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ANNUAL REPORT 2002-2003

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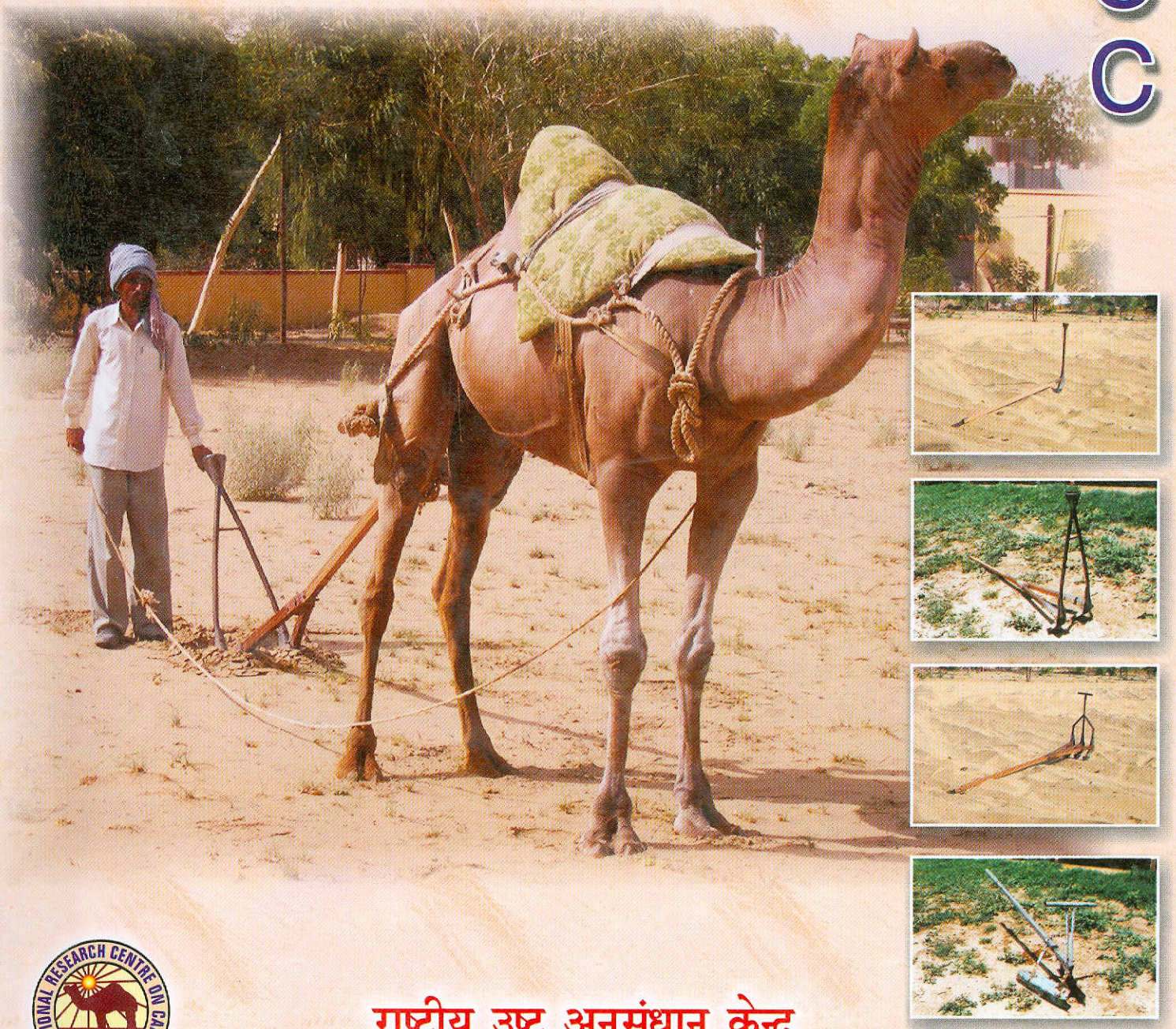

NATIONAL RESEARCH CENTRE ON CAMEL
BIKANER

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र

जोरबीड़, बीकानेर - 334 001 (राज.)

NATIONAL RESEARCH CENTRE ON CAMEL

JORBEER, BIKANER - 334 001 (RAJASTHAN)

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Dr.M.S. Sahani
Director
NRC on Camel
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National Research Centre on Camel
Post Box - 07, Jorbeer.
Bikaner - 334 001 (Rajasthan) India
Phone : 0151-2230183, 2230858
Fax : 91-151-2231213
E-mail : nrccamel@hub.nic.in
Telegram : CAMCENTRE, BIKANER
Web Site : www.icar.org.in/nrccm/home.html

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2002-2003

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Director : Dr. M.S. Sahani

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र

जोड़बीड़ , बीकानेर

National Research Centre on Camel

Jorbeer, BIKANER

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PREFACE

The livelihood of camel in hot arid ecosystem is under threat due to frequent droughts, continues shrinkage in grazing resource, change in cropping system and by fast mechanisation. Thus, the research priorities envisaged in Vision 2020 were reviewed, evaluated and reframed from time to time by both the Research Advisory Committee and QRT.

It's a matter of great pleasure in presenting the Annual Report 2002-03 of the Centre, highlighting the important research achievements, transmission of informations to end users, training and other activities.

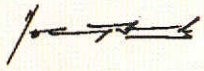
The research and infrastructure development was strengthened remarkably and priority new research programmes were initiated alongwith other continuing programmes. The Centre has carved a role for itself in bringing about a significant improvement in applied research. The awareness regarding the aesthetic use of camel milk as such in some hilly pockets of Rajasthan and Gujarat improved the female camel keeping. The Centre also explored the potential of use of various camel milk products. Similarly, the potential of camel milk in management of type 1 diabetes has opened a new era in the increase utility and awareness of camel milk. The electrification of traditional two-wheel camel cart can be of great advantage in avoiding the accidents of camel carts and to avail benefit of light in villages area which are not electrified.

Application of Polymerase Chain Reaction (PCR) in diagnosis of cameline surra, indigenous preparation of herbal medicine for skin affection would make a great difference in control of such diseases. Molecular characterisation of indigenous camel breeds, cryopreservation of camel semen and distribution of superior germ plasm for breeding purpose to farmers can be great advantage in improving camel farming system in this area. The inter-institutional collaboration with SAUs and other institutes were further strengthened with increase affectivity.

The revenue generation as one of the monitorable targets was achieved due to significant influx of tourists and by organising training programme in the field of biotechnology for PG. students. Draught potential of camel have been explored using different agricultural appliances for the benefit of small and marginal farmers. We have been succeeded substantially in adopting of Hindi in office as well as for research purpose.

The continuous dedicated approach of the scientists, technical, administrative and supporting staff have made it possible to acknowledge their contributions and co-operations.

I also acknowledge the support and guidance received from Dr. Mangala Rai, Director General, Indian Council of Agricultural Research, Secretary, DARE, Govt. of India, Dr. V.K. Taneja, Deputy Director General (Animal Sciences), Dr. Sushil Kumar, Assistant Director General and other officers from various divisions of ICAR Headquarter in achieving the goals set and effective implementation.



(M.S. Sahani)

Director

1. कार्यकारी सारांश

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र : एक संक्षिप्त परिचय

पूर्व में उष्ट्र प्रजनन फार्म के नाम से परिचित यह केन्द्र पशुपालन विभाग (राजस्थान सरकार) एवम् पशु चिकित्सा एवं पशु विज्ञान महाविद्यालय (राजस्थान कृषि विश्वविद्यालय) की देखरेख में रहा। शुष्क और अर्ध शुष्क भू–भागों के विकास में इस प्रजाति के महत्व को देखते हुए भा.कृ.अ.प. द्वारा जोड़बीड़, बीकानेर (राज.) में ऊँट से सम्बन्धित राष्ट्रीय उष्ट्र अनुसंधान केन्द्र की स्थापना 5 जुलाई, 1984 को की गयी। समय के साथ केन्द्र ने विगत वर्षो में अनुसंधान के क्षेत्र में देश – स्तर पर ही नही, अपितु विश्व–स्तर पर भी अपनी पहचान बनाई है। आज केन्द्र में आधुनिक प्रयोगशालाए तथा सभी आधारभूत सुविधाएं उपलब्ध है। इस संपूर्ण अवधि के दौरान केन्द्र ने ऊँटों से सम्बन्धित विभिन्न पहलुओं पर ठोस वैज्ञानिक आँकड़े विकसित किये है।

इस वर्ष के दौरान केन्द्र पर ऊँटों की कुल संख्या 272 थी। विभिन्न आयु वर्ग के इन सभी ऊँटों में मुख्यतः बीकानेरी, जैसलमेरी व कच्छी नस्ल के थे।

विगत वर्षो में प्राप्त उपलब्धियाँ

- बीकानरी, जैसलमेरी एवम् कच्छी नस्ल के ऊँट समुहों का विकास।
- शारीरिक माप, वृद्धि, दूध, बाल–उत्पादन जैसे महत्वपूर्ण अनुवांशिक गुणों का विकास।
- ऊँट के नवजात बच्चों की औसत मृत्युदर को उचित प्रबन्धन द्वारा 20–30 प्रतिशत से 5 से 8 प्रतिशत तक कम करना।
- प्रथम ब्याँत तथा दो ब्याँत के अन्तराल को कम कर, औसत गर्भधारण संख्या बढ़ाकर प्रजनन क्षमता में सुधार।
- भारतीय ड्रोमेडेरी ऊँटों में जैवरसायनिक और रूधिर अध्ययन में अनुवांशिक विभिन्नता नगण्य/परन्तु आर.ए.पी.डी. तकनीक द्वारा विभिन्नता विद्यमान।
- बोझा ढ़ोने, खेत जोतने की क्षमता, थकावट चिन्ह पर महत्वपूर्ण आधारभूत आँकड़े एकत्रित किये गये।
- प्रचलित औषधि के साथ ऊँटनी का कच्चा दूध देने पर टी.बी. मरीज के स्वास्थ्य में तेजी से सुधार।
- भ्रूण प्रत्यारोपण तकनीक विकास व उसके द्वारा दो बच्चों का जन्म।

अधिदेश (मेनडेट)

- ऊँट सुधार पर आधारभूत व प्रायोगिक अनुसंधान करना।
- ऊँट अनुसंधान के लिए राष्ट्रीय स्तर पर सहयोग व नेतृत्व प्रदान करना तथा राष्ट्रीय सूचना–ग्रहण केन्द्र की तरह कार्य करना।
- ऊँट अनुसंधान व विकास के लिए राष्ट्रीय एवम् अन्तर्राष्ट्रीय स्तर पर सहयोग देना।

संगठनात्मक स्वरूप

केन्द्र में उष्ट्र फार्म इकाई, अनुसंधान प्रयोगशालाएं, चर भूमि, आवासीय खण्ड और अतिथि गृह सहित 824 हेक्टेयर भूमि है। वर्ष 2002–03 के दौरान विभिन्न वर्गों के अन्तर्गत स्वीकृत पदों की संख्या 74 थी। निदेशक, 14 वैज्ञानिक, 22 तकनीकी, 10 प्रशासकीय तथा 20 सहायक कर्मचारी गण सहित 67 कर्मचारी कार्यरत रहे।

बजट

वितीय वर्ष 2002–03 में योजनामद में 193.00 व गैर योजनामद में 141.50 लाख रूपये की धनराशि स्वीकृत की गई।

अवसंरचनात्मक विकास के अन्तर्गत ही केन्द्र के पुस्तकालय को और अधिक सम्पन्न बनाया गया। जिसमें इस वर्ष 541 हिन्दी पुस्तकें तथा 110 पुस्तकें विज्ञान आदि विषय से सम्बन्धित की खरीद की गई। वर्ष के दौरान कुल 651 पुस्तकों की खरीद की गई। वर्तमान में केन्द्र के पुस्तकालय में कुल 2293 पुस्तकें उपलब्ध है।

केन्द्र के स्वयं की अनुंसधान परियोजनाएं, रा.कृ.त.प. के निधि के अन्तर्गत तदर्थ अनुसंधान योजनाएं एवम् सहयोगिक अनुसंधान कार्यक्रम केन्द्र की कार्यसूची में रहे।

शोध कार्य

जनन क्षमता में सुधार और जनन अक्षमता के कारणों का अध्ययनः

उष्ट्र वीर्य के मूल्यांकन, उसके परीरक्षण एवं कृत्रिम गर्भाधान के विकास के अन्तर्गत 15 नर ऊँटों के वीर्य नमूने एक नियमित अन्तराल के बाद लिए गये तथा गतिशीलता हेतु इनका मूल्याकंन किया गया। वीर्य का परीरक्षण सफलतापूर्वक किया गया तथा "पोस्ट–था" जाँच अभी जारी है।

प्रजनन काल के दौरान अधिकतर ऊँटों में वीर्य एकत्रण सफलतापूर्वक निष्पादित किया जा सकता है। वीर्य के अध्ययन से यह ज्ञात हुआ है कि ऊँट में शुक्राणु किसी जालीनुमा आकृति में घिरे रहते है तथा गति करने के लिए उनके पास कोई जगह नहीं होती है। जब यह जालीनुमा खोल धीरे–धीरे समाप्त होता है तब शुक्राणु मुक्त होकर गति करने लगते है। ऊँटों के वीर्य के स्कन्धन से शुक्राणुओं का घिरना वैसी ही प्रक्रिया है जो मानव के वीर्य में भी पायी गयी है। ऊँटों व मानव के वीर्य स्कन्धन में अन्तर इतना है कि ऊँटों में स्कन्धन मानव की तुलना में तेजी से होता है। स्कन्धन व शुक्राणुओं का घिरना मादा गर्भाशय में शुक्राणु बैंक की भांति कार्य करता प्रतीत होता है। वीर्य हिमीकरण प्रयोग व उष्ट्र कृत्रिम गर्भाधान प्रयोग जारी है।

एच एम जी नामक हारमोन का उपयोग कर बहु अण्डजनन व भ्रूण प्रत्यारोपण तकनीकी प्रयोग के अध्ययन से यह पता चला कि यह हारमोन बहुअण्डजनन करने में असफल है। बकरियों के अण्डाशय से फोलिकल प्राप्त कर प्रयोगशाला में उनके परिपक्वन का अध्ययन किया गया। केन्द्र द्वारा आर आइ ए प्रयोगशाला में प्रोजेस्टेरोन एन्टी सिरम उत्पादन तकनीक विकसित की गई।

सोनाग्राफी विधि द्वारा अण्डाशय में अण्डों की जाँच कर गर्भाधान करने से गर्भधारण क्षमता में वृद्धि आंकी गयी। बधिया व पूर्ण ऊँट के T_3, T_4, व टेस्टोस्टीरोन हारमोनों की जाँच की गयी।

शुष्क एवम् अर्द्धशुष्क परिस्थितियों में ऊँट की कार्यक्षमता में सुधार

ऊँट की कार्यक्षमता में सुधार लाने के अन्तर्गत एक हल, दुफाली हल, छः डिस्क हैरो, पांचफली कल्टीवेटर तथा मेड निमार्णक संबंधी अनुसंधान का कार्य किया गया। अध्ययन से यह ज्ञात हुआ है कि एक हल, दो हल, तीन हल व मेड निर्माणक रेतीली मिट्टी में ऊँट आसानी से चला पाते है, हैरो व पाँचफली कल्टीवेटर, खींचने में ऊँट के लिए अपेक्षाकृत भारी पाये गये है। एक हल वाला ऊँट लगातार 4.25 घण्टे तक खेत में जुताई कर सकता है तथा इस दौरान 3136 वर्ग मीटर क्षेत्रफल जोत लेते है। इस दौरान प्रति घण्टे औसत जुताई 740.6 वर्ग मीटर आंकी गई। हल द्वारा जुताई की भूमि की गहराई 9–15 सेमी आंकी गयी। हल क्षैतिज तल से 21^0 का कोण बनाता है। ऊँट इस प्रक्रिया के दौरान 9.24 से 16.91 प्रतिशत का ड्राफ्ट बल उत्पन्न करते हैं। वहीं दुफाली औसतन 4 घण्टे

कार्य कर 4000 वर्ग मीटर क्षेत्रफल व छः डिस्क हैरो औसतन एक घण्टे में 2000 वर्ग मीटर क्षेत्रफल में जुताई कर सकता है। अनुसंधान द्वारा देखा गया कि डिस्क हैरो व कल्टीवेटर की बनावट में सुधार की आवश्यकता है।

भारतीय नस्ल के ऊँटों में आनुवंशिक गुणों का निर्धारण, मूल्यांकन, एवम् संरक्षण

उष्ट्र नस्ल की बोझा ढ़ोने की क्षमता में सुधार हेतु चयन के अन्तर्गत 6 वर्ष तक के नर ऊँटों का शारीरिक माप लिया गया। आँकड़ों के आधार पर यह देखा गया कि ऊँटों में बोझा ढ़ोने की क्षमता पर शारीरिक लम्बाई एवं सम्बन्धित चिन्ह सार्थक प्रभाव डालते है। दो समूहों की शारीरिक लम्बाई, हृदय घेर तथा ऊँचाई में भिन्नता का पता लगाने हेतु न्यूनतम वर्ग विश्लेषण में अंतर ज्ञात किया गया।

भारतीय नस्ल के ऊँटों में गुणात्मक व मात्रात्मक प्राचल पर अध्ययन के अन्तर्गत शारीरिक भार एवं वृद्धि के सन्दर्भ में यह ज्ञात हुआ कि नस्ल का 6, 12, 24 महीनों की आयु में सार्थक प्रभाव रहता है तथा लिंग का प्रभाव असार्थक पाया गया।

जनन क्षमता पर अनुसंधान के अन्तर्गत केन्द्र के उष्ट्र समूहों में समागम एवं वत्स–जनन संबंधी वर्ष 2000 से 2003 तक के आँकड़े विश्लेषित किये गये। इस वर्ष वत्स–जनन 79.31 प्रतिशत रही जो कि बीकानेरी नस्ल (88.88%) में कच्छी (80.00%) तथा जैसलमेरी (50.00%) की तुलना में अधिक आंकी गयी। गत वर्ष यह 67.30% रही। इस वर्ष गर्भधारण दर (61.70%) पूर्व वर्ष की अपेक्षा कम देखी गई। बीकानेरी नस्ल में गर्भावधि 382.93±2.81 (14) दिन व कच्छी नस्ल में 385.50±5.25 (4) दिन पाई गई।

केन्द्र के उष्ट्र समूहों में अप्रैल, 2002–मार्च, 2003 के दौरान नस्ल वार मृत्यु–दर के अन्तर्गत 9 बीकानेरी व 6 जैसलमेरी ऊँटों की मृत्यु हुई। जिनमें 40% पाचन तंत्र व 33.33% श्वसन तन्त्र सम्बंधी विकारों के कारण हुई।

आनुवंशिक आण्विक निर्धारण अध्ययन के अन्तर्गत बीकानेरी, जैसलमेरी एवं कच्छी नस्ल की प्रत्येक के केन्द्र के फार्म व बाहरी क्षेत्र से 50 रक्त नमूने प्रति नस्ल के लिए गए। पाँच माइक्रो सैटेलाइट लोसाई - LCA-56, LCA-66, LCA-63, YWLL-08 एवं VOLP- 67 प्रवर्धित एवं विश्लेषित किये गये। PHYLIP 3.6 एवं माइक्रोसेट साफ्टेवयर को प्रयुक्त करते हुए तीनों भारतीय नस्लों में आनुवंशिक दूरी आकलित की गई।

शुष्क और अर्द्धशुष्क परिस्थितियों में विभिन्न उष्ट्र प्रबन्धन विधियों का आर्थिक स्तर पर अध्ययन

उष्ट्र–उत्पाद व प्रबन्धन प्रणाली के अध्ययन के अन्तर्गत बीकानेर एवं पाली क्षेत्र में 300 उष्ट्र–पालकों पर कार्य करते हुए आँकड़ों से ज्ञात हुआ कि राईका/रबारी जाति द्वारा अन्य जातियों– जाट, राजपूत, मुस्लिम आदि समुदाय की अपेक्षा विशाल उष्ट्र समूह रखे जाते है।

बीकानेर क्षेत्र में उष्ट्र रखने वाले अधिकतम 79.33 प्रतिशत आंके गये। जबकि पाली क्षेत्र में उष्ट्र प्रजननकर्त्ता 65.33 प्रतिशत अंकित किये गये। उष्ट्र पालक इसका शहरों एवं गाँवों में मुख्य उपयोग गाड़ा चलाकर आजीविका चलाने में करते है।

1 से 4 वर्ष तक की आयु वर्ग के ऊँट भी बीकानेरी क्षेत्र में (28.44 प्रतिशत) पाली (27.68 प्रतिशत) की अपेक्षा अधिक है। जिसका मुख्य कारण पाली के किसानों द्वारा इस आयु वर्ग के ऊँटों की बिक्री करना है। साथ ही इन दोनों क्षेत्रों में ऊँटों को पालने का उददेश्य तथा उष्ट्र प्रबन्धन भिन्न–भिन्न देखा गया। पाली जिले में बीकानेरी जिले की तुलना में अधिक सिंचित भूमि है। 2–5 ऊँट रखने वाले किसान अपने जानवरों को प्रबन्ध की अर्द्ध गहन पद्धति के अन्तर्गत रखते है। 5 से अधिक जानवर रखने वाले किसान/ऊँट पालक सामान्यतया अपने जानवरों को प्रबन्धन की विस्तार प्रणाली के अन्तर्गत भेज देते है।

उष्ट्र बीमारियों का पर्यवेक्षण, निगरानी एवम् नियत्रंण

पीसीआर की संवेदनशीलता पर तुलनात्मक अध्ययन व उष्ट्र ट्रिपैनोसोमोसिस् के निदान हेतु सीरमीय परीक्षण के अन्तर्गत प्राइमर युगल (21 मरसेन्स व 22 मरसेन्स एन्टीसेन्स) प्रयुक्त करते हुए जब डीएनए का सकारात्मक नियन्त्रण हेतु विस्तारण किया गया तो 227 बीपी का एकल बैंड प्रकट हुआ। जब डीएनए नमूनें प्रयोगात्मक संक्रमित चूहों के रक्त से लिए तथा उसके पश्चात वही प्राइमर सैट काम में लेते हुए विस्तारण किया गया तब भी 227 बीपी का एकल बैंड ही प्राप्त हुआ।

स्वस्थ चूहों के रक्त एवं नवजात उष्ट्र बच्चे से डीएनए प्रयुक्त करते हुए कोई भी विस्तारण रिकार्ड नहीं किया गया। इससे यह सिद्ध होता है कि विस्तारित पीसीआर उत्पाद परजीव जीनोम विशिष्ट है।

भारतीय चिकित्सा पद्धति द्वारा ऊँटों में त्वचीय उपचार

वर्णित चिकित्सा पद्धति द्वारा प्रायोगिक तौर पर ऊँटों में त्वचीय उपचार (मेंज) हेतु केन्द्र द्वारा तीन मिश्रित औषधियां विकसित की गई तथा जिनका तीन चरणों में प्रयोग में प्रयुक्त ऊँटों पर विभिन्न समय अन्तराल पर बाह्य रूप से लेपन किया गया। औषधिं मिश्रण 1 के त्वचीय रोग उन्मूलन में अच्छे परिणाम प्राप्त हुए। यहां तक कि सामान्यतया कम प्रभावित पशुओं में 5 दिन के अन्तराल पर 2 से 3 लेपन पर्याप्त दिखे। औषधि मिश्रण 2 तथा 3 क्रमशः कम लागत में निर्मित किए गए परन्तु मिश्रण 2 की तुलना में 3 का उपयोग कम प्रभावकारी प्रतीत हुआ। उपरोक्त मानकीकरण कार्य केन्द्र द्वारा निरन्तर प्रगति पर है।

ऊँटों में प्रायोभाव, अंतःस्तन संक्रमण के अभिलक्षण तथा प्रतिजैविक संवेदनशीलता पर अध्ययन

