmacology and Toxicology*. 12: 79- 81.
- Dahiya, S.S., Nagarajan, G., Bharti, V.K., Swami, S.K., Mehta, S.C., Tuteja, F.C., Narnaware, S.D. and Patil, N.V. (2013). Sequence analysis of the Toll-like receptor-2 gene of old world camels. *Journal of Advanced Research* (Elsevier).[http:// dx.doi. Org / 10.1016/ j.jare.013.09.001](http://dx.doi.org/10.1016/j.jare.013.09.001).
- Kumar, S., Manohar, G.S., Ghorui, S.K., Kashyap, S.K. and Maherchandani, S. (2014). Isolation and molecular characterization of *oligopeptidase B* gene of *Trypanosoma evansi* from Indian dromedaries. *Indian Journal of Animal Sciences*. 84: 3-7.
- Kumar, S., Manohar, G.S., Ghorui, S.K., Kashyap, S.K. and Maherchandani, S. (2013). Molecular characterization of paraflagellar *rod 1* gene of *Trypanosoma evansi* from Indian dromedaries. *Journal of Camel Practice and Research*. 20: 191-196.
- Kumar, S., Manohar, G.S., Ghorui, S.K., Kashyap, S.K., Maherchandani, S. and Patil, N.V. (2013). Amplification, cloning and sequence analysis of paraflagellar *rod 2* gene of *Trypanosoma evansi* isolated from Indian dromedaries. *Veterinary Practitioner*. 14: 204- 207.
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- Mehta, S.C. (2013). Molecular characterisation of Mewari breed of camel. *Veterinary Practitioner*. 14: 212-215.
- Nagarajan, G., Swami, S.K., Dahiya, S.S., Sivakumar, G., Narnaware, S.D., Tuteja, F.C. and Patil, N.V. (2013). Comparison of virokinine from camel pseudocowpox virus (PCPV) with interleukin10 of the dromedary camel (*Camelus dromedarius*) *Cytokine* 1: 356-359.
- Nagarajan, G., Swami, S.K., Dahiya, S.S., Sivakumar, G., Yadav, V.K., Tuteja, F.C., Narnaware, S.D., and Patil, N.V. (2013). Phylogenetic analysis of immunomodulatory protein genes of Camel pox virus obtained from India *Comparative Immunology, Microbiology and Infectious Diseases*. 36: 415-424
- Nagarajan, G., Swami, S.K., Dahiya, S.S., Sivakumar, G., Tuteja, F.C., Narnaware, S.D., Mehta, S.C., Raghvendar Singh and Patil, N.V. (2014). Comparative sequence analysis of double stranded RNA binding protein encoding gene of parapoxviruses from Indian camels. *Journal of Advanced Research* (Elsevier). 5: 271-276.
- Nagpal, A.K. (2013). Evaluation of roughage based complete feed pellet diets in male camel calves. *Indian Journal of Animal Nutrition*. 30:169-174.
- Nagpal, A.K. and Patil, N.V. (2013). Nutrient utilization and serum biochemical profile of adult dromedary camels given oat straw and groundnut haulms. *Journal of Camel Practice and Research*. 20: 11-13.
- Narnaware, S.D., Nagarajan, G., Dahiya, S.S., Sivakumar, G., Tuteja, F.C. and Patil, N.V. (2013). Chronological classification of pathomorphological lesions in dromedary contagious ecthyma infection. *Journal of Camel Practice and Research*. 20: 87-92.
- Narnaware, S.D., Tuteja, F.C., Nagarajan, G., Dahiya, S.S., Ghorui, S.K. and Patil, N.V. (2014). Primary epicardial hemangiosarcoma in a dromedary camel



- (*Camelus dromedarius*): pathologic and cytologic findings. *Veterinary Practitioner* (In press)
- Poonam, S. Mohod, Jangde, C.R., Narnaware, S.D. and Raut, S. (2014). Experimental evaluation of analgesic property of bark skin of *Saraca indica* (Ashoka) and *Shorea robusta* (Shal). *Journal of Applied Pharmaceutical Science*. 4: 062-065.
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- Rehab, A. Yagi., Ghorui, S.K., Manohar, G.S., Kumar, S., Shinde, N.G. and Joshi, S.P. (2013). Identification and molecular cloning of *RoTat* VSG gene of *Trypanosoma evansi* of camel in India. *Journal of Camel Practice and Research*. 20: 209-212.
- Saini, N., Kiradoo, B.D. and Bohra, D.L. (2013). Micro minerals profile of commonly used feeds and forages of camel in transitional plain of Inland Drainage (RJ-3) of Rajasthan. *Indian Journal Animal Nutrition*. 30:285-288.
- Saini, N., Mehta, S.C., Patil, N.V., Kiradoo, B.D. and Bohra, D.L. (2013). Prediction equation for estimating live body weight of dromedary calves. *Journal of Camel Practice and Research*. 20: 7-9.
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- Singh, S., Poonia, R.K., Raghvendar Singh, Mehta, S.C. and Patil, N.V. (2013). A comparative study on the physicochemical parameters of camel and buffalo milk. *Journal of Buffalo Science*. 2:135-137.
- Shrikant Sharma, Raghvendar Singh, Shashank Rana, Samit Kumar and Yuvraj Singh Negi (2013). Drug Delivery System: A Review” in Biopolymers for Targeted Drug Delivery Systems, Lambert Academic Publishing ISBN 978-3-659-39340-2.
- Shashank Rana, Raghvendar Singh and Shrikant Sharma (2013). In silico modeling and functional Characterization of 3-d structure of chicken (gallus gallus) vitellogenin protein, *Journal of Bioinformatics and Intelligent Control (JBIC)*, 2 (2).
- Shashank Rana, Raghvendar Singh and Shrikant Sharma. (2014). In-Silico Comparative Modelling of clpP2 protein from *Micobacterium tuberculosis* H37Rv. *J. of Bioinf. Control*, 3, 8-14.
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- Tuteja, F.C., Sena, D.S., Narnaware, S.D., Vyas, S., Patil, N.V., Singh, S. and Chirania, B.L. (2013). Congestive heart failure in camels: Gross post-mortem pictorial. *Veterinary Practitioner*. 14: 368-371.
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Vyas, S., Feroz Din Sheikh, Singh, S., Sena, D.S., Bissa, U.K. and Sharma, N. (2014). Sea buckthorn or Leh Berry (*Hippophae rhamnoides*)- an important fodder shrub for Bactrian camel in high altitude Ladakh region submitted to *Journal of Camel Practice and Research*.

Vyas, S., Nath, K., Chirania, B.L., Sharma, N., Singh, S. and Patil, N.V. (2013). Uterine prolapse in dromedary camel- A case report. *Journal of Camel Practice and Research*. 20:105-107.

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Faridi, F. and Sena, D.S. (2013). Role of herbal immunomodulators in combating stress in animals: A report. International symposium on “Latest trends in immunodiagnosis, immunopathology and immunomodulation. RAJUVAS, Bikaner. Dec., 22-24, 2013.

Gholve, C., Kumarsamy, J., Damle, A., Ghorui, S.K., Patil, N.V. and Rajan, M.G.R. (2013). One-step IRMA for serum thyroglobulin in the follow-up of differentiated thyroid cancer patients. SNMICON-2013 on ‘Molecular imaging and radionuclide therapy’, held at BARC, Mumbai, Dec., 12-15, 2013.

Ghorui, S.K, Kumar, S., Raghvendar Singh and Patil, N.V. (2014). Development of real-time PCR assay for *Trypanosoma evansi* detection in camel blood samples XXIV National Congress of Veterinary Parasitology (NCVP) and National symposium on “Towards food security through sustainable animal production and integrated parasite management”. Mannuthy, Thrissur, Kerala. Feb., 5- 7, 2014.