उपरोक्त अध्ययन के अन्तर्गत स्वस्थ दिखने वाली 32 दूधारू ऊँटनियों से दुग्ध नमूनें लेते हुए थनैला (स्तनकोप) की प्रबलता हेतु मूल्यांकित किए गए। दूध देने वाली मादाओं में विभिन्न प्रकार के थनैला के रहते सीरम Zn, cu , Co, एवं Fe लवंण सांद्रता का आंकलन किया गया। माध्य सीरम, Zn, , Cu, एवं Fe सांद्रता में प्रतिकूल, अरोगलक्षण, अविशिष्ट, रोगलक्षण समूह के मध्य असार्थक विविधता आंकी गई। इन समूहों में को–सांद्रता 0.78±0.12, 1.34±0.18, 1,26± 0.10 एवं 0.70±0.41 μg/ml. रही जो कि समूहों में ($p<0.05$) सार्थक रही।

ऊँटनी के दूध द्वारा टाईप–1 के मधुमेह रोगियों में बचाव

ऊँटनी का दूध पिलाने से टाईप–1 मधुमेह रोगियों में इन्सुलिन मात्रा 30 प्रतिशत तक कम की जा सकी। दूध प्रयुक्त करने पर इसकी स्वीकार्यता उत्साहजनक रही। अध्ययन से यह स्पष्ट हुआ कि उष्ट्र दूध आहार में लेना मधुमेह टाईप–1 में एक विकल्प साबित हो सकता है।

ऊँटों के बच्चों को मिश्रित एवं संपूर्ण आहार आधारित मूँगफली चारा व खेजड़ी की पत्तियों के उपयोग पर अध्ययन

इसके अन्तर्गत बीकानेरी, जैसलमेरी एवं कच्छी नस्ल के 3 वर्ष की आयु के 340–390 कि.ग्रा. भार तक के उष्ट्र बच्चों को दो समूहों में बाँटते हुए कार्य किया गया। अनुसंधान से प्राप्त परिणामों से यह स्पष्ट हुआ कि संपूर्ण आहार दिये जाने से न केवल पोषण अन्तगृहीत, पाच्यता, खनिज अवशोषण की ही बढ़ोतरी होती है अपितु यह सीरम उपापचयी प्रोफाइल में भी सुधार लाता है यद्यपि इसमें लागत अधिक है। अन्य अनुसंधान के तहत दूध देने वाली मादाओं एवं उनके बच्चों को शुष्क पारिस्थितिक तंत्र में मिश्रित एवं संपूर्ण आहार के उपयोग से प्राप्त परिणामों से यह स्पष्ट हुआ है कि मिश्रित आहार ऊँटों में पोषण प्राप्ति हेतु पर्याप्त नही था । इसलिए संपूर्ण आहार दिया जाना वांछनीय है।

राजस्थान के शुष्क क्षेत्र में आहार चारे के खनिज स्तर, जैव प्राप्यता तथा क्षेत्र विशिष्ट खनिज मिश्रण को तैयार कर उत्पादकता में सुधार पर अध्ययन

इसके अन्तर्गत राजस्थान के बीकानेर, जैसलमेर, नागौर, चुरू व हनुमानगढ़ जिलों में सर्वे का कार्य किया गया। सर्वेक्षण से यह ज्ञात हुआ है कि इन जिलों में मुख्य आहार व चारे के रूप में बाजरा भूसा, मोठ चारा, ग्वार फलगटी, लूँग, मूँगफली भूसा, गेहूँ भूसा, चना खार, पाला, सेवण एवं हरा चारा दिये जाते है। वहीं आहार के साथ साधारण नमक व खनिज लवण संबंधी जानकारी एकत्रित की गई। अनुसंधान के आधार पर यह स्पष्ट हुआ है कि पिछले 10 वर्षों से बीकानेर (83 प्रतिशत गांव), नागौर (सभी ग्रामों में), जैसलमेर (75 प्रतिशत गांव), चुरू (86 प्रतिशत गांव) व हनुमानगढ़ (सभी ग्रामों में) की उष्ट्र–जनसंख्या में कमी आई है। वहीं इन जिलों में उष्ट्र–दूध को उसी रूप में या खीर एवं चाय बनाने हेतु काम में लिया जाना भी अलग–अलग स्तर पर है। जैसलमेर (75 प्रतिशत ग्रामों में) की तुलना में अन्य जिलों के गाँवों में दूध का उपयोग बहुत ही कम पाया गया।

फसल आधारित पशु उत्पादन नेटवर्क सहयोगिक परियोजना

पशु उत्पादन में चारा स्त्रोत व पोषक की उपयोगिता के सुधार के अन्तर्गत बीकानेर नस्ल के 4 वर्ष तक की आयु के 3 नर ऊँटों पर सिल्वीपाश्चर पद्धति के द्वारा चराई व्यवहार तथा वृद्धि क्षमता पर अध्ययन किया गया। अध्ययन में पाया गया कि ऊँटों द्वारा वर्ष की विभिन्न तिमाही अप्रैल–जून, जुलाई–सितम्बर माह के दौरान सबसे अधिक समय 29.25–32.40 प्रतिशत चारण गतिविधि में व्यतीत हुआ । सिल्वी–पाश्चर क्षेत्र से प्राप्त वनस्पति द्वारा ऊँट स्वंय का निर्वहन कर सकते है।

प्राकृतिक चारागाह में 25 विभिन्न आयु वर्ग के नर व मादा ऊँटों पर किये गये अध्ययन में यह पाया गया कि अक्टूबर–दिसम्बर माह के दौरान उनके द्वारा पाला 50.35 प्रतिशत सबसे अधिक पसन्द किया गया जबकि जनवरी–मार्च के दौरान फोग 28.70 सबसे अधिक पसन्द किया गया। अप्रैल–जून के दौरान फोग 32.20 प्रतिशत तथा जुलाई–सितम्बर माह के दौरान खेजड़ी 30.80 प्रतिशत का खाने में उपयोग किया गया। चारण व्यवहार का अध्ययन करने पर यह पाया गया कि सभी ऋतुओं में चारण गति दूसरी अन्य गतिविधियों की तुलना में अधिक पायी गयी।

केन्द्र में राष्ट्रीय कृषि तकनीकी परियोजना के तहत अनुसंधान योजनाएं

ऊँटनी एवं बकरी के दूध एवम दुग्ध उत्पाद के स्वःजीवन में सुधार – इसके अन्तर्गत उष्ट्र दूध से निर्मित साफ्ट चीज व चीज पकौड़ा उत्पाद तैयार करने में सफलता प्राप्त की गई तथा इसके स्वीकार्यता परिणाम उत्साहवर्धक देखे गये। दूध से निर्मित उत्पाद चीज को रेफ्रीजरेटर तापमान पर भण्डारित किया गया। इसके अलावा "ऊँटनी एवं बकरी के दूध एवम दुग्ध उत्पाद के स्वःजीवन में सुधार" शीर्षक विषयक 14–15 मार्च, 2003 को दो दिवसीय कार्यशाला का भी आयोजन रखा गया। इस कार्यशाला का उद्देश्य उष्ट्र दूध के प्रति जागरूकता लाना तथा दूध के प्रयोग को बढ़ावा देना था।

जैसलमेरी नस्ल के ऊँटों का निर्धारण एवं संरक्षण – शुद्ध जैसलमेरी ऊँट की उपलब्धता हेतु प्रजनन क्षेत्र में सर्वे का कार्य किया गया। जिसके अन्तर्गत नस्ल का निरूपक, नस्ल जनसंख्या आंकलन, उत्पादन वृद्धि एवं उत्पादन आँकड़े, जनन प्राचल, समाजार्थिक अभिमुखता, वीर्य हिमीकरण आदि पर आंकलन/कार्य करते हुए प्रजनन योग्य चयनित नर ऊँटों को रखा जा रहा है।

भेड़, ऊँट, बकरी, गाय तथा भैंस की जनन क्षमता में सुधार – इस योजना के अन्तर्गत दीप्त काल अवधि प्रयोग को अपनाते हुए मादा ऊँटनियों के आँखों तक फेसमास्क लगाया गया। मास्क उपचार द्वारा कम दीप्त काल किये जाने से मादा ऊँटनियों के अण्ड कोषों में पुटक वृद्धि देखी गई लेकिन प्रजनन ऋतु पूर्व इन ऊँटनियों के गर्भ धारण में सफलता प्राप्त नहीं हुई।

वातावरणीय दबाव एवं सेल्टर प्रबन्ध द्वारा सुधार– अध्ययन से यह ज्ञात हुआ है कि अधिकांश किसान अपने ऊँट वृक्ष के नीचे बांधते है जो कि खुले आवासन पद्धति के ही समान है। खुले आवासन प्रणाली में वैज्ञानिक प्रबन्ध प्रणाली को अपनाते हुए प्रसव प्रक्रिया के दौरान एवं नवजात की उचित देखभाल से उष्ट्र बच्चों में होने वाली मृत्युदर में कमी लाई जा सकती है।

कृषि वानिकी इकाई

केन्द्र का संपूर्ण क्षेत्र 824 हेक्टेयर में बंटा हुआ है। जो कुल 5 खण्डों में विभाजित है। नम्बर 1 व 2 में मुख्य रूप से कृषि कार्य किये जा रहे है। चारा संसाधनों में सुधार हेतु विभिन्न चारे वाले वृक्षों– कीकर, झारबेरी, खेजड़ी एवं अरडू के लगभग 6500 पौधों की उचित देखभाल की गई। केन्द्र में पेड़ लगाने के कार्य के अन्तर्गत वर्ष 1999 से राजस्थान वन विभाग, बीकानेर के समन्वय से लगभग 35,000 पेड़ लगाये जा चुके है।

विस्तार कार्यक्रम

किसान दिवस

केन्द्र में दिनांक 23.12.02 को किसान दिवस का आयोजन रखा गया। किसान दिवस के आयोजन का मुख्य उद्देश्य इस अनूठे पशु उष्ट्र के तकनीकी–आर्थिक महत्व तथा इसका गर्म शुष्क प्रदेश के कृषकों की सामाजार्थिक स्तर (Socio-economic status) पर प्रभाव विषयों पर विचार–विमर्श से सम्बन्धित था। केन्द्र में आयोजित किसान दिवस पर पर्याप्त संख्या में किसान, कृषक महिलाएं, पशुधन स्वामी व युवाओं इत्यादि ने भाग लिया। इस दौरान उन्हें उष्ट्र प्रबन्धन, अनुसंधान की प्रक्रिया, उष्ट्र बाल, दूध व त्वचा आदि से सम्बन्धित चलचित्र भी दिखाये गये। इस कार्यक्रम में केन्द्र के वैज्ञानिक, शिक्षार्थी व प्रशासनिक कर्मचारी भी शामिल रहे।

सार्वजनिक उष्ट्र संग्रहालय

केन्द्र में राष्ट्रीय व अर्न्तराष्ट्रीय सैलानियों/किसानों हेतु एक सार्वजनिक उष्ट्र संग्रहालय खोला गया जिसमें उष्ट्र की नस्लों, अनुसंधान से प्राप्त उपयोगी उपलब्धियां, गाड़ा चलाना तथा उष्ट्र के विभिन्न उत्पादों संबन्धित सूचना तथा केन्द्र द्वारा प्रदान की जाने वाली सेवाओं की जानकारियाँ प्रदर्शित की गई है। इस संग्रहालय से सैलानियों की संख्या में भी बढ़ोतरी हुई हैं।

उष्ट्र अनुसंधान संबंधी वैज्ञानिक प्रदर्शनी

केन्द्र द्वारा केन्द्र व राष्ट्रीय स्तर पर विभिन्न वैज्ञानिक प्रदर्शनियां आयोजित की गई। इन प्रदर्शनियों में उष्ट्र पालन संबंधी जानकारी तथा नवीनतम प्रौद्योगिकी दर्शाई गई। जिनमें पहली प्रदर्शनी अखिल भारतीय कला कुंभ, जूनागढ़ फोर्ट, बीकानेर में, दूसरी किसान दिवस के अवसर पर केन्द्र में व तीसरी उष्ट्र उत्सव (15.01.02–25.01.02) पर केन्द्र में रखी गई। इन आयोजनों के अन्तर्गत पोस्टर/चार्ट प्रदर्शित करते हुए आने वाले राष्ट्रीय व अर्न्तराष्ट्रीय सैलानियों, किसानों आदि को पर्याप्त संख्या में लघु साहित्य व प्रसार–सामग्री वितरित की गई।

किसान गोष्ठी

वर्ष के दौरान केन्द्र द्वारा पाँच किसान गोष्ठियां आयोजित की गई। जिनमें एक मल्लीनाथ उष्ट्र मेले, तिलवाड़ा, बाड़मेर, राजस्थान में, तीन केन्द्र के अंगीकृत गांव गाढ़वाला तथा एक केन्द्र में आयोजित रही। इन अवसरों पर उष्ट्र प्रबन्ध तथा बीमारियों संबंधी विचार–विमर्श के दौरान विषय विशेषज्ञों द्वारा जानकारियां दी गई। केन्द्र के वैज्ञानिकों द्वारा किसानों से भी ऊँटों के पारंपरिक रख–रखाव संबंधी जानकारी एकत्रित की गई।

अवसंरचनात्मक विकास

अवसंरचनात्मक विकास के अन्तर्गत केन्द्र में प्रशासनिक एवं पुस्तकालय भवन, लघु पशु आवास, वाहन स्टैण्ड, सेनेटरी पोस्ट का निर्माण किया गया तथा सामुदायिक भवन का निर्माण प्रगति पर है।

खेलकूद गतिविधियां

उष्ट्र–उत्सव, 2003 के दौरान केन्द्र द्वारा उष्ट्र–दौड़, नवजात उष्ट्र बच्चों, उष्ट्र बाल कर्तन तथा साज–सज्जा एवं उष्ट्र दुग्ध प्रतियोगिता इत्यादि विभिन्न प्रतियोगिताओं में भाग लेते हुए पुरस्कार अर्जित किये।

भारतीय कृषि अनुसंधान परिषद अन्तर क्षेत्रीय खेलकूद प्रतियोगिता (2002–2003), केन्द्रीय अन्तर्स्थलीय प्रग्रहण मात्स्यिकी अनुसंधान संस्थान, बैरकपुर, कोलकता द्वारा 28 अप्रैल–1 मई, 2003 के दौरान आयोजित प्रतियोगिता में केन्द्र की वॉलीबाल टीम ने द्वितीय स्थान प्राप्त किया। टीम में श्री मोहनसिंह (कप्तान), श्री अशोक यादव, श्री कँवरपाल शर्मा, श्री जमील अहमद, श्री अनिल कुमार, श्री विष्णु सोनी, श्री महेन्द्र राव, श्री प्रभुदयाल, श्री राम कुमार सुरी,, श्री सतनाम सिंह व श्री नेमीचन्द शामिल रहे। केन्द्र के श्री मोहन सिंह ने डिस्कस थ्रो में द्वितीय स्थान प्राप्त किया।

गैर सरकारी संगठनों के साथ समन्वय

केन्द्र द्वारा वर्ष के दौरान विभिन्न गैर सरकारी संगठनों यथा– ग्रामीण अर्थव्यवस्था का सामाजिक उत्थान, बाड़मेर, लोकहित पशुपालक संस्थान (देशी पशुधन अनुसंधान एवं विकास हेतु संस्था) सादड़ी, पाली, उरमूल ट्रस्ट, बीकानेर से समन्वय स्थापित किया गया। जिसमें उष्ट्र दूध तथा बाल उत्पाद, दही, चाय, उष्ट्र की उपयोगिता इत्यादि विषयों पर समन्वय किया गया। उष्ट्र दूध से निर्मित चाय/कॉफी, राष्ट्रीय व अर्न्तराष्ट्रीय सैलानियों को उपलब्ध करवाई गई तथा इनकी स्वीकार्यता, गुणवता आदि के सन्दर्भ में जानकारी प्राप्त की गई।

हिन्दी चेतना मास, 2002

केन्द्र में 14 सितम्बर, 2002 हिन्दी दिवस के उपलक्ष पर दिनांक 14.09.2002 से 11.10.2002 तक हिन्दी चेतना मास मनाया गया। जिसके अन्तर्गत केन्द्र के अधिकारियों एवं कर्मचारियों हेतु हिन्दी निबन्ध प्रतियोगिता व एक दिवसीय हिन्दी कार्यशाला का आयोजन रखा गया।

संसदीय राजभाषा समिति की दूसरी उप समिति द्वारा केन्द्र का निरीक्षण

14 सितम्बर, 2002 को हिन्दी दिवस के अवसर पर केन्द्र में संसदीय राजभाषा समिति की दूसरी उप समिति द्वारा केन्द्र का निरीक्षण किया गया। निरीक्षण के दौरान समिति सदस्यों को निरीक्षण प्रश्नावली के सन्दर्भ में संतोषजनक कार्रवाई का आश्वासन दिया गया।

केन्द्र–भ्रमण

इस वर्ष के दौरान विभिन्न उच्च–पदाधिकारी केन्द्र भ्रमण हेतु पधारें। जिनमें सर्वश्री आशीष चौपड़ा, ले0 ज0 के0 चिमन सिंह, पीवीएसएम, बीकानेर, श्री अरविन्द प्रसाद, सचिव, डीआईएफ, पटना, श्री सतवीर चौधरी, स्टेट सीनेटर, यूएसए आदि रहें। इन सभी उच्च–पदाधिकारियों ने केन्द्र द्वारा किये गये विभिन्न क्रियाकलापों की जानकारी ली तथा अनुसंधान उपलब्धियों की भूरि–भूरि प्रशंसा की।

2. EXECUTIVE SUMMARY

Research Highlights

Reproduction

Photoperiodic manipulation through application of face mask to breedable female camels in afternoon hours to mimic short day period was found to elicit follicular growth in masked animals, but ovulation and conception during off season were not evident. Although three out of six females under mask group could be impregnated early in the breeding season as compared to control group, but the overall pregnancy rate did not differ in 2 groups. It is concluded that photoperiodic manipulation in form of face mask was not effective to hasten off season breeding in camel. Result obtained in AI experiment revealed that failure of ovulation and sperm entrapment are the 2 major problem to be resolved for development of AI in camel.

Facilities for Radio Immuno Assay of progesterone hormone in camel serum/ plasma has been established at the centre, which can also be extended to other livestock species for research and diagnostic purposes. Efforts are continued to develop assay facilities for other reproductive hormones too.

Onset of breeding season in camel is accomplished by tremendous rise in peripheral testosterone concentration. The levels of testosterone remain elevated for an average period of 11-13 weeks followed by decline to basal levels. The initiation and decline varied individually. It is not uncommon to observe complete absence of rut and endocrine surge in few adult male camels. The enhanced libido appreas to be correlated with higher testosterone profiles. It is not uncommon to observe young rutting males with elevated testosterone profiles to express complete shyness and refusal to copulate. It is also not uncommon to observe refractoriness to copulate in AV by adult male camels despite elevated testosterone profiles. Complete loss of libido after rut appears to be associated with low testosterone profiles.

Draught utility

Trials on improved kind of camel drawn agricultural implements viz. 6-disc harrow and 5-tyne cultivator under rainfed cropping were found to be useful as these increase the rate of ploughing as compared to traditional plough. However, the load generated by camel to pull these implements was found to be high as a result of which camels get fatigued early. Further testing of camel drawn implements and its modification shall be taken up before the next rainy season.

Camel Milk

The camel milk product, soft cheese was prepared successfully and indicated encouraging acceptability in the form of cheese pakoda and bread spreader. The cheese was stored at refrigeratory temperature. A two days workshop was organized on 14-15 March, 2003 under NATP Project

"Improving the shelf life of Milk and Milk products of Camel and Goat" in order to increase awareness and to promote camel milk and milk products utilization. Dairy experts from NDRI, Karnal; CIRG, Makhdoom; CAZRI, Jodhpur; HAU, Hisar; URMUL Dairy, Bikaner and, scientists and technical officers of the centre participated and expressed their views and suggestions for further promoting utility of camel and goat milk products. A Kissan gosthi was also organized in adopted village 'Gadwala' to share know how of camel milk utilization. At this occasion technical bulletin/handouts on camel milk dahi, and camel milk cheese, camel milk tea and coffee were distributed to the camel keepers/farmers. The major emphasis of experts was to develop mozzarella and cheddar cheese, fermented and flavored milk products technology. Evaluation of casein and whey proteins was identified as potential research area of study for pharmaceutical and dairy industry uses.

Genetics & Breeding

Under molecular genetic study blood samples from 50 unrelated individuals of Bikaneri, Jaisalmeri and Kachchhi breeds were collected from farm and field area. Five microsatellite loci viz. LCA-56, LCA-66, LCA-63, YWLL-08 and VOLP –67 were amplified and analysed. At LCA-56, LCA-66 and LCA-63 loci, respectively 2, 3 and 5 alleles were amplified in the three breeds of camel. At YWLL-08 and VOLP – 67 loci 7, 6, 7 and 6, 4, 6 alleles were amplified in Bikaneri, Kachchhi and Jaisalmeri breed respectively. The observed heterozygosity, Nei's expected heterozygosity and PIC were estimated for each locus. The expected heterozygosity and PIC values were highest for YWLL-08 locus and lowest for LCA-56 locus. The genetic distances between the three Indian breeds have been estimated using PHYLIP 3.6 and MICROSAT 2 software. The consensus arrived from observed data indicated close phylogenetic relationship between Bikaneri and Kachchhi breeds. The Jaisalmeri breed joins subsequently.

Mewari breed of camel, well known for its adaptation to the hiliy tracts of Arawali hills, is also known for the production of milk. Camel milk is widely sold in the Mewar and adjacent Malwa region of Madhya Pradesh by camel rearing communities and it is becoming regular source of income for camel keepers. A breed descriptor has been prepared for this breed based on biometry of seventeen body parameters and production aspects. An adult Mewari camel has 159.27±2.61 cm body length, 196.08±3.50 cm heart girth and 194.31±2.38 cm height at wither. Average land holding of the camel owners in the breeding tract was around 6.25 hectare, mostly comprising of unirrigated land. Average annual income was Rs.32,500/- and average family size was about 7 members.

The breed descriptors of the two other important indigenous breeds, Bikaneri and Jaisalmeri, have been prepared by incorporating information on seventeen body measurements along with socioeconomic status, breed status, nutritional information and other relevant information regarding camel husbandry practices in the breeding tracts.

Camel Management

Study of camel production and management systems under two different agro-ecological zones of Bikaner and Pali districts revealed that purpose of camel rearing varied significantly ($P<0.01$) in these two different agro-ecological zone. The camel rearing patterns significantly ($P<0.01$) influence the feeding management system both at Bikaner and Pali region.

Camel Health

The camel conjugates-both peroxidase and fluorescence have been prepared. Initially, the rabbit anti-camel IgG fraction has been purified through protein A column. After desalting, the purified IgG was coupled separately with horse radish peroxidase and fluorescein isothiocynate. The laboratory made conjugates are under extensive field validation for ideal immuno-chemical repository.

Estimation of Somatic Cell Counts in 8 camels after calving at monthly intervals revealed that SCC was lower in second quarter (4-6 months) of lactation, which corresponds to peak yield period. Mean SCC for the whole lactation including 2/3 fragmented cells was more than 5,00,000 per ml of milk. This is above the limit prescribed by IDF for milk from normal healthy quarter. Further studies are required to redefine the limit in camel. Milk yield was observed to vary from 3 to 5 kg per day/ camel.

In view of scientific evaluation and validation of prevailing ethno veterinary medicine practices among rural farmers, the efforts were made to use some of the locally available herbal ingredients against skin disease, 'sarcopticosis,' in dromedary camels. The results of the two modified indigenous formulations were quite encouraging as recorded from various clinical trials in both at farm and under field condition. Further research in this line is in progress for complete standardization of these formulations on modern scientific lines and modify to make these as more easily applicable, storable and cost effective. Annual calendar for prophylaxis and management of camel under arid condition was developed.