Ghorui, S.K., Kumar, S. and Patil, N.V. (2014). Serological survey with PCR validation for camel line

surra in western Rajasthan. XXIV National Congress of Veterinary Parasitology (NCVP) and National symposium on “Towards food security through sustainable animal production and integrated parasite management”. Mannuthy, Thrissur, Kerala. Feb., 5- 7, 2014.

Ghorui, S.K., Kumar, S., Raghvendar Singh and Patil, N.V. (2014). Identification and characterization of VSG gene of *Trypanosoma evansi* isolated from camel XXIV National Congress of Veterinary Parasitology (NCVP) and National symposium on “Towards food security through sustainable animal production and integrated parasite management”. Mannuthy, Thrissur, Kerala. Feb., 5- 7, 2014.

Ghorui, S.K., Kumar, S., Raghvendar Singh and Patil, N.V. (2013). Bioactivity evaluation of certain hepatic enzymes in blood serum of dromedary camel. Abstract: International symposium on “Latest trends in immunodiagnosis, immunopathology and immunomodulation” & VI convention of Society for Immunology and Immunopathology, RAJUVAS, Bikaner. Dec., 22-24, 2013.

Kumar, S., Ghorui, S.K. and Patil, N.V. (2014). Coccidiosis in camel caused by rare infection of *Eimeria leuckarti* XXIV National Congress of Veterinary Parasitology (NCVP) and National symposium on “Towards food security through sustainable animal production and integrated parasite management”. Mannuthy, Thrissur, Kerala. Feb., 5- 7, 2014.

Kumar, S., Manohar, G.S., Ghorui, S.K. and Patil, N.V. (2013). Molecular characterization of Oligopeptidase-B gene of *Trypanosoma evansi* isolated from camel. International symposium on ‘Latest trends in immunodiagnosis, immunopathology and immunomodulation & VI Annual convention of Society for Immunology and Immunopathology’ RAJUVAS, Bikaner. Dec., 22-24, 2013.

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- Nagarajan, G., Swami, S.K., Dahiya, S.S., Narnaware, S.D., Tuteja, F.C., Mehta, S.C., Singh, R. and Patil, N.V. (2013). Characterization of uracil DNA glycosylase encoding gene from camel pseudocowpox. 13th Indian Veterinary Congress and XX Annual Convention of Indian Association for the advancement of veterinary research and International conference on thrust areas in veterinary research, education, regulatory reforms and governance for quality services to farmers. April, 16-17. P. 44.
- Nagarajan, G., Swami, S.K., Dahiya, S.S., Mehta, S.C., Narnaware, S.D., Nath, K., Tuteja, F.C., Singh, R. and Patil, N.V. (2013). Cloning and sequence analysis of interleukin-8 encoding gene from dromedary camel (*Camelus dromedarius*). In International Symposium on “Latest trends in Immunodiagnosis, Immunopathology and Immunomodulation” & VI Annual convention of Society for Immunology and Immunopathology-December 22- 24, 2013 organized by RAJUVAS Bikaner, pp 96.
- Nagpal, A.K. and Mehta, S.C. (2013). Isolation, morphological, biochemical and molecular characterization of fibrolytic anaerobic bacteria from rumen of dromedary camel. Extended abstract paper accepted for presentation in the Glance 2014 Global Animal Nutrition Conference to be held at Bengaluru from 20-22 April, 2014
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- Raghvendar Singh, Ghorui S.K., Nagarajan, G., Dahiya, S.S., Patil, N.V., Poonia, R. and Kishore, N. (2013). Antioxidative enhancing property of fermented camel milk. Abstract: International symposium on “Latest trends in immunodiagnosis, immunopathology and immunomodulation” & VI convention of Society for Immunology and Immunopathology, RAJUVAS, Bikaner. Dec., 22-24, 2013.
- Rehab A. Yagi, Ghorui, S.K., Manohar, G.S., Kumar, S., Shinde, N.G. and Joshi, S.P. (2013) Identification and Molecular cloning of RoTat VSG gene of *Trypanosoma evansi* of camel in India International Symposium on ‘Latest trends in immunodiagnosis, immunopathology and immunomodulation & VI Annual convention of Society for Immunology and Immunopathology’ RAJUVAS, Bikaner. Dec., 22-24, 2013.
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- Sharma, G., Swami, S.K., Srivastava, M., Dahiya, S.S., Mehta, S.C., Narnaware, S.D., Patil, N.V. and Nagarajan, G. (2013). Amplification and cloning of



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Singh, S. (2014). Growth performance of cactus in fields of NRCC. In National workshop on Cactus 21.3.14 at CAZRI, Jodhpur.

Tuteja, F.C., Dahiya, S.S. Narnaware, S.D., Nagarajan, G. and Patil, N.V. (2014). Prevalence of bacterial and fungal diseases in dromedary camel. 32nd Annual convention of Indian Society for Veterinary Medicine (ISVM) & International symposium on ‘The 21st century road map for veterinary practice, education & research in India & developing countries. Feb., 14-16. R.S. Pura, Jammu. Souvenir-cum-abstracts. P.108.

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Key note address / invited papers presented/published

Ghorui, S.K. and Kumar, S. (2014). Climate change: foresight of infectious disease management and production of livestock. Published in ASCAD seminar on “New horizon; effective and productive livestock development” Ajmer, Rajasthan. Feb., 19-20, 2014.

Ghorui, S.K., Kumar, S., Raghvendar Singh and Patil, N.V. (2013). Termination of pregnancy induced by *Trypanosoma evansi* in naturally infected camels. Abstract: International symposium on “Latest trends in immunodiagnosis, immunopathology and immunomodulation” & VI convention of Society for Immunology and Immunopathology. RAJUVAS, Bikaner. Dec., 22-24, 2013. Lead paper.

Patil, N.V. (2014). Brainstorming meet at NRCC, Bikaner on 3-5 January, 2014 delivered lecture on Functional food value of camel milk –potential treasure of health on Jan.3,2014.

Patil, N.V. (2013).Chaired a session on “Livestock Management” in National workshop on “Managing Resources for Optimising of Land Productivity in Thar Desert” and presented on July, 19,201 at CAZRI, Jodhpur.

Patil, N.V. (2014). Management of nutrition for optimum reproduction in farm animals. Souvenir of Key notes and abstracts: National symposium on frontier reproductive biotechnologies for enhancing animal fertility & fecundity: Global perspective and XXIX annual convention of the India Society for Study of Animal Reproduction. Nagpur Veterinary College, Nagpur. Jan., 8-10, 2014.p. 404-412

Patil, N.V. (2014) Chaired one scientific session and delivered lead paper on “Issues of Small Ruminant



Production System in Arid Region” in the ISSGPU Conference at Mahabaleshwar on Feb. 22, 2014.

Patil, N.V. (2013). Delivered lecture and presentation on the topics entitled Management of Animal Production System in Dry Region for Improving Productivity and Health” at PGI, MAFSU, AKOLA on Sept., 23, 2013.

Patil, N.V. (2013). Delivered lecture and presentation on the topics entitled, “Nutritional Interventions during transition period for Optimum Productivity and Reproductive Efficiency in Dairy Livestock” at PGI, MAFSU, AKOLA on Sept., 23, 2013.

Patil, N.V. (2013). Delivered a lecture and presentation on the topic entitled, “Camel- Future animal of Biomedical Research for Human Health”. The faculty of PGI, MAFSU, AKOLA Students and invitees attended the lectures on Sept., 24, 2013.

Patil, N.V. (2014). Delivered Key Note address at National Symposium on Frontier Reproductive Biotechnologies for Enhancing Animal Fertility & Fecundity: Global Perspective and XXIX Annual Convention of the India Society for Study of Animal Reproduction at Nagpur Veterinary College, Nagpur Jan. 10, 2014.

Tuteja, F.C. (2014). Invited lecture on ‘Mastitis- a great challenge to the dairy farmers’. ASCAD seminar 2013-14 on ‘Recent scientific trends for augmenting health, production and reproduction in food animals’. Feb. 5-6, 2014. RAJUVAS, Veterinary college campus, Bikaner.

Vyas, S. (2014). A lecture entitled, “Camel husbandry: status, problems and future” was given on 20/2/2014 at ASCAD seminar organized by The Additional Director (Range), Ajmer, Deptt. of Animal Husbandry, Govt. of Raj. The focus of the seminar was on “New Horizons- Effective and productive livestock development”.

Technical / popular articles

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egrk] , l -l h] fl g] , l -] fpjkfu; k] ch-, y- , oafcll k] ; w ds ½2014½ %m"Vª mñi knu , oa iztuu- jk"Vh; m"Vª vuq ddku dñæ] chdkuj ea vñRek ifj; kst uk vñrxñr be#{ks= eai 'kq kyu çf'k{k.k.ß i"B 7&10-

euthr fl g] , oa , u-oh-ikfVy- ½2012½ vñlk; kñl=dh i 'kq vkqkj e'khu%gj izdkj l sgñfdQk; rh] djHk 10% 67&70-

fcLI k] ; wds , oa egark] , l -l h ½2014½ ÅV i kyu , oa iztuu izdku jk"Vh; m"Vª vuq ddku dñæ] chdkuj ea vñRek ifj; kst uk vñrxñr be#{ks= eai 'kq kyu çf'k{k.k.ß i"B 43&45-

fl g] l Ttu] , Q-l h- Vñst k] , l -l h egark] , oa , u-oh-ikfVy ½2012½ fdl kuka dh l ok eafdl ku d,y l ÷j djHk 10% i"B 13&17-

fl g] l Ttu] , Q l h Vñst k] , oa , u-oh- ikfVy ½2013½ ykjbM fo"kkärk o LoLF; ij ml ds dñHko djHk 11% i"B 66&69-

fl g] l Ttu] , Q l h Vñst k] , oa , u-oh- ikfVy ½2012½ m"Vª i kyu dsfy, pkjk mñi knu dk e°Ro djHk 10% i"B 73&75-

fl g] , l -] Vñst k] , Q-l h , oai kfVy] , u-oh- ½2014½ m"Vª dh foñHku 'kkjhjd voLFkkvka ds vuq i izLUku- jk"Vh; m"Vª vuq ddku dñæ] chdkuj ea vñRek ifj; kst uk vñrxñr be#{ks= eai 'kq kyu çf'k{k.k.ß i"B %26&28

HkkVh] , -ds] jk/kkd" .k oek] , u-oh-ikfVy] ; wdsfcLI k] , u- 'kek] jkeplnz, oaksu fl g] ½2012½ uotkr Vñgm; ka dh mfpr nñ[kkky] djHk 10% i"B 71&72

i d t d e j f l g , o a v ' k k d d e j u x i k y - 1/2012 1/2 Å / M e a
l f e t h o c k s / k s t k s k d k p k j i k p u e a ; k s n k u d j H k 10%
i " B 63 & 66 -

i k f v y] , u - o h (1/2012 1/2 j k " V h ; m " V a v u l d a k k u d l t n z % c g r j
v u l d a k k u g r q i f r c) d j H k 10% i " B 9 & 12 -

j k ? k d " . k j m e s k d e j f c l i k j v k u l n d e j H k V h , o a , u - o h
i k f v y] 1/2012 1/2 i t t u u d h f o f / k ; k j d j H k 10% i " B 71 & 72 -

j k ? k o t a e f l g j 1/2012 1/2 H k j r h ; r k ^ 1/2 d f o r k 1/2 d j H k % 0

j k ? k o t a e f l g j n o t a e d e j] u n f d ' k j p k j k u j f t r t a e d e j
 , o a j k d s k d e j i f i u ; k j 1/2013 1/2 ^ v , f v T e c u k e Å / V u h
d k n i k ^ d j H k % 11% i " B 21 & 22 -

j k ? k o t n z f l g j u l n f d ' k j , o a M k j j k d s k d e j i f i u ; k j 1/2014 1/2
H k j r e a m " V a n d / k m R i k n a d h l E H k o u k , a o m i ; k s x r k ^
j k " V h ; m " V a v u l d a k k u d l t a e] c h d k u j e a v k R e k i f j ; k s t u k
v l r x z r p e # { k s = e a i ' k i k y u c f ' k { k . k s i " B 16 & 18 -

j k d s k d e j i f i u ; k j j k ? k o t a e f l g j n o t n z d e j , o a f t r t n z
d e j 1/2013 1/2 f y O k s y k b t s k u f o f / k } k j k n i k i k m M j d k
m R i k n u ^ d j H k % 11% i " B 55 & 56 -

j s j j k e n ; k y , o a M h - l f i p = k l s u k 1/2013 1/2 H k j r e a c k s) d
l E i n k v f / k d j k * d j H k 11% i " B 81 & 85 -

j s j j k e n ; k y , o a M h - l f i p = k l s u k 1/2013 1/2 d k w h j k b v d k u u %
i l r d k y ; d s l u n H z e a d j H k 11% i " B 101 & 103 -

l s h f u e z y k 1/2013 1/2 i f j o f r z i f j n ' ; e a m " V a i k s k . k j k t H k " k
o k r " k d i f = d k ^ d j H k ^ 11% i " B 14 & 16 -

l s h f u e z y k 1/2012 1/2 l r f y r m R i k n u g r q i k s k . k i c l u / k u ^
j k t H k " k o k r " k d i f = d k ^ d j H k ^ 10% i " B 26 & 30 -

l s u k l f i p = k , o a Q j k g Q j h n h 1/2014 1/2 m " V a V k s y a d k l e f p r
c c l u / k u * j k " V h ; m " V a v u l d a k k u d l t a e] c h d k u j e a v k R e k
i f j ; k s t u k v l r x z r p e # { k s = e a i ' k i k y u c f ' k { k . k s i " B %
78

M h - l f i p = k l s u k , o a j k d s k d e j i f i u ; k j 1/2013 1/2 Å / M s d s
m R i k n u , o a L o k F ; l d k j e s t s & c k s j k s x d h d k v u i z k s
d j H k 11% i " B 29 & 32 -

n f g ; k j , l - , l -] u k j u o j s , l - M h] u k x j k t u j t h] V y s t k j , Q -
l h , o a ' k s y s k d e j L o k e h 1/2013 1/2 m " V a & { k ; j k s - d j H k
11% i " B 53 & 54 -

n f g ; k j , l - , l -] u k x j k t u j t h i d t f l g j ' k s y s k d e j
L o k e h , o a x l s o ' k e l z 1/2014 1/2 Å / M e a e f M h j k s - j k " V h ;
m " V a v u l d a k k u d l t a e] c h d k u j e a v k R e k i f j ; k s t u k v l r x z r
p e # { k s = e a i ' k i k y u c f ' k { k . k s i " B % 61

n o t a e d e j] j k ? k o t a e f l g j] j k d s k d e j i f i u ; k j , o a f t r t n z
d e j 1/2013 1/2 m " V a n d e k d h t f o d x r f o f e k ; k j d j H k %
11% i " B 23 & 25 -

n o t n z d e j , o a j k ? k o t a e f l g j 1/2012 1/2 f d f . o r n i k m R i k n %
 , d d k ; k R e d [k k] ^ d j H k % 10% i " B 50 & 52 -