Status of concentration of micro minerals Zn, Cu, Fe in serum of lactating camels did not reveal significant difference among various categories of mastitis (negative, sub clinical non specific and clinical) whereas, Co concentration in these categories indicated significant differences ($P<0.05$).

Camel Nutrition

The studies on behaviour of camel and camel calves in rangeland revealed that maximum time was spent on browsing followed by walking. An experiment on utilization of Bui (*Aerva tomentosa*) an unconventional plant resource as feed to camel calves revealed no significant difference in comparison to guar phalgati feed in respect of DM intake kg/d, DMI%, digestibility of proximate components nutrient intake of DM, DCP and ME/kgw$^{0.75}$ and water intake l/d.

Agriculture farm management

About 2000 plant seedlings of fodder varieties trees viz khejri (*Prosopis cineraria*) and Neem (*Azadirchata indica*) and Israeli babool (*Acasia fortilis*) were transplanted along the roadside in block No 1 and around camel *baras* in block No 2. Trials were carried out to assess and promote the utility of camel manure on different vegetational flora in pasture plot in block No. 1 in Farm area, preliminary results about the utility of camel compost manure were encouraging.

Extension

Farmers day was organized on 23rd December, 2002 with objective to discuss the techno-economic importance of camel and it's influence on socio- economic status of dry land farming in hot arid region. The centre participated and organized exhibition at All India Kala Khumbh at Junagarh fort, Bikaner (10.01.03 to 15.01.03), Kissan Diwas at NRCC from 22 to 23 Dec.2002 and also participated in various events (camel race, milking, hair cutting and decoration etc.) at the local Camel Festival and also organised one week exhibition from 15th – 22nd January, 2002. In addition five Kissan Gosthis were organised at campus and off campus at Mallinath camel fair, Tilwara, Barmer Rajasthan, on 10th April, 2002, three at our adapted village, Gadwala, on 24th Nov., 2002, 3rd Dec.2002 and 14th March 2003 and one at NRCC, Bikaner on 23rd Dec.,02.

Others

The centre is included as one of the tourist spot of Bikaner city. A new camel museum was established and opened for national/ international tourists, general public/ farmers to disseminate information on camel evolution and utility of camel breeds, important research achievements, carting and camel products (milk, bone, hide and hair).

Infrastructure development

New works have been awarded and taken up for Administrative and library building, small animal house, vehicle stand, sentry post and community centre.

3. INTRODUCTION

3.1 History

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

The National Research Centre on Camel, Bikaner is located in the Jorbeer area at a distance of about 10 km from Bikaner City. The geographical location is 28.3^0 ;North Latitude and 73.5^0 East Longitude at MSL of 234.84m. The topography of the area is arid undulating desert with vast range of sand dunes. The soil type is mostly loose and sandy. The climate is mostly dry and hot with average annual rainfall of around 260-270 mm. The temperature ranges between 30 to 45 ^{0}C in summer season and between 4 to 28 ^{0}C in winter season. The centre maintains a camel herd of about 250 camels of different age groups mainly belonging to three indigenous breeds Bikaneri, Jaisalmeri and Kachchhi.

3.2 Past achievements

- NRC on Camel, Bikaner, has developed an elite camel herd consisting of Bikanei, Jaisalmeri and Kachchhi breeds.
- Genetic parameters have been estimated for several traits viz. biometry, growth, milk and hair production.
- Reduction in early calf mortality from 20-30% under field conditions to around 5.0-7.0% under farm condition through improved management practices.
- Breeding efficiency of camel herd has been improved significantly in terms of mean conception, age at first calving and calving interval.
- Random amplification of polymorphic DNA technique showed genetic variability in Indian dromedary camel.
- Useful baseline data have been generated on draughtability, ploughing capacity and fatigue index of Indian camel
- Raw camel milk as nutritional adjuvant indicated significant role in faster recovery of Tuberculosis in human.

3.3 Mandate

- Undertake basic and applied research for improvement of camel.

- Provide leadership and co- ordinate camel research and training nationally and act as a National repository of information.
- Collaborate with National and International agencies for camel research and development.

3.4 Infrastructure

The infrastructure facilities include a Livestock farming unit, modern research Laboratories, Library, ARIS cell, Agricultural Farm unit and Farm Rangeland, Residential complex and Guest House and Camel museum.

Livestock farm : The farm maintains a herd of about 250 camels comprising of three indigenous breeds viz. Bikaneri, Jaisalmeri and Kachchhi camels. The unit is equipped with one camel Dispensary and a Disease Diagnostic Laboratory, 6 sheds, 3 camel boxes, one metabolic shed and a shed with provision of individual feeding. The farm also has feed and fodder godown and two weighbridges, one mechanical and other electro-mechanical. Four camel corrals, camel dispensary, Agriculture Farm office and post mortem room and pit have been added in block No. 1 and 2 of farm area.

Laboratories : NRC on camel has modern laboratories at 2 different complexes. One having laboratories for camel Physiology cum Biochemistry, Camel Genetics, Camel Reproduction, Camel Health, ARIS cell with LAN and internet connectivity and Administrative Wing and other complex has Camel Nutrition and Field Camel Reproduction laboratories. The research unit has one seminar hall with 120-seat capacity. Recently Genetics and Camel Health Research laboratories have been renovated and modified.

Library : The library subscribes around 40 Indian journals and 6 foreign abstracting services. Subject- wise and year-wise reference database has been created along with photocopying and internet facility. In addition to research literature/ books it has also been strengthened in Hindi books.

Rangeland : The NRC on Camel has 824 ha land partitioned in 5 blocks with two tube wells. About 650 ha of area has been fenced and 35 ha of land has been brought under perennial Silvipasture comprising of grasses, shrubs and trees. Main grasses are sewan (*Lasiurus sindicus)* and Blue panic (*Panicum antidotale)*. In order to improve feed resources Silvipasture development and large scale tree plantation has been under taken in collaboration with State Forest Department in Block No. 1.

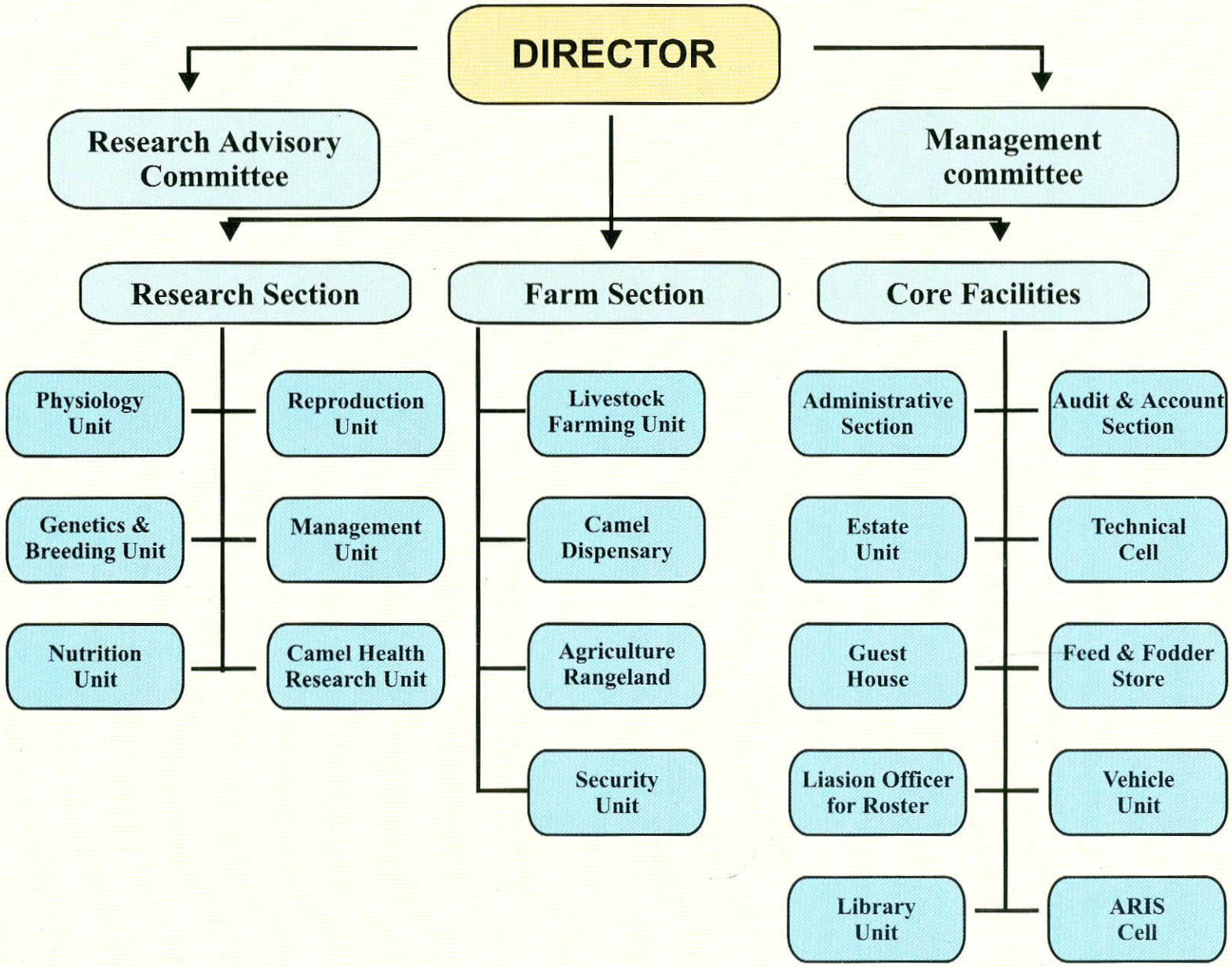
Residential complex : Residential colony of centre is established in two sets, old and new with total 37 quarters which includes type V-2, type IV-5, type III-6, type II-10 and type I-14.

Guest House : Centre has small guesthouse with 6 rooms including two VIP suits, two AC rooms and it can accommodate 12 guests at time.

The construction of new Administrative building, Small Animal House, Vehicle stand, Sentry post and Community center is in progress.

Fig. 3.5 ORGANOGRAM

NATIONAL RESEARCH CENTRE ON CAMEL, BIKANER



3.6 Staff Position (2002-03)

Cadre	Sanction	In position	Vacant
RMP	1	1	-
Scientist	20	14	6
Technical Category III	4	4	-
Category II	7	7	-
Category I	11	11	-
Administrative	10	10	-
Supporting	21	20	1
Total	74	67	7

3.7 Financial Statement and revenue receipt (2002-03)

(in lakhs)

Head of account	**Plan**		**Non Plan**	
	Budget	**Expenditure**	**Budget**	**Expenditure**
Estt. Charge	-	-	120.00	104.44
Wages	12.69	12.68	-	-
O.T.A	-	-	0.20	0.20
T. A	0.25	0.23	1.00	0.94
HRD	3.00	2.46	-	-
Other Charge including Equipment	114.06	113.47	10.00	12.20
Works	63.00	38.78	10.30	9.83
Total	193.00	167.62	141.50	127.61

4. RESEARCH ACHIEVEMENTS

4.1. Project Title: Improvement of working efficiency of camel under arid and semi-arid conditions

Project leader: Aminu Deen

Associates : M. S. Sahani

A pilot trial was conducted with a 3x2 disc harrow and 5- tyne cultivator, to generate our own data to popularize these implements. A wooden beam of 8-10 feet length was attached with 3x2 disc harrow and 5 -tyne cultivator, which, were fixed with camel through harness and other fixtures (Figs 4.1.1 and 4.1.2). A total of 4 adult camels (age 7.5 – 10.5 years) were used. All these camels were trained for draft work and were engaged in pulling cart and agricultural implements for last one year before undertaking a final evaluation trial. Total working time before fatigue (minutes), area covered (m^2), depth of penetration (cm) and force exerted in pulling (kg) were recorded. Results are presented in Table 4.1.1, which shows that the total working time before fatigue with harrow and cultivator for 4 camels averaged 49.86 ± 2.32 and 43.26 ± 2.06 minutes, respectively. The best individual performance recorded were 61.27 ± 5.02 and 57.85 ± 2.63 minutes and the lowest individual performance with these implements measured 41.63 ± 6.59 and 34.5 ± 3.96, respectively. The force exerted in pulling these implements averaged 127.02 ± 4.94 and 164.57 ± 6.50 kg, respectively. The land ploughed averaged 1730.48 ± 79.40 and 1569.5 ± 76.76 m^2. Comparing these results with previous reports, it was observed that effective field capacity observed in present study was slightly higher than that reported earlier. But, data as regards to total working time before fatigue and amount of force generated to pull these implements do not match. Earlier claims that camel can work continuously for 3 hours with these implements before being rested, and a total of 6 hours daily work could be accomplished, are not matching with present study, similarly earlier reports on the force generated by camel in pulling harrow and cultivator, 65.89 and 85.38 kg respectively,

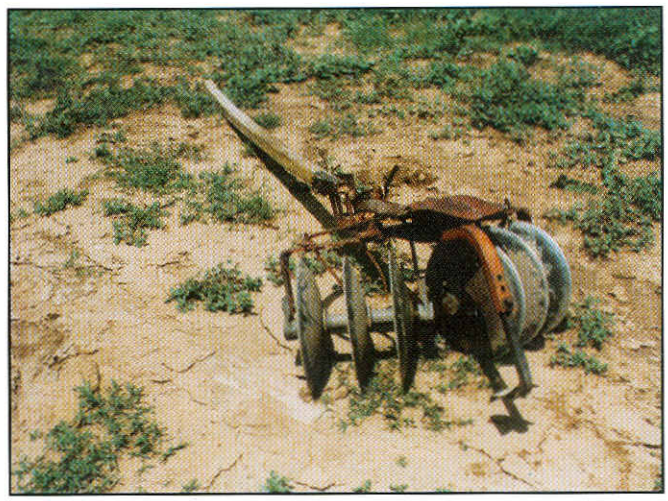


Fig. 4.1.1 : 6-disc harrow

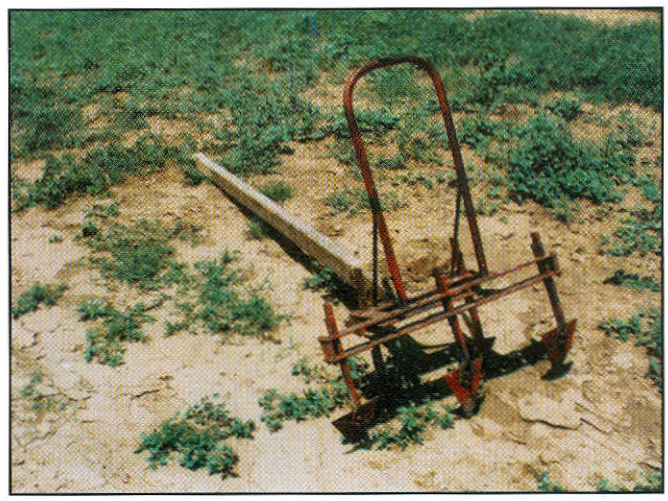


Fig. 4.1.2 : 5-tyne cultivator

appears to be lower than observed in present study. Professional design of implement and beam were critically evaluated and these were observed to be perfectly designed. As such, it is observed that these implements are rather heavy for camels to pull upon and indicating need for modification and re-evaluation of these implements.

Bund former can be used for making bunds at the rate of 3500 - 4000 meter/hr. It has been observed that a camel can plough continuously for 4.25 ± 0.27 hours with traditional plays and can plough 3136 ± 168 m^2 area. The ploughed area per hour measured 740.6 ± 13.6 m^2. The depth of ploughed land measured 9 - 15 cm. The angle of the plough used was 21°. Camel generated a draught force of 9.24 - 16.91 % of their body weight. The energy generated measured 1.10 ± 0.09 horsepower. The ploughing capacity was adjudged to be 523.28 ± 11.74 m^2 per 100 kg. body weight.

Table 4.1.1: Average individual and overall draught performance of camels using different camel drawn implements under sandy soils during rainy season

	Single Hal				Harrow				Cultivator				Bund Former		
	Time (min) before fatigue	Load (kg Force)	Area (m^2)	Depth (cm)	Time (min) before fatigue	Load (kg Force)	Area (m^2)	Depth (cm)	Time (min) before fatigue	Load (kg Force)	Area (m^2)	Dep th (cm)	Time (min) before fatigue	Load (kg Force)	Length (m)
J-58	79.33 ± 9.92	107.25 ± 12.27	1485.88 ± 137	6.5 – 11.0	61.27 ± 5.02	120.8 ± 11.14	1885.5 ± 166.14	7-15 cm	57.85 ± 2.63	158.8 ± 11.72	1879.5 ± 149.55	6-16 cm	77.23 ± 3.30	61.35 ± 5.40	3883.6 ± 161.62
J-54	77.71 ± 4.83	94.0 ± 8.41	1223.28 ± 147.78	6.0 – 13.5	55.57 ± 3.02	132.09 ± 6.45	1793.15 ± 103.41	6 - 16	43.46 ± 2.73	152.36 ± 10.46	1164.23 ± 141.72	6 - 16	77.31 ± 3.68	63.66 ± 5.03	3927.46 ± 167.64
J- 94	68.25 ± 5.52	94 .0 ± 20.66	1265 ± 133.48	6.0 – 9.5	41.64 ± 2.46	133.22 ± 15.23	1538.30 ± 127.32	6 - 12	36.25 ± 4.05	184.1 ± 18.58	1265.12 ± 175.99	6 - 14	70 ± 2.55	61.69 ± 4.38	3878.33 ± 186.46
K-90	80.5 ± 6.34	85.1 ± 9.93	1267 ± 164.49	8.0 – 16.0	41.63 ± 6.59	120.87 ± 6.39	1710.55 ± 289.11	6 - 12	34.5 ± 3.96	164.22 ± 11.55	1474.92 ± 127.50	7.5 - 10.5	92.6 ± 8.84	60.4 ± 2.89	4497.4 ± 468.28
Over all	76.5 ± 3.43	95.09 ± 6.41	1318.5 ± 69.62		49.86 ± 2.32	127.02 ± 4.94	1730.48 ± 79.40		43.26 ± 2.06	164.57 ± 6.50	1569.5 ± 76.76		78.03 ± 2.27	60.79 ± 2.52	4003.57 ± 113.48

4.2. Project Title: Genetic characterization, evaluation and conservation of indigenous camel breeds

Project Leader : S. C. Mehta

Associates : M. S. Sahani, R. Singh, C. Bhakat, U. K. Bissa, B. L. Chirania

Sub project 1 : Selection for the improvement of draughtability of camel breeds

Project Leader : S.C.Mehta

Associates : M.S.Sahani, R.Singh, U.K.Bissa

Selection of studs

Body measurements of camels up to the age of six years were recorded in September, 2002. The effect of breed, age and sex on body measurements were given in the earlier report. Based on the

literature that body length and related traits have significant effect on draughtability, 6, 6 and 2 males, respectively of Bikaneri, Jaisalmeri and Kachchhi breed were selected on the basis of body length, while fixing independent culling level for heart girth and height at wither. Of these, 2 males of Bikaneri, 3 males of Jaisalmeri and one male of Kachchhi breed were transferred to other sections for research. The population mean and mean of the selected individuals plus the selection differential have been presented in Table 4.2.1. Leastsquares analysis of variance was also carried out to see the significance of difference in the two groups for body length, heart girth and height at wither. The selected group had significantly higher body length and heart girth ($P<0.05$). It appears that there is confounding due to age. Further analysis will be carried to observe the actual effects.

Table 4.2.1: Population mean (cm) and selection differential in adult camels

SGR	n	Body length	Heart girth	Height at wither
Selection		*	*	NS
Population	63	153.61±0.76	211.99±1.19	195.15±0.72
Selected	6	160.88±3.20	223.88±5.03	201.00±3.04
S.D.		**7.27**	**11.89**	**5.85**

*($P<0.05$)

Sub projects 2: Studies on qualitative and quantitative genetic parameters in Indian Camel

Project Leader : S.C.Mehta

Associates : M.S.Sahani, C. Bhakat, U.K.Bissa, B.L Chirania

Body weight and growth

The leastsquares mean and analysis of variance of growth data for the period 1997-2003 were calculated. The mean body weight at birth, 3, 6, 9, 12. 24, 36 and 48 month was 35.53±0524, 86.87±1.86, 141.05±2.72, 194.58±4.22, 204.99±3.41, 252.63±6.72, 342.45±8.73 and 407.45±12.10 kg, respectively. Present performance is comparable with the past performance of this herd for last 12 years. The effect of breed was significant at 6, 12 and 24 months of age. The effect of sex was found to be non-significant.

Reproductive parameters

The information on mating and calving performance of the Centre's herd from the year 2000 to 2003 is presented in Table 4.2.2. This year the reproductive performance remained better than previous year. The calving was 79.31%. Highest calving percentage were recorded in Bikaneri (88.88%) followed by Kachchhi (80.00%) and Jaisalmeri (50.00%). The conception rate was observed to be 76.32%. This year the newborn calf mortality was 4.35% and there were two cases of stillbirths.

The data for gestation length was also analysed for the period under report. The Bikaneri and Kachchhi females took 382.93±2.81 and 385.50±5.25 days. Herd mating was undertaken in Jaisalmeri females.

Mortality in NRCC herd

This year there were 15 deaths of which 9 belonged to the Bikaneri breed and six to the Jaisalmeri breed. The postmortem finding revealed the involvement of digestive system in 40% deaths.

Genetic characterisation, evaluation and conservation of indigenous camel breeds

Sub project: Studies on qualitative and quantitative genetic parameters in Indian camel.

Sub Project 3: Database updates

The following databases have been updated in the unit.

1. **Inventory of the Centre's camel herd**. This includes pedigree information on all available animals of Bikaneri, Jaisalmeri, Kachchhi and Arab cross camels in the herd.
2. **Database on biometry of Centre's herd**. This includes information on 17 traits (body measurements) of the camels at the Centre.
3. **Breeding tract database on Jaisalmeri camel**. This includes information on district, tehsil, village, camel breeder and biometry on 17 traits of true to the breed animals of Jaisalmeri breed as found in the breeding tract.
4. **Reproduction database**. This includes information on reproductive performance of the Centre's herd from 1992 to 2002.
5. **Health database**. This includes information on mortality of animals at NRCC farm since 1984 to 2002.
6. **Production database**. This includes information on hair and milk production of camels of NRCC herd.

Table 4.2.2: Reproductive Performance of the Camel Herd

Year	Traits	Bikaneri	Jaisalmeri	Kachchhi	Cross-bred	Pooled
2000	Mating	17	14	6	1	38
	Conception	12 (70.59 %)	12 (85.71%)	2 (33.33 %)	1 (100%)	27 (71.05%)
	Calving	10 (83.33 %)	10 (83.33%)	2 (100%)	1 (100%)	23 (85.19%)
2001	Mating	35	25	17	-	77
	Conception	24 (68.57%)	19 (76.00%)	9 (52.94%)	-	52 (67.53%)
	Calving	16 (66.66%)	12 (63.15%)	7 (77.77%)	--	35 (67.30%)
2002	Mating	24	12	10	-	46
	Conception	18 (75.00%)	6 (50.00%)	5 (50.00%)	-	29 (63.04%)
	Calving M	8	3	2	-	13
	F	8	-	2		10
		(88.88%)	(50.00%)	(80.00%)		(79.31%)
2003	Mating	26	7	5	-	38
	Conception	18 (69.23%)	7 (100%)	4 (80.00%)	-	29 (76.32%)

Hair Production

Annual hair yield data from 1038 Indian dromedary camels belonging to 3 breeds (Bikaneri, Jaisalmeri, and Kachchhi) from 5 different age groups (1, 2, 3, 4-6 year and above 6 year) were recorded and analysed by using Mixed Mode Leastsquares and maximum likely hood computer programme to study the effect of breed, age, sex, year of production influencing hair yield. The least square Mean ± SE for annual hair yield (Kg) is presented in Table-1. The least square analysis indicated significant ($P < 0.01$) effect of breed on annual hair production. The male camel produced significantly ($P < 0.01$) heavier annual hair clip than female in all the breeds and all age groups. Annual hair yield was significantly ($P < 0.01$) influenced by sex factor. Age of camel had significant ($P < 0.01$) effect on annual hair production. The interaction between genetic group and sex, age were significant ($P< 0.01$) on annual hair production.