0 ; k l l e l r 1/2014 1/2 Å / M e a c t u u l e f / k r e g R o i w k z t k u d k j h
j k " V h ; m " V a v u l d a k k u d l t a e] c h d k u j e a v k R e k i f j ; k s t u k
v l r x z r p e # { k s = e a i ' k i k y u c f ' k { k . k s

t h u k x j k t u j ' k s y s k d e j L o k e h] ' ; k e f l g n f g ; k j x l s o
' k e l z , o a i d t f l g j 1/2014 1/2 p p d % Å / M e a , d l d k e d
j k s j k " V h ; m " V a v u l d a k k u d l t a e] c h d k u j e a v k R e k
i f j ; k s t u k v l r x z r p e # { k s = e a i ' k i k y u c f ' k { k . k s i " B %
60

u k j u o j s f ' k j h " k 1/2014 1/2 Å / M s e a g k u s o k y h e g R o i w k z l d k e d
c h e k f j ; k j k " V h ; m " V a v u l d a k k u d l t a e] c h d k u j e a v k R e k
i f j ; k s t u k v l r x z r p e # { k s = e a i ' k i k y u c f ' k { k . k s i " B %
41 -

u k j u o j s f ' k j h " k j ' ; k e f l g n f g ; k , o a t h u k x j k t u j 1/2013 1/2
Å / M s e a x H k k r d s d k j . k o c p k o - d j H k 10% i " B 38 & 41 -

u k x i k y - , - d s 1/2012 1/2 u k x Q u h j s x L r k u e a , d c g e m i ; k s h
i k s k - d j H k 10% i " B 88 & 94 -

u k x i k y , - d s 1/2012 1/2 V k j f i M ; k a d k s f o f i H k u c k s / h u L r j d s
l i w k z v k g j x e s f [k y k u s i j i k s k d r R o k a d s m i ; k s v l s j
o ; L d r k i j c H k k o , o a e l r ; k a d u - d j H k 10% i " B
18 & 25 -

u k x i k y - , - d s 1/2014 1/2 l u r f y r v k g j j k j k Å / M a d k o k k f r u d
i k s k . k c c a k d j a j k " V h ; m " V a v u l d a k k u d l t a e] c h d k u j e a



vkRek ifj; kstuk vlrXr be#{ks= eai 'kq kyu cf'k{k.k.kB i"B%51&55-

ukxiky, -ds egrr, l-l h] jke dckj, oajSj jken; ky ½2013½ fiNys, d n'kd ds nkSku chdkuj vkS jktLFkk çnsk ea tul j[; k] i 'kqku vkS —f'k dh xfr'khyrk- djHk 11% i"B 40&49-

Vq/stk], Q-l h] fl g], l-l -, oauehpn ½2014½ ÅVfu; ka ea Fkuyk jks ds dkj.k] cpko o mi pkj- jk"Vh; m"Va vuq dkku dæ] chdkuj eavkRek ifj; kstuk vlrXr be#{ks= eai 'kq kyu cf'k{k.k.kB i"B%11&15-

Vq/stk], Q-l h] ukFk] ds fpjkfu; k] ch, y-, oa i kfVy], u-oh- ½2014½ VksfM; ka ea Bhdfj; k ¼Ldu dMhfM; \$l l ½ jk"Vh; m"Va vuq dkku dæ] chdkuj ea vkRek ifj; kstuk vlrXr be#{ks= eai 'kq kyu cf'k{k.k.kB i"B%73&77-

Vq/stk], Q-l h] ukxiky], -ds, oa fl g], l-l- ½2013½ jk"Vh; m"Va vuq dkku dæ- py fpfdRI ky; - djHk 11% i"B 4&8-

Vq/stk], Q-l h] ukxjktu] th-, oauehpn ½2013½ 'ou oyM %ou gYFk* vFkok ^, d l d kj %, d LokLF; *- djHk- 11% i"B 86&88-

Vq/stk], Q-l h] ukxjktu] th- nfg; k], l-l-, l-l- ukjuoj}, l-l-Mh- fl g], l-l- ukFk] ds, oa i kfVy], u-oh- ½2012½ ÅV dh foHkUu chekfj; kdsckák y{k.k.kadk Nk; kfp=ka }kjk çn'kU- djHk%10% i"B 42&46-

D. Suchitra Sena and N.V.Patil. (2013). Camel Faecal Metagenomics. published in the training manual for a short course on "Metagenomics: Role of next generation sequencing and bioinformatics" during 15-24, October, 2013. Pp: 98-105

Technical bulletins/books

Mehta, S.C. Prepared and 3rd editing accomplished for the technical bulletin in Hindi entitled "m"V'fodkl dh ifjdYi uk %eokMh ÅWß

Mehta, S.C. and Patil, N.V. Prepared and 1st editing accomplished for the technical bulletin in Hindi entitled "Fkkj dh 'kku % tS yejh ÅV"

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Vq/stk], Q-l h- l g l d knd %l dkn ½2013½ uxj jktHkk'kk dk; k]o; u l fejr] chdkuj- 1&50-

Book Chapter

Mehta, S.C. (2013). Indian hill camel and sustainable camel dairying. Book on the theme "Agro-biodiversity management for sustainable rural development" to be published by the National Academy of Agricultural Research Management, Hyderabad.

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Singh, S. and Ravi, S.K. (2013) Assisted reproductive biotechnologies in camel. Book entitled physiology and nutri- genomics underpinning animal production ISBN 13:978-81-928693-1-5:66-71.

Contributions made in compilation / documentation

Mehta, S.C. Designed four breed posters in Hindi and English

Mehta, S.C. Designed thirteen Display Items (Posters) and the Note Book cover under TSP and accomplished the task.

Narnaware, S.D. Lesions of contagious ecthyma in camels *ÅVka ea eMe jks ds y{k.k* Poster under TSP

Narnaware, S.D., Common diseases of camels *ÅVkaChh ed; chekfj; k; k* Poster under TSP

Radio Talk

Mehta, S.C. (2014) Delivered Radio talk on “Breeding and improvement of Indian camel breeds” under the programme of RAJUVAS with Bikaner Aakashwani Kendra. Broadcasted in January 2014.

Extension leaflets

I ðh , u- , oa i kfVy , u-oh- ½2014½ mRi knu I ðkkj grq ÅVkaChh I rfyr i ksk.k- , uvkj I hl h- 1&6

Gene sequences submitted in NCBI GenBank database

Dahiya, S.S., Nagarajan, G., Swami, S.K., Sivakumar, G. and Patil, N.V. (2013). *Camelus dromedarius* Toll-like receptor 2 mRNA, complete cds Accession No JQ979305

Dahiya, S.S., Nagarajan, G., Swami, S.K., Sivakumar, G., Bharti, V.K., Narnaware, S.D., Tuteja, F.C. and

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Mehta, S.C., Dan, H., Swami, S.K., Dahiya, S.S., Nagarajan, G. and Murdia, C.K. (2013). *Camelus dromedarius* breed Kachchhi alpha s2 casein gene, promoter region (1181bp). NCBI GenBank Accession No. KF648560.