Table 4.2.3 : Leastsquares means along with standard error for annual hair production (kg) of Indian camel breeds.

	Bikaneri	Jaisalmeri	Kachchhi	Overall
Sex		**		
Male	1.04 ± 0.02 (153)	0.80 ± 0.01 (188)	0.68 ± 0.03 (61)	0.84 ± 0.01 (402)
Female	0.87 ± 0.01 (295)	0.71 ± 0.02 (235)	0.63 ± 0.02 (106)	0.74 ± 0.01 (636)
Overall	0.95 ± 0.01 (448)	0.76 ± 0.01 (423)	0.66 ± 0.02 (167)	0.79 ± 0.01 (1038)
Age groups				
1 year	0.76 ± 0.03 (55)	0.61 ± 0.03 (58)	0.59 ± 0.05 (24)	0.64 ± 0.02 (137)
2 year	1.18 ± 0.04 (48)	0.84 ± 0.03 (53)	0.70 ± 0.05 (22)	0.92 ± 0.02 (123)
3 year	1.40 ± 0.03 (56)	1.01 ± 0.04 (50)	0.80 ± 0.04 (31)	1.10 ± 0.02 (137)
4 – 6 year	0.85 ± 0.02 (87)	0.74 ± 0.03 (71)	0.65 ± 0.04 (35)	0.74 ± 0.01 (193)
Above 6 years	0.67 ± 0.01 (202)	0.54 ± 0.02 (191)	0.51 ± 0.03 (55)	0.55 ± 0.01 (448)

** Significant ($P<0.01$)

Sub project 4 : Molecular genetic studies in Indian camel.

Project Leader : S.C.Mehta

Associate : M.S.Sahani

Microsatellite markers for genetic characterisation of Bikaneri, Jaisalmeri and Kachchhi camel

Microsatellite analysis at ten loci was carried out for 50 unrelated camels of Kachchhi breed belonging to the farm and field. Polymorphism was observed at seven loci. Remaining three loci viz. YWLL-29, YWLL36 and YWLL-40 were monomorphic with allele size 208, 136 and 173 bp respectively. At the seven polymorphic loci, number of alleles ranged from 2-5 and the observed heterozygosity ranged from 0.34 to 0.74. The expected heterozygosity and polymorphic information content ranged from 0.3432 to 0.7402 and 0.2843 to 0.7016 respectively (Table 4.2.3).

Table 4.2.3. Amplification of microsatellite loci in Kachchhi breed of camel (*Camelus dromedarius*) using New World Camelidae primers

Locus	Primer 5'→3'	Alleles (n)	Size (bp)	Temp (°C)	H_o	H_e	PIC
VOLP-08	CCATTCACCCCATCTCTC TCGCCAGTGACCTTATTTAGA	3	143 –147	55	0.74	0.7402	0.7016
VOLP–10	CTTTCTCCTTTCCTCCCTACT CGTCCACTTCCTTCATTTC	5	250-264	55	0.34	0.50	0.4531
YWLL-09	AAGTCTAGGAACCGGAATGC AGTCAATCTACACTCCTTGC	2	158-162	58	0.44	0.3432	0.2843
YWLL-44	CTCAACAATGCTAGACCTTGG GAGAACACAGGCTGGTGAATA	2	104-107	60	0.74	0.4758	0.3626
YWLL-58	GGCATCTCTTCCTCATCAAT GACATCTCCAACTTGGAATC	3	173-177	58	0.50	0.58	0.4934
YWLL-59	TGTGCAGGAGTTAGGTGTA CCATGTCTCTGAAGCTCTGGA	2	115-117	58	0.48	0.375	0.3046
YWLL-38	GGCCTAAATCCTACTAGAC CCTCTCACTCTTGTTCTCCTC	4	180-186	55	0.58	0.628	0.5462
YWLL-40	CACATGACCATGTCCCCTTAT CCAGTGACAGTGTGACTAAGA	1	173	55	-	-	-
YWLL-29	GAAGGCAGGAGAAAAGGTAG CAGAGGCTTAATAACTTGCAG	1	208	55	-	-	-
YWLL-36	AGTCTTGGTGTGGTGGTAGAA TGCCAGGATACTGACATTCAT	1	136	55	-	-	-

H_o, observed heterozygosity; H_e, expected heterozygosity

Microsatellite analysis was also carried out at five more loci in Bikaneri, Jaisalmeri and Kachchhi breed of camel. Number of alleles at these loci in the threes breeds ranged from 2 to 7 (Fig. 4.2.1 to 4.2.3). The alleles frequency is presented in Table 4.2.4. The observed heterozygosity, Nei's expected heterozygosity and PIC values are presented in Table 4.2.5.

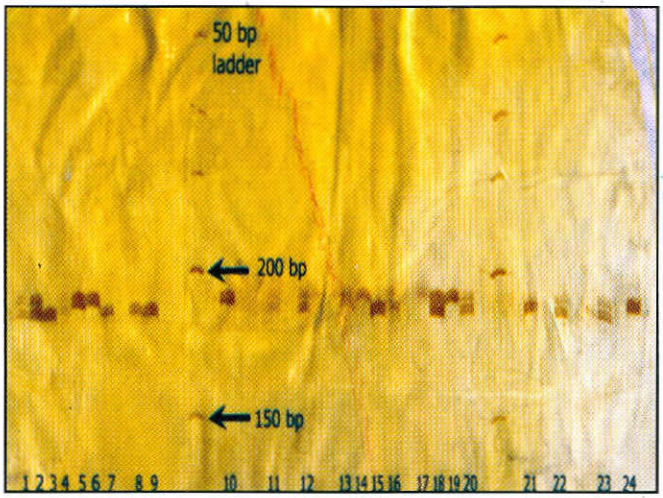


Fig.4.2.1 Photograph Showing alleles at microsatellite locus (YWLL-38) in Kachchhi camels

Table 4.2.4 Allele numbers, size and frequencies for the different microsatellite markers

Locus	Breed	Number of alleles	Alleles and their frequencies						
LCA-56			**134**	**138**					
	JAISALMERI	2	0.74	0.26					
	KACHCHHI	2	0.79	0.21					
	BIKANERI	2	0.72	0.28					
LCA-66			**234**	**236**	**238**				
	JAISALMERI	3	0.39	0.42	0.19				
	KACHCHHI	3	0.18	0.63	0.19				
	BIKANERI	3	0.26	0.46	0.28				
LCA-63			**196**	**210**	**214**	**216**	**220**	**222**	
	JAISALMERI	5	0.05	0.10	0.54	0.07	0.24	0.00	
	KACHCHHI	5	0.02	0.14	0.49	0.14	0.21	0.00	
	BIKANERI	5	0.00	0.05	0.50	0.09	0.31	0.05	
YWLL-08			**132**	**138**	**142**	**148**	**152**	**158**	**162**
	JAISALMERI	7	0.19	0.15	0.11	0.11	0.29	0.13	0.02
	KACHCHHI	6	0.27	0.20	0.02	0.15	0.14	0.22	0.00
	BIKANERI	7	0.27	0.20	0.03	0.17	0.10	0.17	0.06
VOLP-67			**151**	**157**	**161**	**177**	**185**	**189**	**195**
	JAISALMERI	6	0.06	0.09	0.19	0.00	0.50	0.14	0.02
	KACHCHHI	4	0.00	0.27	0.42	0.01	0.30	0.00	0.00
	BIKANERI	6	0.24	0.23	0.14	0.00	0.18	0.14	0.07

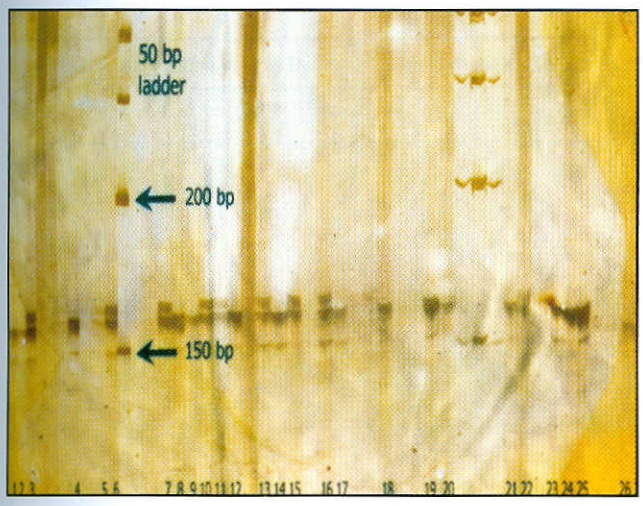


Fig. 4.2.2 :Photograph showing alleles at microsatellite locus (YWLL-09) in Kachchhi camel

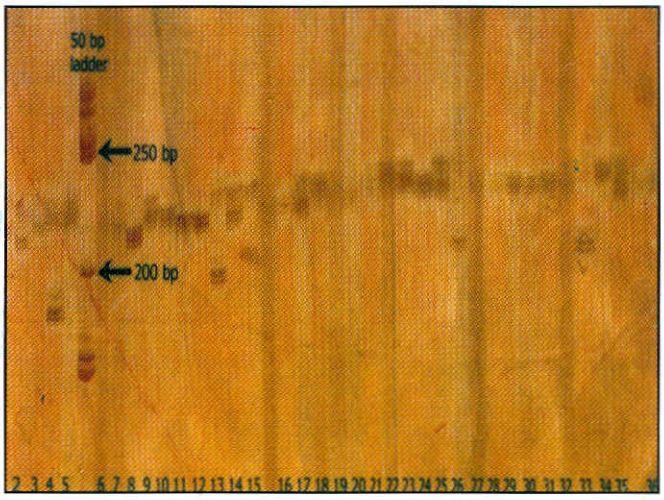


Fig.4.2.3 : Photograph showing alleles at microsatellite locus (LCA-63) in Jaisalmeri camels

Table 4.2.5. Observed heterozygosity (H_o), Nei's expected heterozygosity (H_e) and Polymorphic Information Content (PIC) values for the different microsatellite loci.

Locus	VOLP-67			YWLL-08			LCA-63			LCA-66			LCA-56		
	H_o	H_e	PIC	H_o	H_e	PIC	H_o	H_e	PIC	H_o	H_e	PIC	H_o	H_e	PIC
JAISALMERI	0.68	0.682	0.645	0.80	0.816	0.791	0.38	0.633	0.587	0.48	0.635	0.558	0.40	0.385	0.311
KACHCHHI	0.88	0.661	0.625	0.86	0.796	0.765	0.66	0.676	0.632	0.56	0.535	0.478	0.42	0.332	0.277
BIKANERI	0.32	0.813	0.786	0.94	0.815	0.789	0.54	0.641	0.583	0.26	0.642	0.570	0.46	0.403	0.322

The genetic distances between the three breeds have been estimated using PHYLIP3.6 (Table 4.2.6) and MICROSAT 2 software (Table 4.2.7). The consensus arrived from observed data indicated close phylogenetic relationship between Bikaneri and Kachchhi breeds. The Jaisalmeri breed join subsequently (Fig 4.2.4).

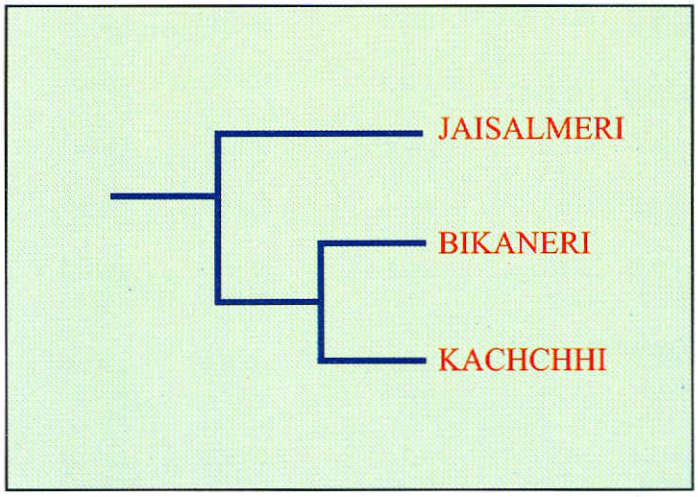


Fig. 4.2.4 Phylogenetic tree showing the relationship between three camel breeds Jaisalmeri, Bikaneri and Kachchhi

Table 4.2.6. Genetic distances calculated by Gendist programme of PHYLIP 3.6 package using allele frequencies

	Nei's distance	Chord distance (Dc)	Reynolds distance Fst
Locus LCA-56			
J-K	0.0031	0.0070	0.0069
J-B	0.0005	0.0010	0.0010
B-K	0.0062	0.0133	0.0132
Locus LCA-66			
J-K	0.1049	0.0613	0.0701
J-B	0.0375	0.0227	0.0204
B-K	0.0455	0.0294	0.0356
Locus LCA-63			
J-K	0.0138	0.0097	0.0082
J-B	0.0200	0.0460	0.0112
B-K	0.0338	0.0432	0.0176
Locus YWLL-08			
J-K	0.1355	0.0362	0.0299
J-B	0.1714	0.0350	0.0345
B-K	0.0202	0.0227	0.0051
Locus VOLP-67			
J-K	0.2566	0.1162	0.0999
J-B	0.3447	0.0637	0.0963
B-K	0.3649	0.1840	0.1070
Pooled over loci			
J-K	0.0811	0.0546	0.0469
J-B	0.0752	0.0435	0.0386
B-K	0.0699	0.0764	0.0398

J- Jaisalmeri, B- Bikaneri and K- Kachchhi

Table 4.2.7. Genetic distances between the breeds calculated by the Microsat 2 software for the different micro-satellite marker

Locus	Between breeds	Nei's distance (Ds)	Reynold's distance (Fst)	Chord distance (Dc)	Slatkin's distance (Rst)	Average squared distance (D1)	Delta mu squared distance (Ddm)	Kinship coefficient distance (Dkf)	Dμ s
LCA-56	J – K	-0.003	0.002	0.038	-0.002	1.444	0.010	0.448	0.051
	J – B	-0.006	-0.004	0.014	-0.005	1.578	0.002	0.502	0.020
	B – K	0.000	0.008	0.052	0.002	1.490	0.020	0.466	0.073
LCA-66	J – K	0.090	0.068	0.158	0.021	0.953	0.044	0.992	0.236
	J – B	0.019	0.016	0.096	0.015	1.128	0.048	1.056	0.139
	B – K	0.031	0.031	0.109	-0.005	0.910	0.00	0.942	0.186
LCA-63	J – K	-0.006	0.003	0.099	-0.004	10.804	0.029	1.079	0.117
	J – B	0.002	0.006	0.217	0.045	10.246	0.960	1.034	0.151
	B – K	0.014	0.013	0.210	0.042	7.396	0.656	1.110	0.174
YWLL-8	J – K	0.092	0.025	0.211	-0.001	46.284	0.372	1.777	0.301
	J – B	0.126	0.030	0.207	-0.002	48.052	0.302	1.860	0.315
	B – K	-0.023	0.000	0.167	-0.005	52.109	0.004	1.659	0.094
VOLP-67	J – K	0.236	0.100	0.382	0.115	102.891	21.902	1.370	0.545
	J – B	0.311	0.096	0.281	0.067	130.504	17.389	1.756	0.462
	B – K	0.333	0.108	0.485	-0.004	102.508	0.260	1.744	0.598
Pooled over loci	J – K	0.065	0.043	0.177	0.069	32.475	4.472	1.037	0.236
	J – B	0.056	0.034	0.163	0.047	38.302	3.740	1.116	0.206
	B – K	0.052	0.036	0.205	-0.002	32.882	0.188	1.072	0.208
Distance ± S.E.over 126 bootstraps	J – K	0.069± 0.040	0.043± 0.018	0.178± 0.053	0.057± 0.043	32.813± 17.605	4.622± 4.008	1.048± 0.203	0.239± 0.074
	J – B	0.064± 0.049	0.034± 0.017	0.162± 0.043	0.040± 0.024	38.827± 22.333	3.852± 3.146	1.134± 0.228	0.208± 0.068
	B – K	0.058± 0.048	0.036± 0.021	0.205± 0.069	0.000± 0.008	33.208± 17.876	0.185± 0.109	1.088± 0.219	0.213± 0.080

4.3. Project Title: Improvement of reproductive efficiency and to study the causes of reproductive failures in camel

Subproject 1: Evaluation and preservation of camel semen and development of Artificial Insemination

Project leader: Aminu Deen

Associates : Sumant Vyas, M. S. Sahani

Experiment no. 1 Evaluation and preservation of camel semen

Semen samples were collected from 15 male camels at twice a week intervals from December 2002 to May 2003 and evaluated for motility using standard technique. Cryo-preservation of semen was attempted and post thaw examinations are continued.

Collection of semen could be satisfactorily accomplished in majority of camels during breeding season. The quantity of semen varied from 3 to 20 ml. Evaluation revealed that camel spermatozoa are tightly packed and are not free to move. Spermatozoa appear to be released slowly from entrapped packing. This entrapment of spermatozoa appears to serve purpose similar to that of reservoir of spermatozoa in other species. Evaluation of frozen semen after thawing is under process.

Experiment no. 2 Artificial Insemination in camel

Thirteen she camels were examined ultrasonographically for the presence of follicle (> 1.0 cm). The hCG 5000 IU (HUCOG-500) was administered to induce ovulation and artificial insemination was attempted after 36 h of hCG administration. Five females could be successfully impregnated with fresh semen. However none could be impregnated with liquid and frozen semen.

Subproject 2: Superovulation and embryo collection in female camels for Embryo Transfer Technology

Project leader: Aminu Deen.

Associates : Sumant Vyas, M. S. Sahani

Experiment 1: Superovulation using hMG

The superovulatory regime using hMG, which is available in the local market was used in association with progesterone implants. Two trials on one female camel were conducted. The ovarian response was assessed by ultrasonography before and during superovulatory regime.

The periodic examination of ovaries by ultrasound during the superovulatory regime revealed poor superovulatory response. Nonsurgical flushing was carried out using Dulbecco's Phosphate Buffer Saline (DPBS). The recovered fluid was clear without turbidity and no embryos could be found.

Experiment 2: Collection and in-vitro maturation of oocytes.

The slaughter house material (goat ovaries) were used for collection of oocytes by both aspiration and slicing methods. The oocytes were searched under the stereozoom microscope using DPBS buffer and attempts were made for their maturation using standard protocol and medium in CO_2 incubator.

The technique is yet to be optimized. The results so far is as follows, collection of oocyte could be satisfactorily accomplished, graded and transferred to media. While culturing in CO_2 incubator the media gets dried. Further attempts in this direction are in progress.

Subproject 3: To develop camel specific radio-immuno-assay for reproductive hormones

Project leader: Aminu Deen

Associates : Sumant Vyas, M. S. Sahani

Six rabbits were given progesterone hemisuccinate coupled with Freund's complete adjuvant by intradermal route to raise antiprogesterone serum.

Booster injections of progesterone hemisuccinate FCA conjugate in rabbits are continued at 30-45 days intervals.

Subproject 4: Application of sonography and other diagnostic techniques in fertility and infertility management.

Project leader : Sumant Vyas

Associates : Aminu Deen, M. S. Sahani

Experiment : Ultrasound examination for the presence of preovulatory follicle before mating in Kachchi females.

During the breeding season, 10 female camels (8-12 yrs) of Kachchhi breed were examined by ultrasound using Scanner-200 for ovarian activity at weekly intervals. The females were mated with virile studs of Kachchhi breed after observation of pre-ovulatory follicle (>1.0 but not >3.0 cm). In the traditional method of breeding practice the females are being mated at any time during breeding season considering that a mature follicle is always present in the ovary.

The results revealed that eight out of 10 females had conceived. The result encourages for considering more camels for ultrasound examination before mating in next breeding season.

Sub project 5: To study the biochemical and hormonal factors affecting puberty in male camels.

Project leader : A. K. Roy

The body weight (Table 4.3.1) and skin thickness of young adult male camels were recorded periodically during the period under report. The blood samples were collected periodically and the serum separated and preserved in the freezer until assayed for the concentration of hormones. The

animals were monitored regularly for their reproductive behavior and appearance of poll gland secretion. The animals were taken in the area for riding exercise to keep fit. The poll gland secretion was observed in some animals but there was no odor that is characteristic to that of adult animals in the rut. Both the groups of young animals when left in the company of females, did not show any kind of sexual libido. The young calves with the intact testes exhibited some interests and curiosity in the company of females. The blood samples were analyzed for T_3, T_4 and Testosterone by radio-immunoassay. The results are presented in the Table 4.3.2. There was a slight increase in the level of T_3 during rut in all the three groups that can be attributed to the higher metabolic rate in this season. There was not much variation in the levels of T_4 during rutting (cold) and non-rutting (summer) seasons. Testosterone was reported to be more in adult and young camel calves during rutting period, however it remained similar in the calves without testicles. But the testosterone levels were not higher enough to match with those of adult camels to initiate the typical rutting behaviour in young camels.

Table 4.3.1 Age, body weight and skin thickness of camels under experiment

Camels	Adult	Young	Young (without testes)
Age (years)	13-15	5	4-5
Body weight (kg)	622	520	528
Skin thickness (mm)			
Shoulder	4.45	4.25	3.80
Abdomen	6.05	5.85	5.10
Hind quarter	4.60	4.25	3.90

Table 4.3.2. Serum T_3, T_4 and Testosterone levels in adult and pre-pubertal male camels during rutting and non-rutting seasons

S.No	Parameters	Adult camel	Young calves	Young (without testes)
1	T_3 (ng/ml)			
	Rutting	2.28	2.16	2.11
	Non-rutting	1.63	1.62	1.85
2	T_4 (µg/ml)			
	Rutting	0.066	0.091	0.074
	Non-rutting	0.070	0.084	0.072
3	Testosterone (ng/ml)			
	Rutting	19.36	1.66	0.04
	Non-rutting	0.35	0.33	0.05

4.4. Project Title: To study the economics of different camel management practices under arid and semi- arid eco- system

Project Leader : C. Bhakat

Associates : N. Sharma, M.S. Sahani

Sub-Project 1 : Studies on Camel Production and Management System in different Agro-ecological zone of Rajasthan

The study has been carried out on the camel production and management systems in two different agro-ecological zone of Bikaner and Pali districts. In all 300 camel keepers were interviewed on suitably developed and pretested survey proforma. Large herds of camel are owned by Raika/Rabri cast whereas other groups like Jat, Rajput, Muslim also owned small number of camel. In Bikaner region camel user were maximum (79.33%) where as in Pali region camel breeders were more (65.33%). Among the 1 to 4 year age group of camels were found to be less in Pali (27.68%) as compared to Bikaner region (28.44 %). It was revealed that in Bikaner region camels are reared primarily for carting purpose, followed by farming operations and for trading purpose. But in Pali region farmers were rearing camel mainly for trading, secondly for pack loading, thirdly for riding purpose (Table 4.4.4). The purpose of camel rearing varies significantly ($P<0.01$) in two different agro-ecological zone of Bikaner and Pali.