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Nagarajan, G., Swami, S.K., Dahiya, S.S., Mehta, S.C., Narnaware, S.D., Raghvendar Singh and Patil, N.V. (2014). Characterization of IL-8 encoding gene of the dromedary camel, 304 bp mRNA. NCBI GenBank Accession No. KF843702

Sena, D.S. and Patil, N.V. (2014). *Pseudomonas aeruginosa* strain DKH-3 (KJ789926)

Sena D.S. and Patil, N.V. (2014). *Pseudomonas aeruginosa* strain WJQ No.1: (KJ789927)

Sena D.S. and Patil, N.V. (2014). *Pseudomonas nitroreducens* strain HP2 (KJ789925)

Farmers Visited at NRCC





8. List of Ongoing Projects

S.No.	Project Code	Project Title	PI/Co-PI	Duration
1	AGB-7	Genetic improvement of milk production potential of Indian dromedary	S.C. Mehta, U.K. Bissa	2007-14
2	AGB-8	Genetic evaluation of performance of Indian camel	U.K. Bissa, K. Nath	2011-14
3	AGB-9	Structural analysis of 5' Flanking region of dromedary milk protein gene(s)	S.C. Mehta, S.S. Dahiya	2011-14
4	AGB-10	Development of milch strain of dromedary & providing seed material for genetic improvement of farmers herd	S. C. Mehta, U.K. Bissa, B.L. Chirania	2013-18
5	AN-5	Enhancing nutrient utilization and reducing methane emission	A.K. Nagpal	2009-14
6	AN-6	Evaluation of feed pellets containing different protein levels in male growing camel calves	A.K. Nagpal	2011-14
7	AN-7	Assessment of nutritional status of lactating camels for improving production performance	N. Saini, N.V. Patil	2011-14
8	VP-3	Management of Trypanosomiasis in camel under farm and field condition.	Sanjay Kumar, S.K. Ghorui, Kashi Nath	2013-16
9	AP-7	Physiological and performance adaptability of camel under hot arid environment having different body scores (BCS)	S. Singh, K. Nath	2011-14
10	AR-5	Improving the efficiency of artificial insemination in camel using existing and emerging technologies	S. Vyas	2008-14
11	AB-1	Production and evaluation of bioactive compounds from indigenous camel milk products	Raghvendar Singh, S.K. Ghorui, G. Nagarajan	2012-15
12	VM-8B	Epidemiology prevalence of parasitic diseases of camel	S.K. Ghorui	2007-14
13	VM-13	Generation and validation of suitable formulation for the treatment of dermal mycoses in camel	F.C. Tuteja, D.S. Sena, S.D. Narnaware,	2013-16
14	VM-12	A pilot study on the Gut/Digestive tract metagenomics of camel	D. S. Sena, N.V. Patil, Raghvendar Singh	2012-15



S.No.	Project Code	Project Title	PI/Co-PI	Duration
15	BT-AS-3	Characterization of Toll-like Receptors (TLR) in Camel	S.S. Dahiya, G. Nagarajan	2012-14
16	VP-1	Investigations on clinical cases for overall health improvement of camel herd	S.D. Narnaware, F.C. Tuteja, S.K. Ghorui, B.L. Chirania	2010-14
17	VP-2	Management of GI Parasites in camel herd and molecular characterization of anthelmintic resistant strains of parasites	S.K. Ghorui, S. Kumar	2008-14

Inter-institutional and externally funded projects

S.No.	Project Code	Project Title	PI/Co-PI	Duration
1	VTC-RM (NAIP)	Network programme on veterinary type culture-rumen microbes (lead centre NIANP, Bangalore/ NRCE, Hissar)	D.S. Sena, N.V. Patil	2013-15
2	AICRP	Nutritional and physiological approaches for enhancing reproductive performance in animals	N. V. Patil, N. Saini, S.Vyas	2014-17
3	AR-7	Phero-chemical analysis in the urine of dromedary camel (<i>Camelus dromedarius</i>)- IPFT, Gurgaon	S. Vyas, S. Alam (IPFT)	2011-14
4	NAIP	Bioprospecting of genes and allele mining for heat and cold stress tolerance in Indian dromedaries (<i>Camelus dromedarius</i>)	G. Nagarajan, S.S. Dahiya, S.C. Mehta	2009-14
5	BT-AS-2-	Development of single domain antibodies for diagnosis/therapy-inter institutional project-BARC Mumbai	Venugopal, M. Venkatesh, S.K. Ghorui, G. Nagarajan	2007 (long term)
6	D-32	Validation of health benefit claims of goat, camel, cow and buffalo milk – NDRI, Karnal, Haryana	Sinita Meena, Y.S. Rajput, Rajan Sharma, R.K. Sharma, Raghvendar Singh	2012- 2014
7	Network project on Animal genetic resources	Characterization of Mewari and Jalori camels (lead Centre NBAGR, Karnal)	Dr. S.C. Mehta	2014-16
8	Collaborative Project-S.P. Med. College	Assessment of camel milk potential in SAM children	T.C. Saini, P.K. Berwal, Raghvendra Singh, N. Saini	2013-14

9. QRT, IMC, RAC and IRC Meetings

RAC Meeting

The RAC meeting of NRCC, Bikaner was held in the committee room of the Centre on April 5th, 2013 at 10.30 AM. The meeting was chaired by Dr. B.C. Patnayak, Chairman RAC and attended by the members of RAC of the Centre Dr B.S. Prakash, Dr. J.R. Rao, Dr. S.B.S. Yadav, Dr. A.K. Rawat, Dr. A.K. Purohit, Dr. N.V. Patil, Sh. Shankar Rebari, Dr. Sumant Vyas and the scientists of the Centre.



IRC Meeting

The Annual Institute Research Council (IRC) meeting of NRCC for the year 2013-14 was held in the Committee Room of the Centre on 3rd May, 2013 and the mid-IRC meeting was held on 7th September, 2013. The meeting was chaired by the Director Dr. N.V. Patil and attended by the scientists, technical officers and research assistants. In the meeting new, ongoing and completed research projects were discussed, progress was assessed and necessary suggestions were given.



Institute management committee

The institute management committee (IMC) meeting of NRCC was held on 22.05.13 and 22.03.14. Dr. N. V. Patil, Dr. A. K. Patel, Dr. R. S. Manik, Dr. R. C.

Sharma and Sh. V. K. Pandey were present in the first meeting whereas in the second meeting Dr. N. V. Patil, Dr. B. K. Beniwal, Dr. A. K. Mishra, Dr. B. D. Sharma, Dr. Raghvendra Singh, Dr. G. Nagarajan and Sh. V. K. Pandey were present.



Farmer's Day





10. Participation in Conferences, Meetings, Workshops and Symposia

Sl. No.	Name of Scientist and Designation	Conferences/Meetings/Workshops/Symposia	Venue	Date
1.	Dr. N.V. Patil, Director	EFC meeting of Camel Immunology Project	New Delhi	18 June, 2013
		India Africa meet on Agriculture and round table meet for delivery of interventions for Africa	India International Centre, New Delhi	24 June, 2013
		85 th Foundation Day of ICAR and Award Ceremony.	New Delhi	16 July, 2013
		Meeting with M.D. and Executive Director, Maize Products	Ahmedabad	18 July, 2013
		National Knowledge Network Project Meeting	Bangalore	25-26 July, 2013
		Meeting with Director, NIANP	Bangalore	27 July, 2013
		Projects review meeting	ICAR Research Complex, Goa.	12 August, 2013
		Meeting for Camel Immunology Project with the experts under the chairmanship of Hon'ble DDG (AS), ICAR	K.B., New Delhi.	20 August, 2013
		Meeting with Head (Soil Science), for cactus cultivation on 23.08.2013.	CSSRI, Karnal	23 August, 2013
		Review meeting to finalise the AICRP and Network Projects under the chairmanship of Secretary, DARE & DG, ICAR.	A.P. Shinde Auditorium, NASC, New Delhi	30-31 August, 2013
		Meeting of VTCC and meeting with Hon'bleDDG(AS) and Secretary, ICAR.	NRCE, Hisar	13 September, 2013
		Meeting of Selection Committee for Senior Scientist	PDC, Meerut	20 September, 2013
		Participated in a meeting with Hon'ble V.C.	MAFSU, Nagpur	21 September, 2013
		Selection committee meet	RPSC, Ajmer	8 October, 2013



Sl. No.	Name of Scientist and Designation	Conferences/Meetings/Workshops/Symposia	Venue	Date
		Conglomerate on Innovative Partnerships under the chairmanship of Hon'ble DG, ICAR	A.P. Shinde Auditorium, NASC, New Delhi	19 October, 2013
		XIII Coordination Committee meeting of AICRP on "Utilisation of Animal Energy"	Indira Gandhi Krishi Viswa Vidhyalaya, Raipur	21-22 October, 2013
		Camel Farmers' Meet and releasing ceremony of publication entitled, "The Camels of Kumbhalgarh" by Lok Hit Pashupalan Sansthan as Chief Guest.	Sadri	6 November, 2013
		Mid Term Review-ICAR Regional Committee No.VI.	CAZRI, Jodhpur	18 December, 2013
		Brain storming session on functional value of camel milk.	NRCC, Bikaner	3 January, 2014
		Interface meeting on Improving Health and Productivity of Tharparkar Cattle	CAZRI, Jodhpur	6 January, 2014
		Directors' Conference.	Baramati and Pune	19-20 January, 2014
		Meeting of Academy of Dairy Science	NDRI, Karnal	8 February, 2014
		Internal review meeting for the Niche Area of Excellence programme on "Metagenomic analysis of ruminal microbes" and to plan similar research work in camel under the chairmanship of Dr. K. Pradhan, former V.C., SKRAU.	College of Veterinary Science & Animal Husbandry, Anand	21 March, 2014
2.	Dr. S.K. Ghorui PS (Vety. Parasitology)	International symposium on Latest trends in immunodiagnosis, immunopathology and immunomodulation & VI convention of Society for Immunology and Immunopathology.	RAJUVAS, Bikaner	22-24 December, 2013
		XXIV National Congress of Veterinary Parasitology (NCVP) and National Symposium on "Towards food security through sustainable animal production and integrated parasite management	Mannuthy, Thrissur, Kerala	5-7 February, 2014



Sl. No.	Name of Scientist and Designation	Conferences/Meetings/Workshops/Symposia	Venue	Date
3	Dr. Raghvendar Singh, PS (Animal Biochemistry)	India – Africa Agriculture South-South Initiative, International Convention Center	New Delhi	23 June, 2013
		Agri-Tech Investor Meet	NASC, New Delhi	18- 19 July, 2013
		Meeting for Camel Immunology Project with the experts under the chairmanship of Hon'ble DDG (AS), ICAR	K.B., New Delhi.	20 August, 2013
		Meeting for organising showcase technology under NAIP for mobilising mass media support	CIAH, Bikaner	5 August, 2013
		Meeting of VTCC Project	NRCE, Hisar	13 September, 2013
		Brain storming session on functional value of camel milk.	NRCC, Bikaner	3 January, 2014
		Krishi Vasant 2014 with NRCC stall for exhibition of NRCC activities and Farmer-scientist interaction-Expert	Nagpur	8-13 February, 2014
		International symposium on Latest trends in immunodiagnosis, immunopathology and immunomodulation & VI convention of Society for Immunology and Immunopathology.	RAJUVAS, Bikaner	22-24 December, 2013
		Participation of Veterinary Scientists in the Farmer Scientists Interactions Planned during Krishi Vasant, 2014 at from	CICR, Nagpur	February 9-13, 2014
4.	Dr. S. Singh PS (Animal Physiology)	XII Annual Conference of SAPI National workshop on cactus.	Mathura CAZRI, Jodhpur	21 November, 2013 21 March, 2014
5.	Dr. A.K. Nagpal PS (Animal Nutrition)	fo'o dh ixfr eafoKku vks iks kfxdh dk ; kxnku&varjkZVh; l aksBh	j{kk oKkfud l puk rFkk iys[ku dlnz Wd hMkdW eV/dkQ gkml] fnYyh	04-07 November, 2013
6.	Dr. S.C. Mehta (Animal Genetics and Breeding)	MDP workshop on Priority Setting, Monitoring and Evaluation of Agricultural Research Projects.	NAARM, Hyderabad	18-22 June, 2013



Sl. No.	Name of Scientist and Designation	Conferences/Meetings/Workshops/Symposia	Venue	Date
		Meeting for Preparation of DARE/ICAR Annual Report 2012-13	NASC, ICAR, New Delhi	30 September, 2013
		RFD Mid-term review Meeting	NASC, ICAR, New Delhi	22 October, 2013
		International symposium on Latest trends in immunodiagnosis, immunopathology and immuno-modulation & VI convention of Society for Immunology and Immunopathology.	RAJUVAS, Bikaner	22-24 December, 2013
		Meeting with the Secretary, Animal Husbandry Department and prepared draft document of state policy on development of camels in Rajasthan for submission to the Chief Minister.	-	3 February, 2014
		Project Development Workshop funded by National Fund for Basic, Strategic and Frontier Application Research in Agriculture.	NAARM, Hyderabad	20-22 March, 2014
		Meeting on performance indicator	NCAEP, New Delhi	17 July, 2013
		Agri-Tech Investor Meet	NASC, New Delhi	18- 19 July, 2013
		NKN-Garuda meet organized by NIC and CDAC	Bangalore	25-26 July, 2013
		National Workshop on Science, Technology, Innovation and intellectual Property Rights: Envisaging the interfaces.	CAZRI, Jodhpur	10 January, 2014
8.	Dr. D. Suchitra Sena,PS (Vety. Medicine)	First International and Third National conference of Biotechnology, Bioinformatics and Bioengineering	Tirupati, Andhra Pradesh	28-29 June, 2013
		International symposium on Latest trends in immunodiagnosis, immunopathology and immunomodulation & VI convention of Society for Immunology and Immunopathology.	RAJUVAS, Bikaner	22-24 December, 2013



Sl. No.	Name of Scientist and Designation	Conferences/Meetings/Workshops/Symposia	Venue	Date
9.	Dr. F.C. Tuteja, SS (Vety. Medicine)	ASCAD Seminar 2013-14 on Recent Scientific Trends for Augmenting Health, Production and Reproduction in Food Animals	Veterinary College Campus, Bikaner	5-6 February, 2014
		32 nd Annual Convention of ISVM & International Symposium on The 21 st Century Road Map for Veterinary Practice, Education & Research in India & Developing Countries.	R.S.Pura, Jammu	14-16 February, 2014
10.	Dr. Nirmala Saini, SS (Animal Nutrition)	International symposium on Latest trends in immunodiagnosis, immunopathology and immunomodulation & VI convention of Society for Immunology and Immunopathology.	RAJUVAS, Bikaner	22-24 December, 2013
		International symposium on Latest trends in immunodiagnosis, immunopathology and immunomodulation & VI convention of Society for Immunology and Immunopathology.	RAJUVAS, Bikaner	22-24 December, 2013
		Prospects in improving production and marketing and value addition of carpet wool .	ARC, Bikaner.	31 December, 2013
		Brain storming session on functional value of camel milk.	NRCC, Bikaner	3 January, 2014
11.	Dr. G. Nagarajan, SS (Animal Biotechnolog)	Brain storming session on Micronutrients deficiency in fodder in western region of country	SKRAU, Bikaner	8 March, 2014
12.	Dr. Sanjay Kumar Scientist (Sr.Scale) (Vety. Parasitology)	NRCC stall in Farmer's Fair. Awareness workshop on "National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA).	CAZRI, Jodhpur CIFE, Mumbai	19 September, 2013 27-28 September, 2013
		International symposium on Latest trends in immunodiagnosis, immunopathology and immunomodulation & VI convention of Society for Immunology and Immunopathology.	RAJUVAS, Bikaner	22-24 December, 2013