Pali district is having more irrigated land as compared to Bikaner region. Camel management varies in these two-agroecological region (Table 4.4.2). Camel keepers having single camel were maximum in irrigated area as compared to non-irrigated area. Camel keepers having more than 5 camels were maximum in non-irrigated area as compared to irrigated area. Camel ownership's were also varied in these two region. In Bikaner region farmers owning single camel (45.51 %) were maximum followed by 2-5 camels and > 5 camels. In Pali region farmers having 2-5 camels (42.96 %) were maximum followed by single camel and > 5 camels. Table 4.4.3 reveals the influence of camel keeping pattern on feeding management system in Bikaner and Pali district. Percentage of various management system practices in Bikaner and Pali district based on number of camel owned by farmers presented in Table 4.4.1. Farmers maintaining one camel mainly followed intensive system for feeding. Most of the farmers having 2 to 5 camels preferred semi-intensive system of management. Camel keepers who are keeping more than 5 camels generally follow extensive system of management. The chi-square values are found to be significant ($P < 0.01$) in both cases, indicating that camel keeping patterns were significantly influenced by the feeding management system in both Bikaner and Pali region. Rearing practices of camel adopted in Bikaner and Pali region are presented in table 4.4.3. Most of the small camel keepers having one camel were rearing their camel at household level in Bikaner (78.13 %) and Pali (76.67 %) region. Most of the medium categories of camel keepers having 2-5 camels send their camel for grazing around village, which may be up to 50 km range. Maximum of large categories of

farmer (owning more than 5 camels) reared their camel by following migration with some herdsmen. The migration practices is more in Pali (65.00 %) as compared to Bikaner (56.52 %) region. It reveals that camel rearing practices of Bikaner and Pali region were significantly ($P < 0.01$) influenced by categories of farmers of that area. In Bikaner region seasonal migration was maximum whereas, in Pali region prolonged migration was maximum. In both type of migration short distance (up to 50 km) movement was higher in Bikaner region where as long distance covered (more than 50 km) was more in Pali area. In both of these regions camel rearing was considered to be third way/means of revenue. Rearing of livestock other than camel like cattle, buffalo, sheep, goat etc was second source of revenue and agriculture was the first means of revenue of farmers.

Table 4.4.1. Percentage of management system practiced in Bikaner and Pali District

No. of camels owned/ camel keepers	Management system (%)			
	Intensive	Semi Intensive	Extensive	Overall
Bikaner (N = 150)				
1 Camel	81.25	10.94	7.81	42.67
2 –5 Camels	31.75	55.56	12.69	42.00
>5 Camels	21.74	26.09	52.17	15.33
Overall GT	51.33	32.00	16.67	
Chi Square	60.88 **			
Pali (N= 150)				
1Camel	81.67	10.00	8.33	40.00
2 –5 Camels	27.14	60.00	12.86	46.67
>5 Camels	15.00	25.00	60.00	13.33
Overall GT	47.33	35.33	17.34	
Chi Square	73.52**			

(** - Significant at $P < 0.01$)

Table 4.4.2 Camel keeping pattern adopted by camel keepers (%) under irrigated and non-irrigated zones of Bikaner and Pali Districts

Dist.	Zone	Camel Keepers (%)		
		1 Camel	2 –5 Camel	> 5 Camel
Bikaner	Irrigated	50.26	29.14	20.60
	Non-Irrigated	40.78	28.53	30.69
	Overall	45.51	28.84	25.65
Pali	Irrigated	34.89	43.76	21.35
	Non-Irrigated	26.57	42.15	31.28
	Overall	30.73	42.96	26.31

Table 4.4.3 Rearing practices adopted in Bikaner and Pali district

Grazing/Percentage	Bikaner			Pali		
	No. of camels owned			No. of camels owned		
	1	2 – 5	> 5	1	2 – 5	> 5
House hold / stall staying	78.13	33.34	8.70	76.67	25.71	10.00
Grazing around vill.(up to 50 Km)	21.87	63.49	34.78	23.33	68.57	25.00
Migration (>50 Km)	-	3.17	56.52	-	5.72	65.00
Chi Square		94.69 **			89.05 **	

(** - Significant at P < 0.01)

Table 4.4.4 Purpose of camel rearing in two different Agro-ecological Zone of Bikaner and Pali

No.	Purpose	Bikaner		Pali	
		M.S.V	Rank	M.S.V	Rank
1	Carting	6.20	I	3.54	V
2	Farming use	6.00	II	2.07	VI
3	Trading	5.20	III	6.78	I
4	Pack loading	2.40	VI	6.09	II
5	Riding	4.20	IV	4.75	III
6	Safari	2.80	V	3.70	IV
7	Others	1.20	VII	1.00	VII
r_s.		0.04 **			

(** - Significant at P < 0.01)

4.5. Project Title: Surveillance, monitoring and control of camel diseases

Subproject-1: Comparative studies on the sensitivity of Polymerase Chain Reaction (PCR) and serological tests for the diagnosis of camel Trypanosomosis

Project leader : S.K. Ghorui,

Associates : S.K. Dixit, F.C.Tuteja,

Trypanosoma evansi isolated from camel were maintained in albino rats, mice and rabbits upon inoculation at dose rate of $1x10^4$ live parasites intraperiotoneally. These animals were monitored for parasites throughout the period by wet-film examination. These isolate of parasite used to produce fulminating parasitaemia resulting death of mice and rats invariably 4-5 days post infection. However in rabbits chronic type of infection with fluctuating parasitaemia was established.

The parasites were also maintained in liquid Nitrogen at – 196°C under 12% Glycerol as cryo-protectant. The viability and pathogenicity of this stabilate was checked from time to time after inoculating (1/P) in mice and rats. There was no change in viability and infectivity of these stabilate while infecting in mice/ rats.

Blood samples from 127 camels were collected from trypanosome endemic area viz. Amarpura, Gadwala. All the blood samples were examined for parasite by Wet film examination. Thick smear examination, Thin smear examination and Mice inoculation test examination. Besides PCR and Ab-ELISA were also employed for detection of cameline surra.

The results are presented in Table 4.5.1. It was revealed that PCR assay is much sensitive detector of *T.evansi* parasitaemia than microscopic examination of fresh blood.

During the year 127 serum samples have been analyzed for ELISA. The base line mean ELISA value was fixed as 0.108±0.06 from the newborn camel calves as well as one year old camel calves who have been little exposed. The positive sample as compared with all control ELISA value are 2-fold greater than that as 0.426±0.04, and 37 samples have been detected at this range of ELISA value. However, some of the higher ELISA sample did not show any infection. In these animals the level of antibody still persists even after the successful elimination of infection by chemotherapeutic intervention or self cure. The primers used in PCR reaction in the present study were found to be parasite specific (Fig 4.5.1). With the current PCR detection method, drug sensitivity test, field monitoring for incidence and a prophylaxis can be performed with very high accuracy.

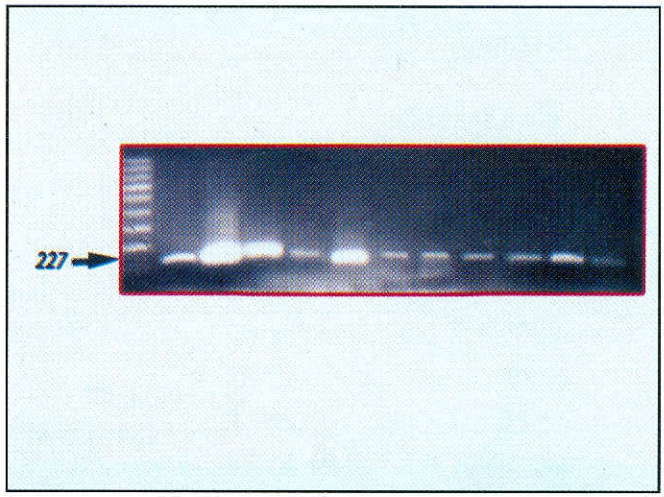


Fig.4.5.1 PCR product of T.evansi in whole camel blood (lane 2-12) and Lader DNA marker (lane 1) in 1.2% Agarose gel

Notwithstanding the accurate detection of active infection by PCR an antibody dependent test (Ab-ELISA) would still be useful for epidemiological studies of the disease.

Table 4.5.1. Comparative performance of parasitological and DNA based diagnosis of trypanosomosis in camel during 2003-04

S.N.	Parasitological	Samples examined	Number and %age of positive samples
A 1.	Wet film	127	9 (7.08%)
2.	Thick smears	127	11 (8.66%)
3.	Mice inoculation	127	13 (10.23%)
B.	DNA Based	127	23 (18.11%)
C.	Ab-ELISA	127	28 (22.04%)

Subproject 2: Indigenous system of medicine against skin affections in camel mange

Project leader : S.K. Dixit,

Associates : S.K. Ghorui, F.C.Tuteja

In the process of scientific validation of ethno veterinary practices and its reorientation on modern lines, three indigenous formulations were developed from a previously tested formulation I after its partial modifications and evaluated for its therapeutic efficacy on naturally occurring mange cases in camels. Three phased quarterly study in six groups of camels was a model for evaluation of different combinations of formulations for each one separately. Change in duration and frequency remained a base for sub groupings for standardization of schedule and doses. Recovery from clinical symptoms such as uneasiness, itching, erythema, excoriation, alopecia, thick brown scabs and thickening and wrinkling of skin etc. was one of the criteria for effective therapeutic indexing including skin scraping and some hematological examinations (Fig. 4.5.2 & 3). Experimental animals subjected for the application of formulation I proved better in terms of fast clinical recovery from various symptoms followed by formulations II and III as none of the animals of group I exhibited symptoms viz. itching and thickening and wrinkling of skin whereas in those treated with formulation II & III symptoms persisted up to last day of application of drug with relatively greater degree of intensity in formulation III treated group of animals. Patches of hypermelanosis and progressive but a bit slow hair growth was additionally recorded in both of the treated groups (II & III) indicating its reduced efficacy. However, in formulation II treated animals these clinical symptoms were nearly subsided on 45 day of observation. Two- three applications of formulation I at fifth day of interval appeared to suffice the purpose while few more applications were required with shorter interval (5- 3 days) in formulation II & III. Skin scrapings failed to record its authenticity as a confirmatory tool for diagnosis due to its repeated failure to observe any detectable mite/ ova in various clinically symptom-matologically positive cases

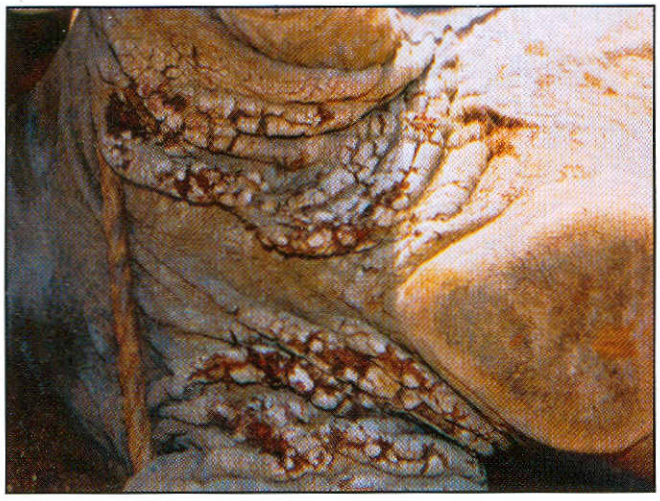


Fig. 4.5.2 : Severe mange infection in brisket region of camel

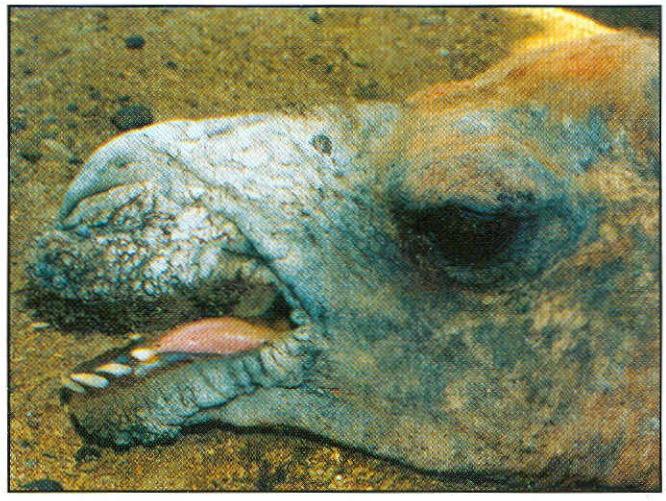


Fig. 4.5.3 : Severe mange infection around the mouth of camel

particularly in formulation III treated group. However in formulations I & II treated animals, it was nearly nil to note any detectable mite/ ova after two applications of the drug. Depending upon the severity of the cases, the treatment cost is highly variable ranging from Rs.100 to 300 in the formulation I and nearly same in the formulation II and III reaching maximum up to Rs. 450 per animal. Insignificant fluctuating pattern of hemoglobin may not be of much value except a watch for further deteoriation of health as it may be a reflection of altered and influenced feeding behavior of affected animals. Restoring trend of eosinophilia may be a unique signal of the ability of the formulations for a effective cure and possible elimination of triggering factors. Further research is in progress in view of its promising and encouraging results.

Subproject-3: Studies on prevalence, characterization and antibiotic sensitivity of intramammary infections in camel

Project leader: F.C. Tuteja

Associates : S.K. Ghorui, S.K. Dixit

Aseptically collected 128 quarter milk samples from 32 apparently healthy camels were evaluated for the prevalence of mastitis. Somatic cell count of all the milk samples was performed as per standard methods using Giemsa stain. Standard procedures using 5 per cent sheep blood agar and MacConkey's lactose agar were followed for bacteriological examination. Based on the results of cultural examination and somatic cell count, the animals were divided into four groups, Group.1: Negative (Culturally –ve and SCC<500000 per ml), Group.2: Subclinical (Culturally +ve and SCC>500000 per ml), Group3: Latent (Culturally +ve and SCC<500000 per ml), Group.4: Non-specific (Culturally –ve and SCC>500000 per ml).

Blood samples from clinically infected animals were taken as a separate group. The samples were collected from these lactating female camels, taking due sterile precautions. Blood samples were harvested by jugular venepuncture and serum was separated. 2.5 ml of serum was mixed with equal volume of nitric acid in Kjeldhal digestion tube. The digested samples were subjected to estimation of the minerals by atomic absorption spectrophotometer, AAS4141 of ECIL, Hydrabad, India. Copper (Cu), Zinc (Zn), Iron (Fe) and Cobalt (Co) were estimated at wavelength 324.4 nm, 212.9 nm, 248.3 nm and 240.4 nm.

No significant variation among negative, sub-clinical, non-specific and clinical groups ($P<0.05$) was recorded in the mean serum Zn, Cu and Fe concentration. However Co concentration in these groups recorded to be 1.78±0.12, 1.34±0.18, 1.26±0.10 and 0.70±0.41 µg/ ml, respectively (Table.4.5.2), varied significantly among groups ($P<0.05$). A marginally variable degree of concentration in the Mean serum values of Zn, Cu, Co and Fe was observed in the animals having SCC upto 2.0, 2.0-5.0, 5.0-10.0 and above10 lacs/ml of milk were 1.30 ± 0.60, 1.56 ± 0.16, 2.42 ± 0.84 and 1.78 ± 0.12; 2.37 ± 0.32, 1.35 ± 0.08, 3.93 ± 0.46 and 1.26 ± 0.10; 2.45 ± 0.51, 0.95 ± 0.14, 2.77 ± 0.71and 1.41 ± 0.16; 2.60± 0.95, 1.25 ± 0.25, 3.35 ± 1.33and1.35 ± 0.29 µg per ml, respectively (Table 4.5.3). Here the difference in Serum Zn, Fe and Co concentration varied non-significantly among groups. However Cu concentration varied significantly among groups ($P<0.05$).

Table 4.5.2. Mean serum Zn,Cu,Co and Fe concentration of camels affected with mastitis

Mastitis type	No. of animals	Zn (µg/ ml)	Cu (µg/ ml)	Co (µg/ ml)	Fe (µg/ ml)	Mean SCC ($x10^5$)
Effect				*		
Negative	5	1.30±0.58	1.56 ±0.17	1.78±0.12	2.42±0.83	369025±209717
Sub clinical	16	2.62±0.33	1.19 ±0.10	1.34±0.18	3.94±0.48	1059593±117235
Latent	-	-	-	-	-	-
Non-specific	11	2.12±0.39	1.33 ±0.12	1.26±0.10	3.07±0.56	867606±141391
Clinical	1	2.20±1.30	1.80±0.39	0.70±0.41	6.90±1.86	-

*Significant ($P<0.05$)

Thirty two quarter milk samples from eight apparently healthy camels of an organized herd were examined for milk SCC at monthly interval. Estimation of SCC in 8 camels after calving at monthly intervals revealed that SCC was lower in second quarter (4-6 months) of lactation (Table 4.5.4). Mean SCC for the whole lactation was more than 5,00,000 per ml of milk, including 2/3 fragmented cells. Therefore, International Dairy Federation Criteria adopted for cattle i.e. if milk having SCC more than 5,00,000 per ml is considered to be from unhealthy udder may not be valid for Dromedary camel. Daily milk yield in these camels ranged from 3-5 kg.

Table 4.5.3. Relationship between mean SCC and mean Zn, Cu, Co and Fe concentration

SCC per ml of milk (lacs)	No. of animals	Zn (µg/ml)	Cu (µg/ml)	Fe (µg/ml)	Co (µg/ml)
Effect			*		
Upto 2.0	5	1.30 ± 0.60	1.56 ± 0.16	2.42 ± 0.84	1.78 ± 0.12
>2.0-5.0	18	2.37 ± 0.32	1.35 ± 0.08	3.93 ± 0.46	1.26 ± 0.10
>5.0-10.0	7	2.45 ± 0.51	0.95 ± 0.14	2.77 ± 0.71	1.41 ± 0.16
>10.0	2	2.60± 0.95	1.25 ± 0.25	3.35 ± 1.33	1.35 ± 0.29

*Significant (P<0.05)

Table 4.5.4: Relationship of mean SCC with stage of lactation

Lactation (Months)	Somatic Cell Count x10^3 /ml of milk								
	Animal Number								
	J336	B165	J370	J65	B102	B333	J55	B246	Mean
1	700	700	665	833	630	668	639	862	712
2	646	665	585	773	550	585	569	770	643
3	617	509	461	592	512	493	464	639	536
4	506	360	318	445	433	484	433	474	432
5	372	436	410	423	442	388	417	296	398
6	509	391	528	477	420	655	344	503	478
7	608	499	783	585	649	830	541	509	626
8	690	541	559	655	748	926	589	522	654
9	277	805	837	732	757	859	585	550	675
10	732	926	923	808	764	923	630	595	788
11	754	748	1183	958	831	935	659	668	842
12	843	827	1069	932	837	847	704	719	847
13	894	1247	993	-	964	1011	815	824	964
14	999	1346	963	-	1193	1104	964	961	941

Sub project 4: Influence of camel milk in the management of type-1 diabetes

R.P. Agarwal, S. C. Swami, M.S. Sahani, F.C.Tuteja and S.K. Ghroui

The effects of camel milk on glycemic control, lipid profile and diabetes quality of life in type I diabetic patients, were evaluated in randomly selected type I diabetic patients (24) which were divided into 2 groups. Group I (N=12) received usual care i.e. standardized diet, standardized exercise regimen and insulin for 3 months. Then camel milk (500 ml) was added for next 3 months. Patients of group 2 (N=12) received camel milk (500 ml) and usual care for first 3 months and only usual care in next 3 months. Frequent blood glucose monitoring was done to keep euglycemic status by titrating the dose of insulin. Analysis of HbA, c, lipid profile, insulin and C-peptide was done in the beginning, at the end of third and sixth month. In group I patients the requirement of insulin was 40.83±7.12 at the beginning, 41.67±5.49 after 3 months and it reduced to 26.83±8.44, ($P<0.05$) after camel milk supplementation. In group 2 dose of insulin increased from 30.00±13.01 to 40.57±15.20 when camel milk was withdrawn. Improvement was observed in glycemic control; in group I HbA, c reduced from 9.48±2.17 to 8.19±1.84 and in group 2 HbA, c decreased from 9.59±1.62 to 8.02±1.17. Statistically significant improvement was seen in D.Q.L. score. It is concluded that moderate intake of camel milk reduces the insulin requirement with better glycemic control and diabetes quality of life without affecting lipid profile.

4.6. RESEARCH SCHEMES UNDER NATP

4.6.1 : Improving the shelf life of milk and milk products of camel and goat

Project Leader : Raghvendar Singh
Research Associate : Sanjay Shukla

Quantification of Lactoperoxidase and thiocyanate in Camel raw milk:-

The shelf life of raw camel milk is influenced by the presence of thiocyanate, hydrogen peroxide and lactoperoxidase constituents, which collectively activate LP- system in milk. The LP-system is beneficial for transporting and processing of camel milk in rural remote areas of arid and semi-arid zone of the country. The determination of these constituents was under taken to study quality of raw camel milk of late lactation period. Data are given in the following Table 4.6.1.1.

Table 4.6.1.1 Mean level of thiocyanate and lactoperoxidase in raw camel milk

Parameters	Breeds of camel	
	Bikaneri	Jaisalmeri
Thiocyanate (mg/L)	8.70 ± 1.38	10.15 ± 0.94
Lactoperoxidase(Unit/ml)	2.1 ± 0.10	2.2 ± 0.30

Milk products

I. Cheese

Cheese is a product prepared from milk by the coagulation of casein and carrying with it the rest of the milk ingredients. For preparation of cheese, camel milk was filtered, pasteurized by HTST method and cooled to 2-5^{0}C. The calcium chloride was added at the rate of the 0.02 percent followed by the 50 percent diluted HCl at the rate of 4-ml per liter, the milk was then heated to 21^{0}C. After addition of rennet at the rate of the 50 mg per liter, it was incubated at 25^{0}C for one hour for its setting. After cutting the cheese curd, the cooking was performed at 42^{0}C and whey was drained out. The prepared product was washed three times with water at 26^{0}C, 15^{0}C and 10^{0}C respectively followed by salting of cheese curd with NaCl at the rate of the 1-2 percent and stored at refrigerated temperature. Cheese can be utilized as cheese bhujiya, cheese basan pakoari, bread spread or as a vegetable.

Fig. 4.6.1.1 : Camel milk products

Soft cheese evaluation

The fresh camel milk was collected from late lactating camel of NRCC and evaluated for its gross chemical composition before its processing for the preparation of cheese. The composition of raw camel milk is given in the Table 4.6.1.2. The prepared cheese product was evaluated and data are given in the Table 4.6.1.3.

Table 4.6.1.2 Composition of camel raw milk before processing for the cheese

Parameter (%)	(Average ± SE)
Moisture	89.44 ± 0.61
Fat	2.67 ±0.44
SNF	7.89 ± 0.17
Total Solid	10.56 ± 0.61
Acidity	0.182 ± .001

Table 4.6.1.3 Properties of camel milk cheese

Parameter (%)	(Average ± SE)
Moisture	61.07 ± 4.29
Total Solid	38.99 ± 4.22
Fat	9 ± 1.53
Acidity	0.068 ± 0.012
Yield of cheese	12.17 ±0.64

Catalase activity in camel milk

The camel milk samples were collected in cold condition from late lactating camels of Bikaneri and Jaisalmeri breeds and processed within half an hour for determination of catalase activity in raw milk. The activities of catalase in Bikaneri and Jaisalmeri breeds ranged from 0.083 to 0.193 and 0.095 to 0.142 moles/min/gm of protein respectively.

II. Camel Flavored Milk

Standardization of camel milk process using different combination of stabilizers, flavour and colours was studied. The stabilizers used were carrageena and sodium alginate with use of different flavors i.e. pineapple, vanilla, chocolate and kesar along with yellow, rose and pink colours. The suitability of favored milk processes and their acceptability are under evaluation by the hedonic scale and results are in positive scale. The chemical evaluation will be done later.

Evaluation of dairy starter cultures for camel milk fermentation

All the dairy fermentation use lactic acid bacteria for acidification, characteristic flavor/body production and texture. Lactic starter cultures may consist of single strain used alone or in combinations as a mixed strain cultures. The camel and cattle (SARAS from URMUL dairy, Bikaner) milks were fermented using four different lactic starter cultures which were purchased from National collection of dairy cultures, Division of Dairy Microbiology, N.D.R.I., Karnal. The development of acidity and DMC were recorded up to the nine hour at the interval of three hour during incubation to study comparative rate of development of acidity in both the milk. The strains used in this study were 159 (Dahi culture), 167 (Dahi culture), 144 (Yogurt mix culture) and 15 (*Lactobacillus acidophilus*). It was observed that rate of development of acidity is comparatively slow in camel milk than cattle milk in all the four lactic strains.