Sl. No.	Name of Scientist and Designation	Conferences/Meetings/Workshops/Symposia	Venue	Date
		Camel Festival 2014 with Exhibition of NRCC.	Karni Singh Stadium, Bikaner	15-16 January, 2014
		XXIV National Congress of Veterinary Parasitology (NCVP) and National Symposium on “Towards food security through sustainable animal production and integrated parasite management	Mannuthy, Thrissur, Kerala	5-7 February, 2014
		KrishiVasant 2014 with NRCC stall for exhibition of NRCC activities	Nagpur	8-13 February, 2014
13.	Dr. S.D. Narnaware, Scientist (Sr. Scale) (Vety. Pathology)	Workshop on Electron Microscopy for for Diagnostics and Biomedical Research	National Institute of Pathology (ICMR), New Delhi	23 -27, September, 2013
		International symposium on Latest trends in immunodiagnosis, immuno-pathology and immunomodulation & VI convention of Society for Immunology and Immunopathology.	RAJUVAS, Bikaner	22-24 December, 2013
14.	Dr. S.S. Dahiya Scientist (Veterinary Microbiology)	International symposium on Latest trends in immunodiagnosis, immuno-pathology and immunomodulation & VI convention of Society for Immunology and Immunopathology.	RAJUVAS, Bikaner	22-24 December, 2013

11. Distinguished Visitors, Appreciation and Awards

S.No.	Date	Name and Address
1.	10.04.2013	Mr. Ashutosh Sarkar, ICARDA, New Delhi
2.	27.06.2013	Justice Amitava Roy, Chief Justice, Rajasthan High Court
3.	27.06.2013	Justice Mahesh Chandra Sharma, Justice, Rajasthan High Court
4.	10.08.2013	Shri Bhawani Shankar Sharma, Mayer, Bikaner
5.	10.08.2013	Shri Gulab Chand Kothari, Editor, Rajasthan Patrika
6.	16.11.2013	Dr. H.P.Vyas, Vice Chancellor, Rajasthan Technical University, Bikaner
7.	21.11.2013	Mr. JiJi Mammen, CGM, NABARD, Rajasthan, Jaipur
8.	28.11.2013	Dr. S. K. Garg. Former Vice Chancellor, DUVASU, Mathura
9.	26.12.2013	Justice O.P.Verma, District Judge, Bulandshahar
10.	26.12.2013	Mr. Ashutosh Dave, SWANSEA, UK
11.	26.12.2013	Mr. Deepak Dave, Chief Operational Manager, North Western Railway
12.	28.12.2013	Mrs. Manju Gupta, DRM, Bikaner
13.	03.01.2014	Dr. A K Srivastava, Director, NDRI, Karnal
14.	24.02.2014	Dr. G.R. Patil, Joint Director Research, NDRI, Karnal
15.	03.03.2014	Dr. N. M. Shah, Dean, CVAS, S.K. Nagar, Dantiwada
16.	19.03.2014	Justice J.N. Singh, Justice, Patna High Court, Patna



Director NDRI visit to NRCC



Dr. H.P.Vyas, Vice Chancellor, Rajasthan Tech. Uni., Bkn.



Interaction of foreign students with Director, NRCC



Joint director NDRI Joint Director(R) NDRI visit to NRCC



DRM Bikaner visit to NRCC



Dean Veterinary College Dantiwara interacting with Ph.D. student



Justice J.N. Singh, Judge Patna High court



Dr S. K. Garg, Ex Vice Chancellor visit to NRCC



12. Personnel

DIRECTOR

1. Dr. N.V. Patil

PRINCIPAL SCIENTIST

2. Dr. S.K.Ghouri, Veterinary Parasitology
3. Dr. Sumant Vyas, Animal Reproduction
4. Dr. Raghvendar Singh, Animal Bio-Chemistry
5. Dr. S.C.Mehta, Animal Genetics & Breeding
6. Dr. A.K.Nagpal, Animal Nutrition
7. Dr. Sajjan Singh, Animal Physiology
8. Dr. D.Suchitra Sena, Veterinary Medicine

SENIOR SCIENTIST

9. Dr. F.C.Tuteja, Veterinary Medicine
10. Dr. Nirmala Saini, Animal Nutrition
11. Dr. U.K.Bissa, Animal Genetics & Breeding

SCIENTIST

12. Dr. G.Nagrajan, Animal Bio-technology
13. Dr. Sanjay Kumar, Veterinary Parasitology
14. Dr. N. Shrish Dadarao, Veterinary Pathology
15. Dr. Devendra Kumar, Livestock Products Technology(On Study leave)

16. Dr. Shyam Singh Dahiya, Veterinary Microbiology

TECHNICAL OFFICER

17. Dr. N. Sharma, LSF, T - 9
18. Sh. Ram Kumar, Farm Manager, T-9
19. Dr. B.L. Chirania, Sr. Veterinary Officer, T-9
20. Shri. Dinesh Munjal, Technical Officer, T-7/8
21. Dr. Kashi Nath, Veterinary Officer, T-6
22. Sh. Ram Dayal Raigar, Technical Officer, T-6
23. Shri M.K. Rao, Technical Officer, T-6
24. Shri Nemi Chand, Technical Officer, T-6
25. Shri Mohan Singh, Technical Officer, T-5
26. Sh. Nand Kishore, Technical Officer, T-5
27. Sh. Manjeet Singh, Technical Officer, T-5
28. Shri Ram Chandar, Technical Officer, T-5

ADMINISTRATION

29. Shri V.K. Pandey, Admin. Officer
30. Shri A.K. Yadav, Asstt. Admin. Officer
31. Shri Ram Kumar Suri, P.S.
32. Shri B.K. Acharya, Asstt. Fin. & Acc. Officer



Release of “Camel dermal Mycoses- A pictorial Manual”



Distribution of Mineral Mixture to Camel Farmers During Ambulatory Clinic/ Field Visits

13. Infrastructure Development

Works

The works of extension of guest house of the centre to improve the facility, work of four VIP along with one living room, kitchen store is on completion stage and repair and maintenance of old Guest House has been completed. The work of renovation of Nutrition Laboratory building and Renovation of Research Laboratory has been completed whereas the Repair of feeding mangers ,boundary wall and camel corrals is in progress. Recarpetting and repair of campus and Agriculture Farm Roads is in final stage. Over Head Tank

and Under Ground along with pump room of capacity one Lakh litre is in progress. Camel milk parlour facility has been shifted at a new room where the ticketing facility is available.

Central Instrument Facility

Renovation of Nutrition Laboratory building completed and in the facility the central instrument facility (CIF) is shifted from research building to strengthen the functioning of the facility.



Cactus

Cactus pear was introduced first time in the agriculture farm of the center considering high water conservation ability and drought tolerance, and its potential of being used as an emergency feed during

extreme drought as it can also greatly reduce the water needs of livestock. It is potential plant for rehabilitation of degraded sites-wastelands, range/grasslands and stabilization of sand dunes can be managed by this plant species. The *opuntia* species of cactus is widely used as animal feed globally.



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0; k[; ku çLrñ djrsq Jh eukst dñkj] ofj"B rduhdh
vfekdkjh] Hkk—vuqij f"kn] ubZfnYyh usdgk fd jkstej kZ
ds dkedkt ea fglñh Hkk"kk dk ç; kx djus ij gh Hkkjr

l jdkj dh jktHkk"kk uhr vfekd çHkkoh o dkjxj <æ l s
ykw gkschA mlgkaus çfHkkfx; ka dks Hkkjr ljdkj dh
jktHkk"kk uhr dsvlrñ vuñNñk fu; ekñ mi &fu; ekñ
ekñkvka vkfn ds ckjs ea foLrkj iñd tkudkjñ nrs gq
dgk fd jktHkk"kk çj. kk vkj çkñ lgu ds }kjk vkj
vfekd çHkkoh fl) gkschA dk; Zkkyk ds fglñh dk Hkfo"; ^
fo"k; d 0; k[; ku ea Jherh l æhrk l Bñ] ç'kk- vfek- , oa
iñd jktHkk"kk vfekdkjh] Hkkjrñ; thou chek fuxe] chdkuj
us dgk fd jktHkk"kk vkt vfekd çHkkoh , oa rstñ l s
dk; ç. kkyh ea 'kkfey gsrñ tk jgh gS bl dk Js xg
ea-ky;] jktHkk"kk foHkx dks tkrk gA dEI; Wj ij fglñh
ç; kx vkt ekñj&ekñj viuh idM+cuk jgk gA mlgkaus
dgk fd l H; rk , oa l —fr ds fodkl graq gkaus okyk
0; ; fdl h çdkj dh iñçkflr ds mñs ; dks ydñ ugha
fd; k tkrk çYd ; g furkñ vko'; d gsrFk vkt Hkh
bl jk"V"o ds Kku dh vkj fo'o vkdf"ñr gSft l dsfy,
mlga fglñh dk Kku yñk vko'; d gkschA vfrffk oDrk
Jh vfuy dñkj] jktHkk"kk vfekdkjh] eMy jñ çclëkd
dk; kzy;] m-i-jñ, oal fpo] ujkdkl] chdkuj us^dEI; Wj
%; mudkM dk egRo^ fo"k; d 0; k[; ku ea dgk fd vkt
dEI; Wj ij fglñh eadk; Zdjuk vkl ku gsrñ tk jgk g\$
; mudkM dsekè; e l svki dghaij fdl h Hkh txg l ans k
¼ & es ½ l ñoekk dk ykHk mBk l drs gA vkt fglñh ds
dh&ckM] Lis y pñj vkfn mi yçk g\$ xxy vkbZ, ebZ ds
ekè; e l s Vad. k vkfn dh l ñoekk muds fy, cgn
mi ; kxh l kfr gksjgh gS tks fglñh Vad. k ugha tkur\$ os
bl l s fglñh Hkk"kk eavi uk dke cgrj rjhds l sfu"i kfnr
dj l drs gA l kFk gh dbZ , d h os l kbZ/a g\$ tks fglñh
Q,UV] duoVZ , oa vuñkñ tñ h l ñoekk eg\$ k djok jgh
gA

dñæ funskd , oadk; Døe vè; {k M,-furhu ol rjko
ikfVy us dgk fd dñæ dk; Zkkykvka ds ekè; e l s
jktHkk"kk dk; ç. kkyh ds cgrj dk; kZ; u ij fujUrj
fplru djrk gA bl graqdñæ viuh vuñ ækku mi yçk; kñ
xfrfofek; kñ okf"kd çfRnuka dks jktHkk"kk fglñh ea
çdkf'kr@çpkfjr dj t: jreñka dks ykHkñuor djus

grrRij jgrk gā M,-'kjr-plæ egrkj çekku oSkfud }kjk èkU; okn iLrko Kkfir fd; k x; kA

jktHkk"kk dk; Zkkyk % 11 Qjojhl 2014

vk; kstr jktHkk"kk dk; Zkkyk ea'fo'o dh ixfr ea foKku rFkk iSkj kfxdh dk ; ksnku^fo"k; d iEke 0; k[; ku eadlnz ds MKW'kkad dèkj ukxiy] ièkku oSkfud us crk; k fd j{kk vuq èkku rFkk fodkl I xBu] ubZfnYyh }kjk 5&7 fnl Ecj] 2013 eavk; kstr vUrkZVh; fgluh I Eesy eadlnzdh vkj I s'l arfyr vkgkj }kjk Åvka dk oSkfud iSkk.k izèku^ ij vky[k iLrqr djrs gq I Hkh dk m"Va iztkfr ds I j{kk.k , oa fodkl dh vkj è; ku [khp x; kA mlgk us dgk fd fgluh dk fodkl I Hkh dk ufrd drd; gSrFkk ge bl dks viuku; ckyuseaxoz dk vuqko djA

jktHkk"kk dk; Zkkyk ea vkef=r vfrfFk oDrk MKW ?ku'; ke 0; kl us fgluh Hkk"kk 'kq Lo: i ea'fo"k; d 0; k[; ku iLrqr djrs gq dgk fd Hkk"kk dk eny vkekkj



ml dh èofu; k; gā, s sea; fn ge I kFkd vkj 'kq vkj 0; kogkfjd mPpkj.k ds ifr xHkhj jgaks rksuf'pr : i I s Hkk"kk ds ifr gekjk I kekftd vkj jk"Vh; nkf; Ro dqkyrk ds I kFk fuHkk; k tk I dskA

bl volj ij dlnz funskd MKWurhu ol Urjko i kVvy usdgk fd Åv ikyd o fdl kuka ds I kFk ijLij I økn dh fLFkr eagea Hkk"kk ds 'kq o 0; kogkfjd igyw dh vko'; drk i M-rh gā; fn I økn dh fLFkr I arksttud gā rks oSkfud o rduhdh Kku dk glRkrj.k djus ea I øèkk gkschA MKW kVvy us fgluh dks ijs euk; kx I s viuk, tkusdh vihy djrs gq Hkk"kk ds I jyhdj.k rFkk ekfyd y[ku dksc<kok fn, tkusdh vko'; drk trkbA

dk; Zkkyk dk; Dè dk I pkyu i Hkkjh jktHkk"kk MKW Qrg pln Vvstk us fd; k rFkk èkU; okn iLrko ea I gk; d , oa forr y[kfkedkj Jh Hkjr dèkj vkpk; Z }kjk vfrfFk; kq dlnz funskd o ifr Hkkfx; kads ifr vkHkkj 0; Dr fd; k x; kA

o"z ds nkjku fgluh ea fudkys x, çdk'kuka dh I ph

- 1- jktHkk"kk okf"kd i f=dk ^djHk* vad n'ke-, oaX; kjgoka 1/2nks vad 1/2
- 2- okf"kd çfronu fgluh , oavasth vyx&vyx : i èk
- 3- vkRk i fj; kstuk dsrgr e: {k= eai 'kq kyu çf'k{k.k i qLrdk
- 4- mRiknu I èkkj grrq Åvka dk I arfyr i Skk.k 1/4y 1/2

TSP 2014



TSP 2014



Brain Storming Meet on "Campaign for Functional Food Value of Camel Milk"





Prof. (Dr.) K.M.L. Pathak, DDG(AS) addressing on New Year at the Centre



Mrs. Manju Gupta, DRM, Bikaner as chief guest on the occasion of Foundation Day



Visit of Members of Mahaveer International and Plantation by school children on the occasion of Foundation Day



हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

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