Workshop on Promotion of camel and goat milk Utilization

A two days workshop was organized under NATP Project "Improving the shelf life of milk and milk products of camel and goat" in order to promote camel milk and milk product utilization. In this regard, invited dairy experts from NDRI, Karnal; CIRG, Makhdoom; CAZRI, Jodhpur; HAU, Hisar; URMUL Dairy, Bikaner and, scientists and technical officers of the center participated and expressed their views and suggestions for further improvements in ongoing research project on camel and goat milks. A kisan ghosthi was organized in Gadwala village to share know how of camel milk utilization and also distributed technical bulletins on camel milk dahi and camel milk soft cheese to the farmers. The major emphasis given by the experts to develop mozzarella and cheddar cheese, fermented and flavored milk products technology. Evaluation of casein and whey proteins is potential research area of study of their pharmaceutical and dairy industry uses.

Fig. 4.6.1.2 :Dr.S. Singh, chief guest of inaugeral function

4.6.2. Characterisation and conservation of Jaisalmeri breed of camel

CCPI : S. C. Mehta
Associates : R. Goel, N. Sharma
JRF : H. K. Bithu

Sub-Project1 : Characterisation and conservation of Jaisalmeri camel

Survey of the breeding tract for availability of pure Jaisalmeri camels was carried out. The whole breeding tract was initially divided into 12 strata. The Jaisalmer and Barmer districts were divided into four strata where as the Jodhpur and Bikaner districts were divided into two strata. During survey it was observed that in the Bikaner district pure Jaisalmeri animals are not available. Due to this the survey was restricted to the four strata of the Jaisalmer and Barmer district and two of the Jodhpur district. In all 36 enumerators were employed for the characterisation work, of which 16 were in Jaisalmer, 15 in Barmer district and 5 in the Jodhpur district (Fig. 4.6.2.1). A breed descriptor of the Jaisalmeri breed has been prepared. Information on the breeding tract, its climate, feed-fodder, water resources, housing, physical characteristics, growth, production and reproductive performance of the breed in the breeding tract has been included in the breed descriptor. The average land holding of the camel breeder is 63.54 beega, most of which is unirrigated (59.54 beeghas). Average grazing distance is 4 km and grazing time is about 8 hours a day. Average annual income of the camel breeders is Rs 21044 and average family size

is 8 members per family (Table 4.6.2.1). Biometry of 4494 camels of Jaisalmeri breed has been done and the data has been analysed for 3701 records (Table 4.6.2.3). Using these records, the population of Jaisalmeri Camels has been estimated to be 1.64 Lakhs (Table 4.6.2.2). Elite 14 Jaisalmeri males are being maintained under the project and cryopreservation of the semen is being carried out.

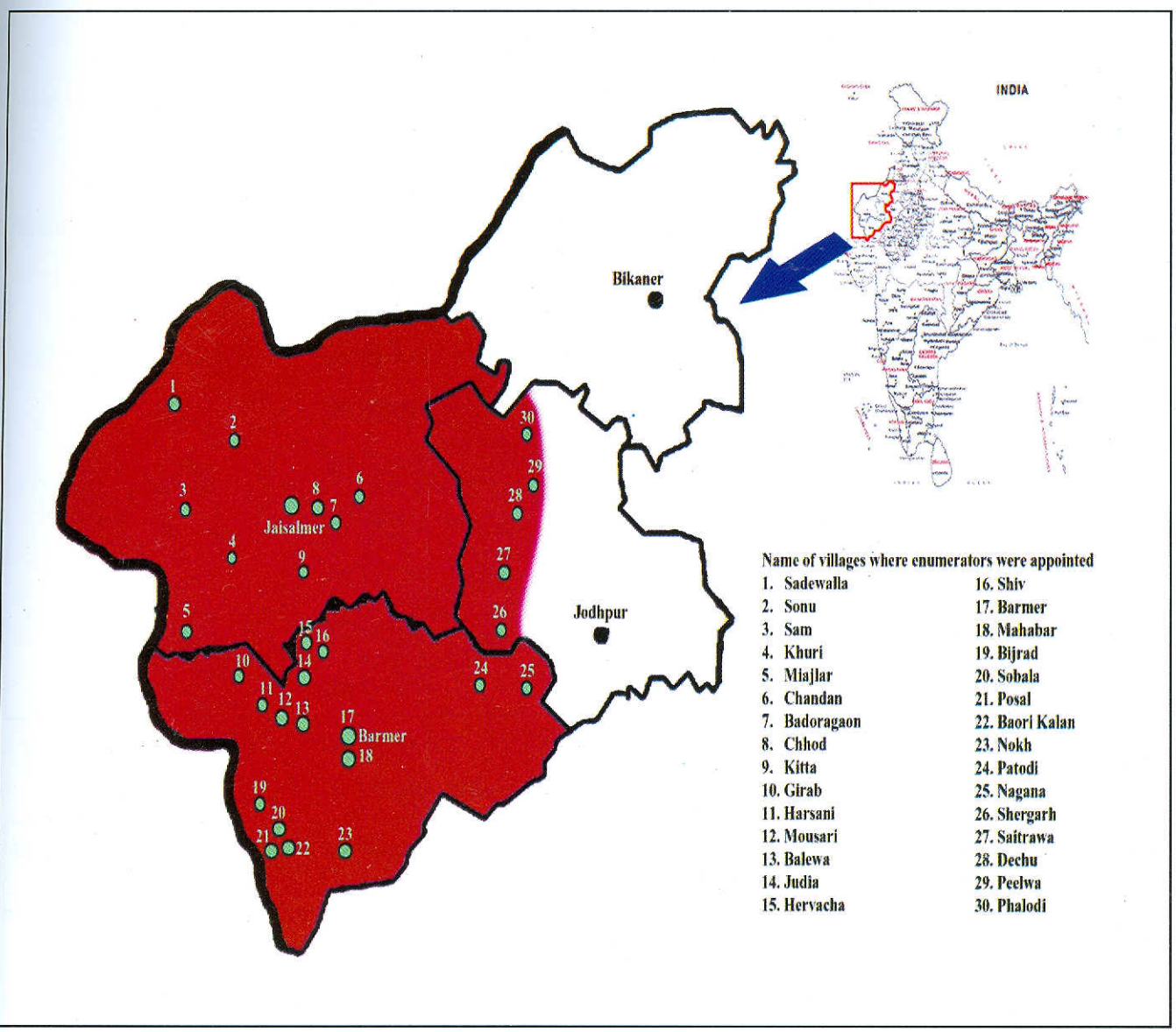


Fig. 4.6.2.1. Map of the breeding tract showing the work Centres of the project

Table :4.6.2.1. District and tehsil wise average annual income and family size

District	Tehsil	Income	Family size
Breeding tract		21044.00	8
Jaisalmer	Pooled (Dist.)	19213.00	7
	Jaisalmer	19656.00	7
	Pokhran	24465.00	8
Barmer	Pooled (Dist.)	24326.00	7
	Barmer	36100.00	8
	Chohtan	27966.00	7
	Shiv	27575.00	7
	Balotra	16224.00	8
	Guramalani	30375.00	7
	Ramsar	13907.00	7
Jodhpur	Pooled (Dist.)	19591.00	9
	Phalodi	14759.00	9
	Shergarh	34839.00	8
	Luni	17511.00	8

Table : 4.6.2.2. Population of Jaisalmeri camel in the breeding tract

District	Total Camel Population*	Total Jaisalmeri Camels	Breedable Males	Breedable Females
Jaisalmer	43042	40511	12607	12551
Barmer	111873	102341	21860	41147
Jodhpur**	29029	21772	8061	5376
Total	183853	164624	42528	59074

*as per Livestock Census 1997

**part of Jodhpur district

Table : 4.6.2.3. (a) Least squares mean of body measurements of Jaisalmeri camel (cm)

Traits/ Effects	Body length	Heart girth	Height at wither	Neck length	Leg length (F)	Leg length (H)
Sex**	126.36±0.40 (3701)	173.39±0.35 (3701)	173.93±0.34 (3701)	95.00±0.31 (3701)	132.50±0.25 (3701)	139.37±0.26 (3701)
Male	127.97	174.90±0.40 (1798)	175.31±0.38 (1798)	95.80±0.36 (1798)	133.04±0.29 (1798)	140.32±0.30 (1798)
Female	124.75	171.87±0.41 (1903)	172.56±0.39 (1903)	94.22±0.36 (1903)	131.97±0.29 (1903)	138.43±0.30 (1903)
Age**	126.36±0.40 (3701)	173.39±0.35 (3701)	173.93±0.34 (3701)	95.00±31 (3701)	132.50±0.25 (3701)	139.37±0.26 (3701)
<1 Year	85.45±1.77 (58)	118.38±1.56 (58)	135.34±1.49 (58)	72.89±1.37 (58)	109.66±1.11 (58)	114.96±1.15 (58)
1 Year	109.34±1.00 (181)	150.60±0.88 (181)	157.38±0.84 (181)	87.37±0.78 (181)	124.92±0.63 (181)	131.78±0.65 (181)
2 Years	125.42±0.81 (276)	172.82±0.72 (276)	176.29±0.68 (276)	93.92±0.63 (276)	132.12±0.51 (276)	138.76±0.53 (276)
3 Years	137.97±0.70 (373)	187.85±0.62 (373)	185.18±0.59 (373)	101.46±0.54 (373)	139.92±0.44 (373)	146.73±0.46 (373)
4 Years	144.00±0.69 (384)	199.20±0.61 (384)	191.04±0.58 (384)	104.92±0.53 (384)	142.44±0.43 (384)	150.07±0.45 (384)
≥5 Years	155.98±0.27 (2429)	211.43±0.24 (2429)	198.36±0.23 (2429)	109.48±0.21 (2429)	145.96±0.17 (2429)	153.94±0.18 (2429)

**(P<0.01)

Table : 4.6.2.3. (b) Least squares mean of body measurements of Jaisalmeri camel (cm)

Traits/ Effects	Foot pad length (F)	Foot pad Width (F)	Foot pad Length (H)	Foot pad Width (H)	Hump Circum(H)	Hump Circum(V)
Sex	15.49±0.05 (3701)	14.91±0.04 (3701)	13.91±0.05 (3701)	13.30±0.05 (3701)	72.73±0.68 (3701)	33.41±0.40 (3701)
Male	15.51±0.05 (1798)	15.03±0.05 (1798)	13.89±0.05 (1798)	13.38±0.05 (1798)	75.92±0.78 (1798)	34.87±0.45 (1798)
Female	15.46±0.05 (1903)	14.80±0.05 (1903)	13.94±0.05 (1903)	13.23±0.05 (1903)	69.54±0.78 (1903)	31.94±0.46 (1903)
Age**	15.49±0.05 (3701)	14.91±0.04 (3701)	13.91±0.05 (3701)	13.30±0.05 (3701)	72.73±0.68 (3701)	33.41±0.40 (3701)
<1 Year	10.88±0.20 (58)	10.22±0.20 (58)	9.55±0.20 (58)	8.76±0.20 (58)	37.64±3.00 (58)	17.76±1.75 (58)
1 Year	12.90±0.11 (181)	12.55±0.11 (181)	11.41±0.12 (181)	11.04±0.11 (181)	61.88±1.70 (181)	28.11±0.99 (181)
2 Years	15.51±0.09 (276)	14.80±0.09 (276)	13.88±0.09 (276)	13.15±0.09 (276)	73.88±1.38 (276)	32.97±0.80 (276)
3 Years	16.66±0.08 (373)	16.10±0.08 (373)	15.12±0.08 (373)	14.48±0.08 (373)	78.46±1.18 (373)	36.69±0.69 (373)
4 Years	17.75±0.08 (384)	17.19±0.08 (384)	16.06±0.08 (384)	15.46±0.07 (384)	86.43±1.17 (384)	39.21±0.68 (384)
≥5 Years	19.22±0.03 (2429)	18.71±0.03 (2429)	17.46±0.03 (2429)	16.92±0.03 (2429)	98.10±0.46 (2429)	45.72±0.27 (2429)

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

Table : 4.6.2.3. (c) Least squares mean of body measurements of Jaisalmeri camel (cm)

Traits/ Effects	Face length	Distance between eyes	Distance between ears	Ear length	Tail length
Sex	44.70±0.15 (3701)	18.66±0.07 (3701)	15.07±0.06 (3701)	10.70±0.04 (3701)	47.82±0.13 (3701)
Male	44.81±0.17 (1798)	18.81±0.08 (1798)	15.35±0.07 (1798)	10.70±0.04 (1798)	47.90±0.14 (1798)
Female	44.58±0.17 (1903)	18.52±0.08 (1903)	14.78±0.07 (1903)	10.70±0.04 (1903)	47.75±0.14 (1903)
Age**	44.70±0.15 (3701)	18.66±0.07 (3701)	15.07±0.06 (3701)	10.70±0.04 (3701)	47.82±0.13 (3701)
<1 Year	34.45±0.65 (58)	13.73±0.32 (58)	10.58±0.27 (58)	8.22±0.16 (58)	37.14±0.55 (58)
1 Year	39.51±0.37 (181)	16.18±0.18 (181)	13.02±0.15 (181)	9.61±0.09 (181)	43.02±0.31 (181)
2 Years	44.70±0.30 (276)	18.61±0.15 (276)	15.15±0.12 (276)	10.77±0.08 (276)	47.59±0.25 (276)
3 Years	47.68±0.26 (373)	19.99±0.13 (373)	16.11±0.11 (373)	11.24±0.06 (373)	51.52±0.22 (373)
4 Years	49.02±0.25 (384)	21.26±0.12 (384)	16.96±0.11 (384)	11.99±0.06 (384)	52.91±0.21 (384)
≥5 Years	52.82±0.10 (2429)	22.21±0.05 (2429)	18.58±0.04 (2429)	12.38±0.03 (2429)	54.77±0.09 (2429)

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

4.6.3 Improving reproductive efficiency of sheep, camel, goat, cattle and buffalo

CCPI : Aminu Deen
Co- PI : Sumant Vyas
S.R.F. : Mamta Jain

Photoperiodic manipulation to improve reproductive efficiency in camel,

The study was conducted on 14 sexually mature female camels of Kachchhi and Jaisalmeri breed, which were randomly divided into 2 groups of 7 each. A facemask (Fig. 4.6.3.1) covering the eyes was applied to 7 camels, of group A daily at 2.30 P.M. till the commencement of dark hours to mimic reduced photoperiod. Another 7 females of group B were kept as control in the same enclosure.

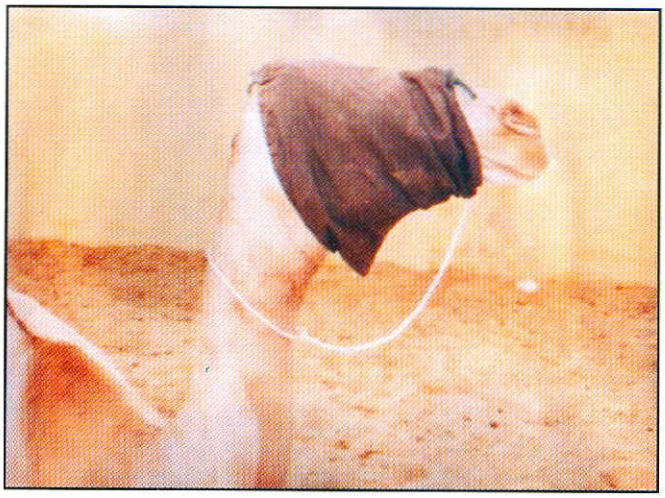


Fig. 4.6.3.1 : Eyes of she camels covered with mask

The experiment was initiated in the month of September (3 months before commencement of breeding season). The animals were routinely examined for ovarian follicles at weekly interval through Pie Scanner-200 using 5MHz transvaginal transducer. Table – 4.6.3.1 shows weekly status of ovarian follicles in the 2 groups of animals. Growing and mature follicles were observed in 3-5/7 animals of group A as compared to 0/7 of group B by the end of 3-5 weeks. Similarly it was assessed that ovulating follicles were present in 4/7 animals of group A as against 0/7of group B by the end of 7th week.

Table – 4.6.3.1: Ovarian follicle status

Weeks	Per centage of follicles	Per centage of follicles
1	-	-
2	-	-
3	42.8	-
4	57.1	-
5	71.4	-
6	85.7	14.3
7	85.7	14.2
Ovulating follicles by end of 7th week	50	0

Natural matings were attempted in animals of either group that showed a mature follicle. Ovulation and conception were monitored using peripheral plasma progesterone profiles. Table 4.6.2 presents month wise mating, ovulation and conception in 2 groups.

Table 4.6.3.2: Month wise mating, ovulation and conception in 2 groups of camel under photoperiodic control experiment

Month	Number of services		Number of ovulation		Number of conception		Remarks
	A	B	A	B	A	B	
November	6	0	3	0	0	0	No difference
December	7	2	4	1	3	0	Performance of Group A was superior
January	5	7	1	5	1	4	Performance of Group B was superior
February	3	3	1	1	1	1	No difference
March	1	0	0	0	0	0	No difference

A total of six services were given to 4/7 animals of group A during month of November as against none to group B. Out of 6 attempts successful ovulation could be induced three times only in 2/4 animals but none of these animals conceived. As such overall performance of the 2 groups did not differ.

A total of seven services were given to 4/7 animals of group A during month of December as against 2 services to 1/7 animals of group B. Number of successful ovulation in group A were 4/7 as against 1/2 in group B. Numbers of successful conception measured have been 3/4 of group A as against 0/1 in group B. The performance of group A was adjudged to be superior over group B for this month.

In the month of January, a total of 5 services to 4 animals of group A were recorded as compared to 7 to 7 animals of group B. The number of ovulations were 1/5 and 5/7 respectively, and number of successful conceptions were 1/1 and 4/5 respectively. These results indicated that despite presence of follicles, successful pregnancy could not be established during off-season. Only advantage of photoperiodic manipulation in terms of improving reproductive efficiency in camel was that successful pregnancy could be established early in the breeding season in 3/7 animals of Group A as against 0/7 in group B. However, overall pregnancy rate did not differ between the 2 group as indicated in Table-4.6.3.3.

Table 4.6.3.3 Month of impregnation in 2 groups of camel under photoperiodic control experiment

Groups	No. of animals	No. of conceived	No. failed to settle	Oct.	Nov.	Dec.	Jan.	Feb.	March
A	7	5	2	-	-	3	1	1	-
B	7	5	2	-	-	-	4	-	1

Endocrine profiles of testosterone monitored during pre-rut, rut and post-rut stages of male camels

Study was also undertaken on 5 adult male camels, which were monitored for their sexual behaviour and testosterone profiles from September to the end of April. The weekly profiles of testosterone of 5 male camels have been depicted in Fig. 4.6.3.2. The profiles indicated that 4 of the 5 camels exhibited rise in testosterone concentration while one did not exhibit a rise. This rise corresponds to onset of rutting activity. Initiation of rise in testosterone profiles varied between the camels but it is maintained for 100-115 days irrespective of onset period of rise. After a period of 100-115 days the levels decline to basal concentration.

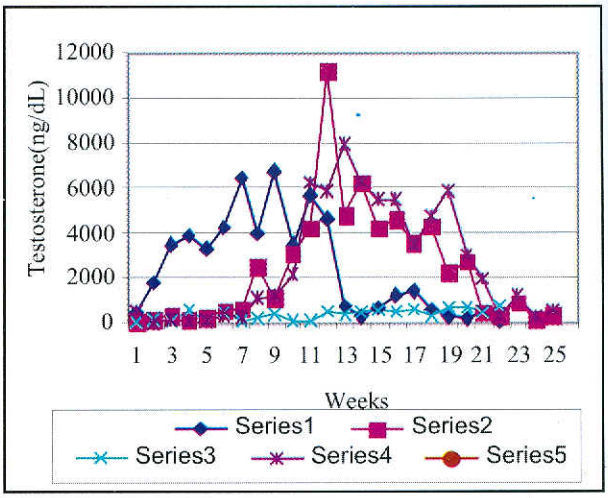


Fig:4.6.3.2 : Plasma testosterone concentration (ng/dl) during pre-rut, rut and post rut stages in dromedarius camel

As presented in previous year report and observed this year also, libido and ability to copulate and ejaculate semen in AV in camels is at peak during mid January and February months. By the end of May, majority of the camels lose libido and do not take interest in courtship.

These hormonal profiles and observations on sexual behaviour are also indicative of little possibility, if any, for successful non-seasonal breeding in this species.

Major problems in AI

Female camels proposed for experimental artificial insemination were subjected to routine screening for ovarian follicles using pie scanner-200 ultrasound machine and transvaginal transducer of 5 MHZ capacity (Pie Medical equipment B.V. Philipsweg, The Netherlands) The camels were sedated with 4-6 ml of xylazine (Izine, Intaas Pharmaceuticals, India) administered intravenously and restrained in sitting posture. Those female which exhibited mature ovarian follicle (1.5-2.0 cm or greater in diameter) were injected intramuscularly with 5000 IU of hCG (Profassi, Serono, Italy or Hucog,). The animals were inseminated 24-48 hrs after injection either with cooled semen, frozen thawed semen or whole semen. Blood samples were harvested by jugular venepuncture in heparinized vials and plasma was separated in a refrigerated centrifuge (C- 24, Remi, India) at 2500 rpm on appropriate days to monitor peripherals plasma progesterone profiles. Plasma samples were preserved at – 20^0C till used for analysis. Progesterone analysis of plasma samples was conducted by Coat- A- Count RIA kits (PITK PG-1,2002-12-11) of Diagnostic Products Corporation, Los Angeles, CA 90045-5597. Counting dpm were recorded by I^{125} Gamma counter IC- 4072 serial 315 of Electronics corporation of India Limited, Hyderabad.

Plasma progesterone levels above 1ng/ml after 5-7 days of hCG injection was considered indicative of luteal phase and ovulation. Levels below this were considered as failure of ovulation. A total of 33 cases were monitored and divided into following 4 groups

Those showing progesterone profiles consistently above 1ng/ml were categorized as pregnant. Those showing only one point above 1ng/ml followed by decline were categorized ovulated but failed to conceive due to failure of fertilization. Those showing more than 2 points above 1ng/ml followed by decline categorized as ovulated, fertilized but failed to conceive due to early embryonic demise. Those showing levels below 1ng/ml were categorized as failure or ovulation.

Results are presented in Fig. 4.6.3.3 in form of line diagram. It contains 4 series, series 1 depicts progesterone profiles of 5 female camels, the progesterone levels were indicative of luteal phase. All these animals were confirmed clinically pregnant and completed their gestation and delivered healthy calves. Series 2 contains progesterone profiles of 17 female camels, which exhibited levels below 1ng/ml indicating failure of ovulation. Series 3 contains progesterone profiles of 8 female camels, which showed only one point above levels of demarcation. These levels indicated ovulation but failure of fertilization. Series 4 contains progesterone profiles of 3 female camels, which showed higher profiles at more than 2 points followed by decline. These levels indicated successful ovulation and fertilization but failure of embryo survival. Based on these results, the low conception rate with AI in camel can be categorized and rated as failure of ovulation 17/33 (51.51%), failure of fertilization 8/33 (24.24%) and early embryonic death 3/33 (9.09%).

In the present study, pregnancy rate with frozen thawed or refrigerated diluted semen was nil. Successful impregnation of female camels could be possible with deposition of whole semen only.

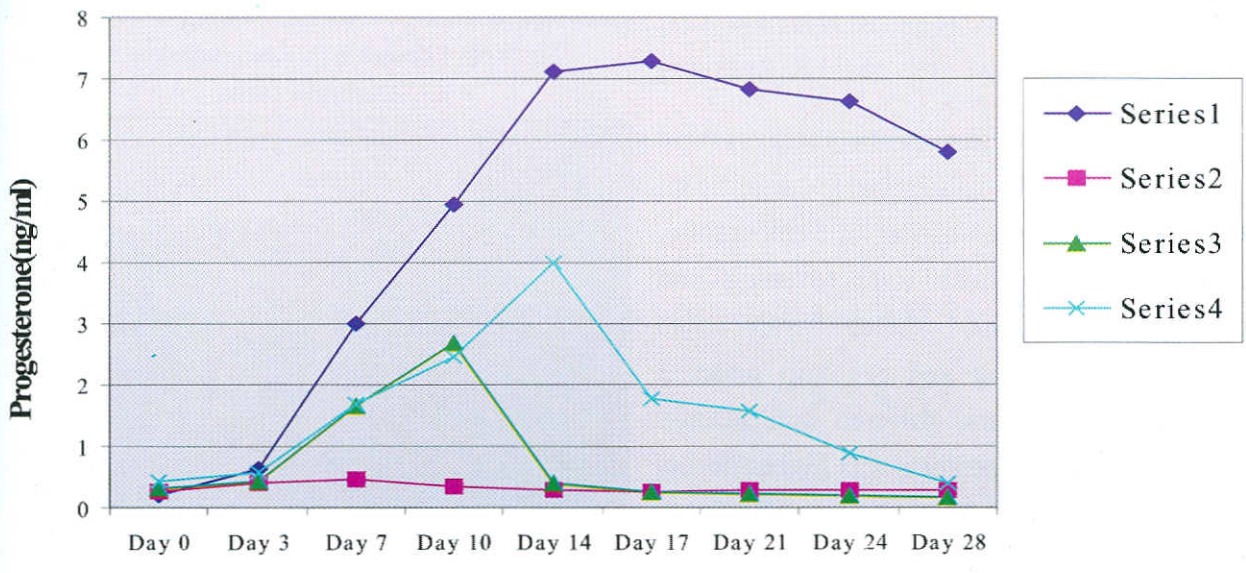


Fig.4.6.3.3 : Progesterone profiles of artificially inseminated female camels

4.6.4 Environmental stress and its amelioration through shelter management

CCPI : Champak Bhakat

Associates : N.Sharma, R. Singh

SRF : D. Chaturvedi

Study was carried out on three male camel (around 8 to 10 years age) which were allotted randomly into three comparable shelters in switch over design for 21 final trial days during hot-humid season. Three types of shelters are developed by using locally available eco-friendly agricultural materials, viz : 1. Thatch Roofed Open Type Kuchchha shelter (TROTK), 2. Asbestos Roofed Close Type Concrete Shelter (ARCTC), 3. Loose Housing (LH) systems.

Cardinal Physiological Responses

The mean ± SE of Rectal Temperature (RT), Respiration Rate (RR), Pulse Rate (PR) under three shelter groups are presented in Table 4.6.4.1.The close scrutiny of the table reveals that RT, RR, PR varied just after work and values were found to be higher during evening time in three treatment groups. The paired sample correlation's between cardinal physiological responses (evening and morning) in different shelters were calculated (Fig. 4.6.4.1). The RT (morning and evening) under three shelters (ARCTC, TROTK and LH) was correlated. Similarly, RR and PR (morning and evening) under three treatments (shelters) were highly correlated. All values were significant ($P<0.01$). The t test values of Rectal Temperature, Respiration Rate and Pulse Rate (evening and morning) under various shelter were also calculated. RT (morning and evening) under 3 treatment groups (shelters) differed significantly ($P<0.01$). The body temperature was higher during evening as compared to morning. The significant ($P<0,01$) differences were observed in RR (morning and evening) in 3 shelter treatments. The respiration rate was higher in evening than morning.

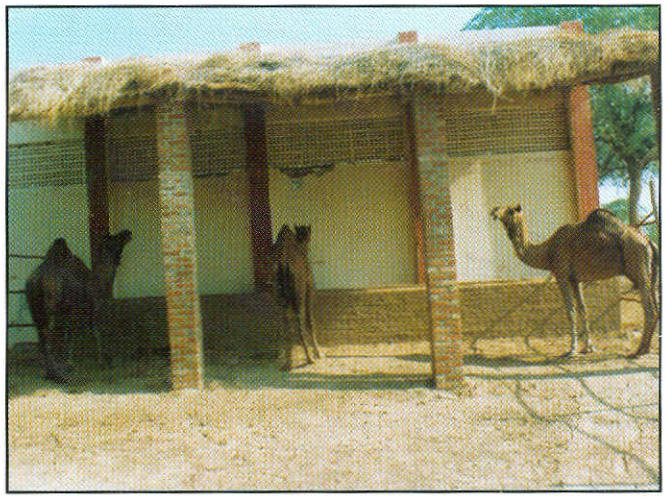


Fig. 4.6.4.1 Camel in thatched roofed open type Kuchchha shelter

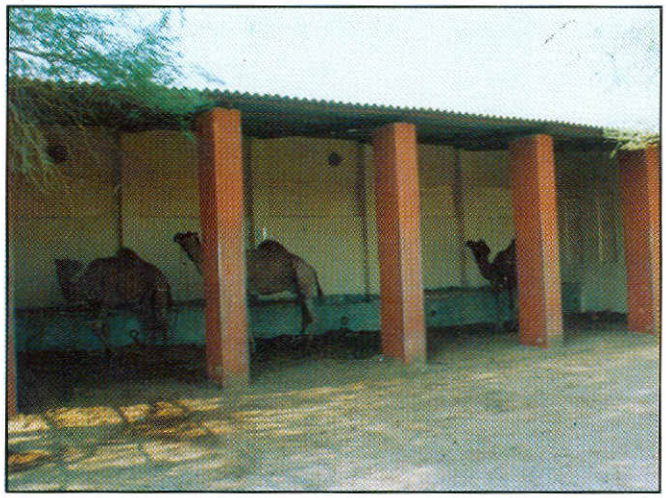


Fig. 4.6.4.2 Camel in Asbestos Roofed Close type Concrete shelter

Similar trend is found in case of PR (evening and morning). All the values (higher and lower) obtained in the experiment were in normal range (Fig. 4.6.4.2). Paired sample correlation between Rectal Temperature, Respiration Rate and Pulse Rate before and after work under various shelters indicated that the cardinal physiological signs after work (AW) and before work (BW) were not so correlated but high correlation between PR (AW) & PR (BW) under Asbestos Roofed close type concrete shelter was significant at 1 % level where as under Thatched Roofed open type kuchchha shelter it was significant at 5 % level. RT, RR, PR before and after work under three shelter groups ARCTC , TROTK and LH varied significantly.

Table 4.6.4.1. Mean ± SE of Rectal Temperature (RT), Respiration Rate (RR), Pulse Rate (PR) under three shelter groups

Shelter	Time of Observation	RT (°C)	R.R (Beats / min)	PR (Beats /min)
Thatched roofed	Morning	36.59 ± 0.12	10.24 ± 0.37	45.00 ± 1.08
	After Work/fatigue	39.62 ± 0.12	27.47 ± 0.91	68.14 ± 1.44
	Evening	38.39 ± 0.13	12.29 ± 0.40	50.23 ± 1.27
	After 20h Rest	36.60 ± 0.11	10.28 ± 0.36	45.28 ± 1.01
Asbestos roofed close type	Morning	36.60 ± 0.11	10.52 ± 0.40	45.67 ± 1.14
	After Work/ fatigue	39.60 ± 0.14	27.86 ± 0.86	68.62 ± 1.62
	Evening	38.40 ± 0.13	12.85 ± 0.49	50.76 ± 1.21
	After 20h Rest	36.61 ± 0.10	10.57 ± 0.39	45.71 ± 1.11
Loose housing	Morning	36.62 ± 0.16	10.42 ± 0.35	45.33 ± 1.02
	After Work/ fatigue	39.61 ± 0.12	27.66 ± 0.74	67.90 ± 1.48
	Evening	38.39 ± 0.14	12.76 ± 0.41	50.42 ± 1.05
	After 20h Rest	36.61 ± 0.16	10.47 ± 0.36	45.42 ± 1.03

Micro and Macro environment :

The Mean ± SE of climatic components in different micro and macro environment were presented in Table 4.6.4.2. The paired sample correlation between (Fig. 4.6.4.1) the RH (M) and RH (E) were highly correlated under all micro environments and macro environment. All values were significant (P<0.01). The t-values of RH (morning, evening) and THI (morning, evening) in different shelter and macro environment were differ significantly (P<0.01). In any particular period RH (morning) was higher than RH (evening) in all micro and macro environments. THI (morning) and THI (evening) in all three shelter groups and Macro Environment differ significantly (P<0.01). All over the THI (evening) was higher than THI (morning) in all shelters and macro environment.

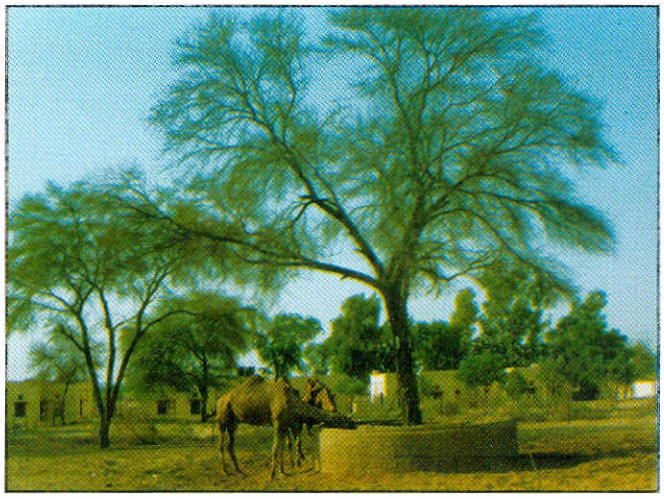


Fig. 4.6.4.3 : Camels under loose housing system

Behavioural aspect of camel in different shelter

The feed and water intake schedule and posture of camels in different shelter were recorded. It was revealed that maximum consumption of concentrate was found within 2 h of supply & it ranged from 80.0 % to 80.6 %. Remaining amount of concentrate was also consumed in next 2-4 h. and it ranged from 19.35 % to 20.00%. No residual amount of concentrate was found after 4 hr of supply in 3 treatment groups. Within 0-2 hr of fodder supply maximum amount of fodder were consumed in 3 treatment groups. It ranged from 20.00 % to 20.86 %. This time period was followed by 2 – 4 h, 4 – 6 h, 6 – 8 h, 8 – 10 h and 10 - 12h. The lesser and lesser amount of fodder consumption was found as the day progressed and it become least at night. Immediately after offering, the fodder and concentrate intake was vigorous and later on the intake was gradually reduced with lapse of time. The measured quantity of ad-libitum water was provided to all camels under various shelter treatments. Time (minute) for consumption of particular amount of water varied from 8.43 ± 0.55 to 8.79 ± 0.51.

Maximum time involved in standing posture was during 0–2 h, 2–4 h of feed supply. Then it was gradually reduced as time lapsed in all shelter cases. As the day light disappear all camels were having a tendency to go on lying posture in their respective shelter. Maximum time involved in lying posture were during 10 – 12 hr at night time in all shelter cases.

Table 4.6.4.2. Mean ± SE of climatic components in different micro and macro environment

			Days Of Final Trial			Overall
			1-7	8-14	15-21	
Micro	TROTK	Ambient Temp. MAX (°C)	33.36 ± 0.53	34.86 ± 0.26	33.21 ± 0.75	33.81 ± 0.34
		Ambient Temp. MIN (°C)	25.28 ± 0.52	23.93 ± 0.51	24.93 ± 0. 53	24.71 ± 0.31
		RH_1(%)	46.29 ± 3.38	33.86 ± 3.16	44.00 ± 2.62	41.38 ± 2.07
		RH_2(%)	16.14 ± 1.34	11.14 ± 0.55	17.57 ± 0.81	14.95 ± 0.81
		THI_1	62.46 ± 0.24	63.64 ± 0.39	62.67 ± 0.37	62.93 ± 0.22
		THI_2	66.27 ± 0.25	67.41 ± 0.18	66.26 ± 0.20	66.64 ± 0.17
	ARCTC	Ambient Temp. MAX(°C)	37.43 ± 0.46	38.78 ± 0.29	37.29 ± 0.71	37.83 ± 0.33
		MIN (°C)	27.29 ± 0.52	26.07 ± 0.50	26.93 ± 0.53	26.76 ± 0.31
		RH_1 (%)	49.43 ± 3.47	36.85 ± 3.18	47.29 ± 2.67	44.52 ± 2.11
		RH_2 (%)	19.43 ± 1.36	14.00 ± 0.72	21.14 ± 1.06	18.19 ± 0.90
		THI_1	71.74 ± 0.46	73.39 ± 0.44	71.91 ± 0.43	72.38 ± 0.29
		THI_2	78.25 ± 0.26	78.68 ± 0.30	79.15 ± 0.26	78.69 ± 0.17
	UT/ LH	Ambient Temp. MAX (°C)	35.43 ± 0.52	36.79 ± 0.21	35.28 ± 0.70	35.83 ± 0.32
		MIN (°C)	26.29 ± 0.53	25.00 ± 0.56	25.92 ± 0.52	25.74 ± 0.31
		RH_1(%)	47.29 ± 3.35	34.85 ± 3.17	45.29 ± 2.67	42.48 ± 2.08
		RH_2(%)	17.14 ± 1.33	11.71 ± 0.57	19.14 ± 0.97	16.00 ± 0.89
		THI_1	65.65 ± 0.22	66.93 ± 0.45	66.66 ± 1.05	66.42 ± 0.39
		THI_2	70.22 ± 0.29	71.21 ± 0.12	69.42 ± 0.17	70.28± 0.19
Macro	ME	Ambient Temp. MAX(°C)	39.47 ± 0.41	40.83 ± 0.23	39.30 ± 0.67	39.86 ± 0.29
		MIN (°C)	23.26 ± 0.44	21.94 ± 0.53	22.83 ± 0.63	22.67 ± 0.32
		RH_1 (%)	44.29 ± 3.24	31.86 ± 3.29	42.29 ± 2.59	39.47 ± 2.07
		RH_2 (%)	14.43 ± 1.38	8.86 ± 0.46	16.14 ± 0.96	13.14 ± 0.89
		THI_1	77.88 ± 0.44	79.27 ± 0.63	78.12 ± 0.26	78.42 ± 0.29
		THI_2	84.06 ± 0.43	87.42 ± 0.72	84.36 ± 0.25	85.19 ± 0.46

Economic Analysis

The daily average fodder consumption (kg) under thatched roofed open type kuchchha shelter, asbestos roofed close type concrete shelter and under tree shed were 12.50 ± 0.30, 11.50 ± 0.29 and 12.00 ± 0.35, respectively. Concentrate 1kg Saras animal feed and 1kg cotton seed cake were consumed by all camels under 3 shelter groups. The market rate of each feed stuffs during experimental period were taken and based on it expenditure per camel were worked out. Total expenditure per camel per day under Thatched Roofed open type kuchchha shelter, Asbestos Roofed close type concrete shelter and Under Tree / loose housing were Rs. 56.25, Rs.52.65 and Rs.54.45, respectively which include cost of concentrate (Rs. 15/-)

The total cost (materials, fittings, labour cost) involved for preparation of thatched roofed shelter was Rs. 19,369. The present of value of Plinth Area Rate (taken from CPWD) of asbestos roofed concrete type close shelter was Rs. 15,7200, where as renovation and repairing cost was Rs.7790/-. The total cost involved for renovation/repairing of loose housing /under tree shed was Rs. 2955/-.

Biochemical analysis

The mean ± SE of camel blood biochemical attributes under different shelter management are presented in Table-4.6.4.3. The morning blood creatinine, and urea levels were recorded comparatively lower than evening while glucose and triglycerides were observed higher in all the three shelter groups. The higher level of blood glucose and triglyceride in the morning as compared to evening in all the three groups may be due to high metabolic rate to meet out heat stress during day time. Further the values for blood creatinine and urea were recorded comparatively higher in evening than morning which lead to higher rate of urea cycle and dephosphorylation of ATP to supplement more energy during day time. The least change in diurenal variation in blood glucose, triglyceride, urea and creatinine in TROTK shelter management resulted superiority over L.H. and ARCTC shelter management.

The results indicate that for camel, thatched roofed open type kuchchha shelter and loose housing are better than asbestos roofed close type concrete shelter.

Table 4.6.4.3 The mean ± SE of camel blood biochemical attributes under different shelter management

Parameters	Asbestos roofed close type concrete shelter		Thatched roofed open type kuchchha shelter		Loose housing	
	M	E	M	E	M	E
Glucose (mg/dl)	105 ± 2.33	91 ± 2.33	97 ± 2.96	91 ± 3.23	108 ± 3.46	90 ± 4.06
Creatinine mg/dl)	1.91 ± 0.09	2.20 ± 0.10	2.01 ± 0.15	2.15 ± 0.13	1.70 ± 0.06	1.92 ± 0.01
Triglyceride (mg/dl)	36 ± 1.53	27 ± 0.67	40 ± 1.20	31 ± 0.88	35 ± 5.85	22 ± 5.20
Urea (mg/dl)	65.48 ± 6.47	71.06 ± 3.98	70.23 ± 2.20	74.68 ± 1.74	63.09 ± 3.89	72.18 ± 5.21

Service project on extension, communication and human resource development

Project Leader : Champak Bhakat

Associates : N. Sharma, B.L. Chirania, M.S. Sahani

Kissan Diwas

Kissan Diwas was organized on December 23, 2002 with major objective to educate farmers about improved technology of camel rearing and the techno-economic importance of camel and it's influence on socio- economic status of dry land farming in hot arid region. Farmers and livestock owners from different age groups and women of near by villages have participated in this programme. All participants visited camel museum, lab, camel farm etc. A film show on camel management and disease aspects were shown. Farmers were motivated to follow improved scientific camel rearing at their household level. At this occasion recent handouts on various aspect published by the centre were distributed. The NRCC honored 10 progressive farmers and farm women who had participated in Kissan Diwas.

A view of Kissan Gosthi

Scientific Exhibitions

Three scientific exhibitions were organized at the center and outside, highlighting camel husbandry practices and latest technology developed.

- All India kala khumbh at Junagarh- Fort, Bikaner (10.01.03 to 15.01.03),
  Theme – "Potentiality of utilisation of Camel and its milk and hair products."
- At the occasion of Kissan Diwas at NRCC from 22 to 23 December 2002,
  Theme- "Camel for mankind".
- At the occasion of Bikaner Camel festival (15.01.02 to 25.01.02), at the centre,
  Theme- "Research achievement on camel".

About 65 posters/display charts were prepared, handouts and brochures on different aspects of camel management practices and camel research achievements were distributed among the farmers, their family members and to the National and International tourists.

Kissan Gosthis

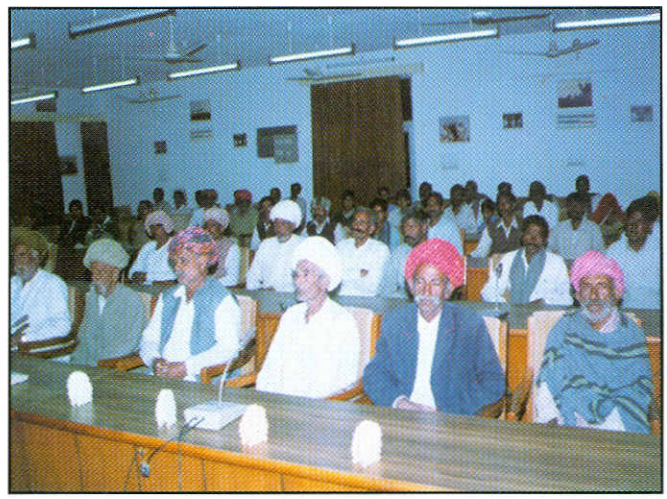
Five Kishan Gosthies were organized during the year.

- One during Mallinath camel fair, Tilwara, Barmer, Rajasthan, on 10.04.02.
- Three at adapted village, Gadwala, on 24.11.02, 03.12.02, 14.03.03.
- One at NRCC, Bikaner on 23.12.02.

The problems related to camel management practices and diseases were the major issues of discussion during the various question and answer session. The scientists provided the solution and got feedback from farmers about the traditional camel husbandry practices. The farmers were apprised about advanced breeding practices, disease prevention, drought use and other management practices of camel rearing.

Prize Distribution to the Farm Women by Dr.M.S. Sahani (Director) on Kissan Diwas

Prize Distribution to the Camel keepers by Dr.M.S. Sahani (Director) on Kissan Diwas



Farmers at Kissan Gosthi

Visits

National/International level scientists, students, (from veterinary colleges, Medical Colleges, SAUs, schools, Universities), livestock owners, administrators, Defense Officers, N.G.Os, Indian and foreign educationists, Journalists, Youth, farmers and farm women etc were demonstrated about on

going research programme, camel husbandry practices, and latest technology know-how of the centre during the reporting period.

Camel festival

The centre participated in various competitions/ events viz : Camel race, new born camel calf, camel hair cutting, decoration and camel milking which were organized at the time of Camel Festival – 2003 and won prizes in different events.

Camel exhibition on the occasion of the Camel Festival

Collaboration with NGO

Collaboration has been continued with various NGOs viz, Social Upliftment of Rural Economy, Barmer, Lokhit Pasu Palak Sansthan (A society for indigenous livestock Research and development), Sadri, Pali and Urmul Trust (Bikaner). Centre participated and provided information about utility of milk and milk products, hair and bone items for higher economic gains and sustenance of camel.

Revenue Generation Programme

The centre has activated the revenue generation targets fixed by the council and is making continuous efforts to increase and strengthening the revenue generation by still photography, camel riding and also through sale of camel hair, milk, NRCC brochure etc. The total revenue generated during the reporting year was Rs. 2,19,360/-.

4.6.5 Evaluation of locally available feed and fodder to improve and formulate economic rations with high roughage diets

CCPI :A. K. Nagpal
Associates : A. K. Roy
SRF : Manju Arora

Experiment 1. Utilization of groundnut haulms , khejri leaves based mixed and complete rations in camel calves

Eight camel calves of Bikaneri (4), Jaisalmeri (3) and Kachchhi breeds (1) of 3 years age and 340-390 kg body weight were divided randomly into two groups. The mixed ration group (MR) camel calves were fed MR consisting of dry groundnut haulms and dry khejri leaves (75:25) and group CR camel calves were given complete ration. The percent composition of complete ration was groundnut

haulms (32), wheat straw (30), dry khejri leaves (25) jaggery 4.0, wheat bran 3.0, guar churi 5.0, mineral mixture 0.2 and common salt 0.8 and was mixed manually. Animals were fed *ad. libitum* on mixed and complete rations for a period of 92 days and a digestibility trial of 6 days duration was conducted in the last week.

The chemical composition of feeds and drinking water is presented in Table 4.6.5.1. There was small variation in chemical composition of mixed and complete rations. The drinking water was observed to be poor source of potassium and phosphorus.

Intake, digestibility of nutrients, plane of nutrition and nutritive value of 2 rations are presented in Table 4.6.5.2. It was observed that feeding of complete feed resulted in significant ($P<0.01$) higher growth rate of 432 g/d in CR group as compared to 318 g/d in MR group which was also reflected from better ($P<0.01$) feed/gain ratio. Mean voluntary DMI was 7.13 and 7.37 kg/day in groups MR and CR respectively. This was 1.79 and 1.82 % of body weight or 79.97 and 81.56 g/kg $W^{0.75}$/d in respective groups. The growth rate as well as feed efficiency were affected by the quality of roughage included and roughage concentrate ratio of the complete ration. No statistical significance was observed for water intake l/kg DM intake both groups.

Table 4.6.5.1. Chemical composition of feed ingredients of complete feed (on % DMB)

Parameters	GN haulms	Wheat straw	Khejri leaves	Mixed ration	Complete ration	Water (mg/l)
CP	8.70	3.95	14.64	10.18	11.02	-
EE	2.28	1.47	4.93	3.19	2.52	-
CF	25.10	34.21	14.50	22.42	22.89	-
TA	13.01	12.36	11.12	11.21	12.61	-
NFE	50.91	48.01	54.81	53.00	50.96	-
NDF	40.19	77.79	42.42	48.43	54.08	-
ADF	29.72	53.69	23.37	31.57	32.25	
Macrominerals (g/kg)						
Na	4.887	1.091	0.786	2.619	3.691	334.0
K	7.980	6.177	8.138	9.665	9.939	4.0
Ca	12.15	4.33	22.90	17.98	14.02	66.13
P	1.610	0.471	1.731	1.654	2.17	4.159
Mg	7.06	4.08	5.43	5.71	4.86	35.24

Table 4.6.5.2. Nutrient digestibility and intakes in camel calves given mixed and complete rations

Parameter	MR	CR	t-value
No. of animals	4	4	
Performance			
Initial B.Wt. (kg)	369.50±6.34	362.50±10.51	
Final B.Wt. (kg)	398.75±7.05	402.25±10.59	
Gain (kg)	29.25±1.11	39.75±1.70	
Growth rate (g/d)**	317.93±12.05	432.07±18.50	5.17
DMI (kg/d)	7.13±0.46	7.37±0.28	
DMI kg/100 kg B.Wt.	1.79±0.12	1.82±0.06	
Water intake (l/d)	20.09±2.49	17.38±1.22	
Water intake l/ kg DM intake	2.79±0.19	2.37±0.15	
Total feed intake kg over 92 days	654.15±18.11	663.23±17.66	
Feed /Gain **	22.41±0.57	16.76±0.66	6.48
Nutrient digestibility %			
DM	55.56±1.87	57.01±0.63	
OM*	59.96±1.87	66.53±1.06	3.06
CP**	42.09±1.84	59.73±0.82	8.76
EE*	38.79±1.14	47.40±2.97	2.70
CF	61.15±4.99	64.06±1.04	
NFE	69.61±2.90	70.05±1.32	
NDF	44.38±4.82	38.09±1.55	
ADF	27.32±3.07	22.34±3.01	
Nutrient intake			
DCP kg/d	0.307±0.03	0.482±0.02	
TDN kg/d	4.133±0.38	4.363±0.13	
ME MJ/d	62.259±5.67	65.712±1.98	
DM g/kg $W^{0.75}$	79.97±5.18	81.56±2.53	
DCP g/kg $W^{0.75}$ **	3.45±0.33	5.37±0.16	5.24
TDN g/kg $W^{0.75}$	46.33±4.19	48.59±1.28	
H_2O l / kg DM	2.79±0.19	2.37±0.15	
Feed cost Rs./q	131.25	225.00	

Feed cost Rs./q: Groundnut chara- 125 , Khejri leaves-150, Wheat straw-125, Jaggery- 860 , wheat bran- 560 , Guar churi- 500 , mineral mixture - 4000 and common salt- 100 , Guar gum -500 added @ 150 g/q complete feed.

* = $P < 0.05$, ** = $P < 0.01$

The feeding of complete diet also resulted in significant (P<0.05) changes in the digestibility of proximate principles as well as detergent fibre components. A significant (P<0.05) increase in digestibility of CP and EE but decrease in NDF and ADF digestibility was observed in group CR over group MR. Higher OM, CP and EE digestibility of complete feeds was due to the higher proportion of concentrates. The feeding of complete ration to camel calves also resulted in significant (P<0.05) higher intake of DCP on metabolic body weight basis. Higher intake of DCP , TDN and ME in group CR was also reflected in higher growth of camel calves. In the present experiment not only the nutrient intakes were lower but daily body weight gains were higher than the recommendations of 10 kg DM, 600 g DCP and 4700 g TDN for 400 kg camel calves growing @ 100g/d by ICAR (1985).

The intake of macrominerals was higher in CR group than in MR group which was attributed to higher DM intake as well as minerals addition in complete ration (Table 4.6.5.3). Apparent absorption refers to the difference between mineral intake and its faecal excretion. A significant (P<0.05) difference in apparent absorption (%) of Na, Ca, P and Mg was observed between 2 groups. The K absorption was very high in both the groups varying between 89-92 percent because of high K contents (9.7-9.9 g/kg) in the rations. The low Ca absorption of 3.54 % in MR group inspite of high Ca intake (129.50 g/d) might be due to presence of some antimetabolites. Low absorption coefficients of Ca and P could be attributed to wide Ca and P ratio. Again the low Mg absorption (6.57%) in MR inspite of higher Mg intake (41.20 g/d) might be attributed to antagonism from higher Ca intake as well as some antimetabolite in CR . The mineral absorption depends on several factors viz., binding capacity of transport proteins, solubility, composition of diet, mineral intake, mixture of minerals present in the intestine, antimetabolites and the physiological factors such as age, hormonal status.

Table 4.6.5.3. Intake (g/d) and apparent absorption (%) of macro minerals in camel calves given complete and mixed ration

Parameter	MR	CR	%
Na Intake	25.39±2.01	32.84±1.26	
Na absorption*	65.38±2.31	74.78±2.73	2.63
K intake	69.02±4.45	72.87±2.76	
K absorption	89.43±1.23	91.66±0.98	
Ca Intake	129.50±8.42	103.85±3.92	
Ca absorption**	3.54±2.63	31.23±6.31	4.05
P Intake	12.03±0.76	15.97±0.60	
P absorption**	30.03±0.96	49.74±2.54	7.26
Mg Intake	41.20±2.61	36.06±1.30	
Mg absorption*	6.57±11.86	44.30±4.50	2.97

MR – Mixed ration; CR – Complete ration

No significant difference was observed for serum biochemicals and electrolytes between CR and MR group (Table 4.6.5.4). All the parameters, however, varied within normal limits.

The results indicated that feeding of complete feed not only increased nutrient intake, digestibility, mineral absorption but it also improved the serum metabolic profile although at a higher cost.

Experiment 2. Utilization of mixed and complete rations by lactating camels and their calves in arid ecosystem

Seven lactating camels of Bikaneri (4) and Kachchhi breed (3) of 8-10 years age and average 516.00±20.92 kg body weight in their second/third lactation along with their calves were selected from the institute camel herd after 88 days of calving. The milch camels were randomly divided into two groups on the basis of body weights and lactation number. One group of 3 camels MR (milch) was fed on mixed ration comprising of dry moth chara (*Phaseolus aconitifolius*) 74.3%, dry khejri leaves (*Prosopis cineraria*) 25, mineral mixture 0.2% and common salt 0.5% while second group of 4 camels CR (milch) was given complete ration consisting of moth chara 35.7%, dry khejri leaves 25%, wheat straw 30%, molasses 4%, guar churi 5%, mineral mixture 0.2% and common salt 0.5%. All the 7 camel calves were fed on same complete ration as that given to CR(milch). The milch camels were housed in separate pens for individual feeding and camel calves in single pen for group feeding in a shed with asbestos roof, sandy floor. The fresh drinking water was offered and measured individually twice at 10.00 AM and 4.00 P.M. The animals were allowed one hour walking exercise daily in the farm rangeland area. Milk yield of lactating camels was recorded twice a week at 0800 and 1600 hrs. The calves were allowed to suckle two teats on one side, whereas the teats on other side were milked by strippng method. Animals were fed *ad libitum* on mixed and complete diets for a period of 92 days. Daily weighed quantity of feed was given during morning and feed residue was recorded next day. At the end, a digestion trial of 5 days duration was conducted on all the milch camels and camel calves to determine the nutrient utilization. The pooled samples of mixed & complete feed, feed ingredients and faeces were analysed for proximate principles, P, NDF, ADF. Milk fat, SNF, total solids, protein were tested according to ISI (1981). The calcium and magnesium in water, feed, faeces and milk were analysed by complexometric titration. Blood samples of lactating camels and their calves were collected to compare their biochemical profile. Sodium (Na) and potassium (K) in water, milk, feed, faeces and serum were estimated on Systronic mediflame photometer.

The chemical composition of moth chara, khejri and wheat straw more or less similar to that of mixed & complete ration The milk components such as fat and protein were on the lower side due to adverse hot conditions.

A significant ($P<0.05$) difference was observed among camels and their calves in respect of body weight changes, voluntary DMI kg/100kg body weight and digestibility coefficients (Table 4.6.5.6). The

mixed ration given to MR(milch) could not maintain their body weight, hence camels lost body weights of 332.5 g/d. The CR(milch) camels fed on complete ration could maintain their body weights. The camel calves maintained on complete ration achieved growth rate of 587g/d. The DMI kg/100kg body weight was 3.06 in CR(milch) and significantly ($P<0.01$) higher than 2.35 in MR (milch) and 2.40 in CR(calves). Water intake (l/kg DMI) was 3.92 & maximum in MR (milch) as compared to 2.75 in CR(milch) and 2.79 in CR(calves). Camel calf growth was higher in the present study (586 g/d) as compared to 500 g/d observed in camel calves kept on only moth chara plus milk suckling. The digestibility coefficients showed significant ($P<0.05$) difference for DM, OM, CP, EE and NFE among 3 groups. Higher DM, CP and NFE digestibility in CR (milch) and CR(calves) given complete ration was attributed to inclusion of concentrates in the ration plus milk suckling by younger animals.

Table 4.6.5.4. Body weight changes, nutrient digestibility and intakes in lactating camels and their calves given mixed and complete ration

Parameter	MR(Milch)	CR(Milch)	CR (Calves)
No. of calves	3	4	7
Initial B.Wt. (kg)	508.00±20.88	522.00±34.86	96.17±9.63
Final B. Wt. (kg)	478.33±25.26	524.50±38.64	150.17±13.52
B. Wt. changes (kg)	-29.67±6.43	2.50±5.24	54.00±4.02
ADG ** (g)	-332.46^{a} ±69.88	27.17^{b} ±56.91	586.96^{c} ±43.73
DMI (kg/d)	10.98±1.55	15.97±0.77	3.57±0.19
DMI* (kg/100 kg b.wt.)	2.35±0.41	3.06±0.10	2.40±0.08
Water intake (l/d)	41.57±3.38	43.80±2.26	9.86±1.13
Water intake (l/ kg DMI)	3.92±0.53	2.75±0.11	2.79±0.34
Nutrient digestibility %			
DM**	62.85^{ab}±3.36	58.64^{a}±1.18	70.86^{b}±2.04
OM*	69.65^{ab} ±2.35	68.67^{a} ±1.31	76.04^{b} ±1.62
CP**	41.79^{ab} ±3.59	61.92^{a} ±1.86	71.53^{b} ±1.94
EE**	32.85±4.96	49.23^{b} ±0.9	82.97^{c}±1.78
CF	62.08±4.29	65.15±0.85	64.29±2.72
NFE*	80.21^{ab} ±1.66	72.74^{a} ±1.85	83.96^{b} ±1.05
NDF	43.59±7.00	44.06±2.09	48.82±3.9
ADF	29.26±6.83	22.98±2.69	37.93±3.80

Values with different superscripts in a row differ significantly * = $P < 0.05$, ** = $P< 0.01$

The intake of mixed ration by MR (milch) group was not enough to satisfy the DM, DCP and energy requirement of camels (Table 4.6.5.5). However, the feeding of complete rations to CR(milch) camels resulted in significant ($P<0.05$) higher intake of DM, DCP and TDN on metabolic body weight basis than the MR (milch) group (Table 4.6.5.3). Milk yield was similar between MR and CR with overall average of 5.87 l/d and varied between 3.80 and 7.90 l/d. Feed cost was similar for mixed and complete ration. The feed cost was higher in CR (milch) due to higher feed intake but had no proportionate effect on milk yield.

Table 4.6.5.5. Effect of experimental rations on nutrient intake and economics

Parameters	MR(milch)	CR(milch)	CR(calves)
Plane of nutrition			
DCP (kg/d)	0.499±0.02	1.144±0.06	0.332±0.02
TDN (kg/d)	6.559±0.64	9.739±0.39	2.574±0.11
ME (MJ/d)	98.80±9.66	146.70±5.84	38.773±1.68
DM ** (g/kg W $^{0.75}$)	109.24 ^{ab} ±17.63	146.17 ^{a} ±3.14	83.60 ^{b} ±2.61
DCP** (g/kg W $^{0.75}$)	4.88 ^{a} ±0.14	10.51 ^{b} ±0.53	7.79^{c} ±0.27
TDN** (g/kg W $^{0.75}$)	63.83 ^{a} ±3.85	89.32 ^{b} ±2.87	60.49 ^{a} ±1.92
ME** (MJ/kg W $^{0.75}$)	0.961 ^{a} ±0.06	1.345 ^{b} ±0.04	0.911 ^{a} ±0.03
Nutritive value			
% DCP	4.54	7.16	9.30
% TDN	59.74	60.98	72.10
Economics			
Feed cost (Rs./q)	268.50	265.25	265.25
Feed intake (kg/d)	11.67	17.17	3.201
Feed cost (Rs./d)	31.33	45.54	8.49
Milk yield (kg/d)	5.67±0.94	6.03±0.85	-
Feed cost (Rs./ kg milk)	5.53	7.55	-

Feed cost Rs./q: Moth chara-250 , khejri-300, wheat straw-150, molasses- 500 , Guar churi- 585 , mineral mixture - 4000 and common salt- 60

Values with different superscripts in a row differ significantly * = $P < 0.05$, ** = $P< 0.01$

The intake of all the 5 major minerals viz., Na, K, Ca, P and Mg was higher in CR (milch) than that in other 2 groups (Table 4.6.5.6). Apparent absorption refers to the difference between mineral intake and its faecal excretion. The apparent absorption of all the 5 major minerals differed significantly ($P<0.01$) among 3 groups and was higher in CR (calves) than MR (milch) and CR (milch) except for Mg.

Table 4.6.5.6. Intake (g/d) and apparent absorption (%) of macro minerals in lactating camels and their calves given complete and mixed ration

Parameter	MR(milch)	CR(milch)	CR (Calves)
Na Intake	78.66±9.33	106.25±4.95	25.19±1.28
Na absorption **	77.58^{a}±3.27	68.94^{a} ±3.38	87.77^{b}±0.89
K intake	105.65 ±14.86	189.75 ±9.12	47.73±2.55
K absorption**	86.81^{a} ±0.43	83.63^{a} ±2.36	93.51^{b} ±0.53
Ca Intake	323.80±45.60	394.00±18.90	80.17±4.67
Ca absorption**	22.72^{a} ±7.27	34.27^{a} ±3.52	51.93^{b} ±2.76
P Intake	13.29±1.85	16.98±0.81	5.43±0.3
P absorption**	57.78^{a} ±3.72	49.78^{a} ±1.66	72.76^{b} ±2.33
Mg Intake	152.26±21.23	171.19±8.21	33.63±2.01
Mg absorption**	65.42^{b} ±1.31	42.26^{a}± 3.71	$48.87^{a\,b}$ ±3.48

Values with different superscripts in a row differ significantly * = $P < 0.05$, ** = $P< 0.01$

The values of serum glucose, TG, K, P and Mg differed significantly among three groups (Table 4.6.5.7). These values were similar in MR and CR (milch) but significantly higher in CR calves except Mg. Low serum glucose may possibly be due to higher energy requirements of lactating camels.

The results indicated that mixed ration was not sufficient to meet the nutrient requirement of camels, hence feeding of complete ration is recommended. Feeding of complete feed not only increased higher nutrient intake and digestibility but it also improved body weights and serum metabolic profile although at a higher cost.

Table4.6.5.7. Serum biochemical and electrolytes profile of milch camels and their calves

Parameter	MR(milch)	CR(milch)	CR(calves)
Glucose** (mg/dl)	43.33[a]±1.14	42.66[a] ±3.40	75.12[b] ±3.85
Total protein (g/dl)	6.05±0.25	5.78±0.14	5.37±0.22
Cholesterol (mg/dl)	36.56±8.14	38.91±1.20	32.95±3.17
Triglycerides** (mg/dl)	8.11[a] ±1.78	9.13[a] ±1.03	32.48[b] ±4.81
Sodium (mEq/l)	107.00±2.08	109.25±5.65	103.43±4.72
Potassium** (mEq/l)	4.20[a] ±0.31	3.75[a] ±0.13	5.59[b] ±0.23
Chloride (mEq/l)	88.95±7.53	101.27±2.49	83.50±5.99
Calcium (mg/dl)	7.29±0.56	7.72±0.41	8.37±0.26
Phosphorus** (mg/dl)	4.09[a]±0.21	2.93[a] ±0.14	6.36[b]±0.37
Magnesium ** (mg/dl)	6.20[b] ±0.04	5.36[ab] ±0.39	4.68[a] ±0.19

Values with different superscripts in a row differ significantly * = $P < 0.05$, ** = $P < 0.01$

Experiment 3. Utilization of chane ki khar- Gram straw *(Cicer arietinum)* in the complete ration of camel calves

Twelve camel calves (approx. 10 months; 308-364 kg) were randomly divided into 3 groups of 4 each. Control group (CR 1-L) was given complete ration in loose form consisting of *chane ki khar*, groundnut haulms and concentrate in the ratio of 70:15:15. Group CR 1-FB given complete ration having similar composition as that of CR1-L but in the form of feed blocks prepared on feed block formation machine developed by IARI, New Delhi under NATP. Group CR 2-FB was given complete ration consisting of *chane ki khar*, groundnut haulms and concentrate in the ratio of 60:25:15 in feed block form. The animals were housed in well ventilated shed having sandy floor, asbestos roofing and provision for manger for individual feeding. The animals were allowed 1 hour walking exercise daily in the morning. Daily feed intake and refusal were recorded for 98 days. The body weights of animals were recorded at the beginning and at the end of experiment on two subsequent days. The digestibility trial was conducted on 10 camel calves at the end of feeding period. The pooled samples are being analysed for proximate principles, detergent fibres as well as mineral elements.

Physical and chemical composition of experimental feeds is depicted in Table 4.6.5.8. No significant difference in feed gain ratio and digestibility coefficients of DM, OM,CP and EE were observed which showed that all the three feeds were equal and can be used for feeding camel calves. The observations indicated that feeding of complete ration in feed block form results in non-selection of feed ingredients, less feed wastage by camels and requires less feed storage space.

Table 4.6.5.8. Physical and chemical composition (%) of experimental feeds

Parameter	CR1-L	CR1-FB	CR2-FB	Chane ki khar	Groundnut haulms
Physical composition					
Chane ki khar	70.3	70.3	60.3		
G.N. haulms	15	15	25		
Molasses	4	4	4		
Guar churi	6	6	6		
Wheat bran	4	4	4		
Mineral mixture	0.2	0.2	0.2		
Common salt	0.5	0.5	0.5		
Chemical composition					
CP	11.68	11.68	12.09	9.10	12.89
EE	1.57	1.57	2.03	1.05	2.49
Total ash	11.97	11.97	11.78	12.34	10.62

CR1 – L – Loose form

CR1 – FB – Feed block

CR2 – FB – Feed block with chane ki khar

4.6.6 Study on the mineral status of feed and fodders in arid zone of Rajasthan, bio-availability and preparation of area specific mineral mixture for improved productivity in camel (Competitive Grant Programme Under NATP).

PI : G.P. Singh

Survey of Jaisalmer District

A total of 12 villages of Jaisalmer district were surveyed to collect samples of feed & fodder and information about feeding practices. During the survey it was observed that in 58% villages common salt was part of diet meant for camel. However, mineral mixture feeding to camel was not practiced. Major animal population in district were sheep, goat, cattle and camel, respectively, in number. This is

the only district surveyed under this project where camel population increased in 25% of villages and decreased in 75% villages and another interesting fact was noted during survey that in 75% villages camel milk were being used as such or as kheer. This could be the reason for increased population of camel in these village. The common feed and fodder used for feeding to camels in villages were guar chara, guar phalgati, sewan grass, moong and moth chara.

Survey of Nagore District

Nagaur is another district of arid zone where survey was conducted. About 10% villages were selected randomly and feed and fodder samples were collected along with information on feeding practices, increase or decrease of camels population, use of camel milk etc. In Nagore, farmers in 33% villages were feeding mineral mixture to cattle and other animals but not to camel. Camel population was lowest among the animals like sheep, goat and cattle. Most disbursing observation was that the camel population decreased drastically during last 10 years. Farmer explained the reasons i.e. high cost of feeding, competition with mechanical power like tractor for agricultural work and carrying load, less use of camel milk by general public, input and output ratio etc. Major feed and fodder of Nagore district are Bajra, Jawar Straw, Moong, Moth chara, Khejri Loong and guar phalgati.

Survey of Churu District

About 10% villages of Churu district were selected randomly and surveyed for collection of feed and fodder samples fed to camels and information regarding feeding of camels and other related information were also collected. In this district, only 14% villages used common salt in feed of animals but very rarely to camels. Here in this district feeding of mineral mixture is very uncommon rather unknown. Sheep and goats are the main animal in 86% villages, cattle and buffaloes in 7% villages each. Survey indicated decrease in Camel population in 86% villages and at the same time camel population was static in 14% villages during last 10 years. Common feed and fodder of the district are Bajara Straw, Khejri Loong and Beripala, moong and moth chara, guar chara, Doob grass in certain pockets. Camel milk utilization data was very dismal, because it is used occasionally in 14% villages.

Survey of Hanumangarh District

In this district 12 villages were selected randomly and feed and fodder samples were collected for estimation of trace mineral. In addition to collection of feed and fodder samples, the information about feeding practices, use of salt and mineral mixture for feeding was also collected. Farmers in 75% villages were using common salt in the diet and in 50% villages mineral mixture was used for feeding milch animal particularly to buffaloes but not camels, Major animal population in descending order were buffaloes, sheep, goat, cow and camels. In this district too, camel population decreased with very fast rate and it is continuing. Occasional use of camel milk as such or as Kheer was reported only in 17% villages. Feed & fodder of Hanumangarh district was different from Bikaner, Churu, Nagore and Jaiselmer. Wheat straw, Guar phalgati, berseem, oat and Jowar were main fodders.

Trace mineral status in Churu and Jaisalmer District

Average copper, zinc and cobalt content in the feed and fodder of Churu district were 11.94, 22.50 and 33.67 ppm respectively. A large number of feed and fodders samples were deficient in copper and zinc (Table 4.6.6.1). Similarly, copper, zinc and cobalt contents in feed,and fodder of Jaisalmer were 22.01, 28.92 and 16.82 ppm. respectively. In Jaisalmer a majority of feed and fodder were deficient in respect of all the three elements monitored viz. Copper, Zinc and Cobalt. (Table 4.6.6.2)

Table 4.6.6.1 Concentration of Copper, Zinc and Cobalt in feeds and fodder of Churu district (ppm):

S.No.	Feeds & Fodder	Cu	Zn	Co
1	Khejri Long	11.68	24.47	30.22
2	Groundnut Chara	9.95	18.53	42.77
3	Channa Straw	13.30	17.60	35.03
4	Beri Pala	7.04	18.50	28.25
5	Moth Gunna	13.95	25.07	37.53
6	Guar Gunna	16.40	30.60	36.10
7	Bajara Straw	12.31	26.61	33.23
8	Bhurat grass	17.20	31.60	32.40
9	Guar phalgati	8.90	22.89	33.17
10	Moth Chara	9.65	22.54	35.90
11	Wheat Straw	9.42	24.68	32.75
12	Dub grass	14.80	21.00	34.10
13	Moong Straw	8.55	19.55	27.15
14	Bajara tutra	14.03	11.37	32.77
	Average	**11.94**	**22.50**	**33.67**

Comparison of trace mineral contents in Churu and Jaisalmer District

Most interesting feature was that while copper and zinc contents of feeds and fodders of Jaisalmer was higher than those observed in Churu district, however, Cobalt content was higher in Churu district. (Fig. 4.6.6.1).

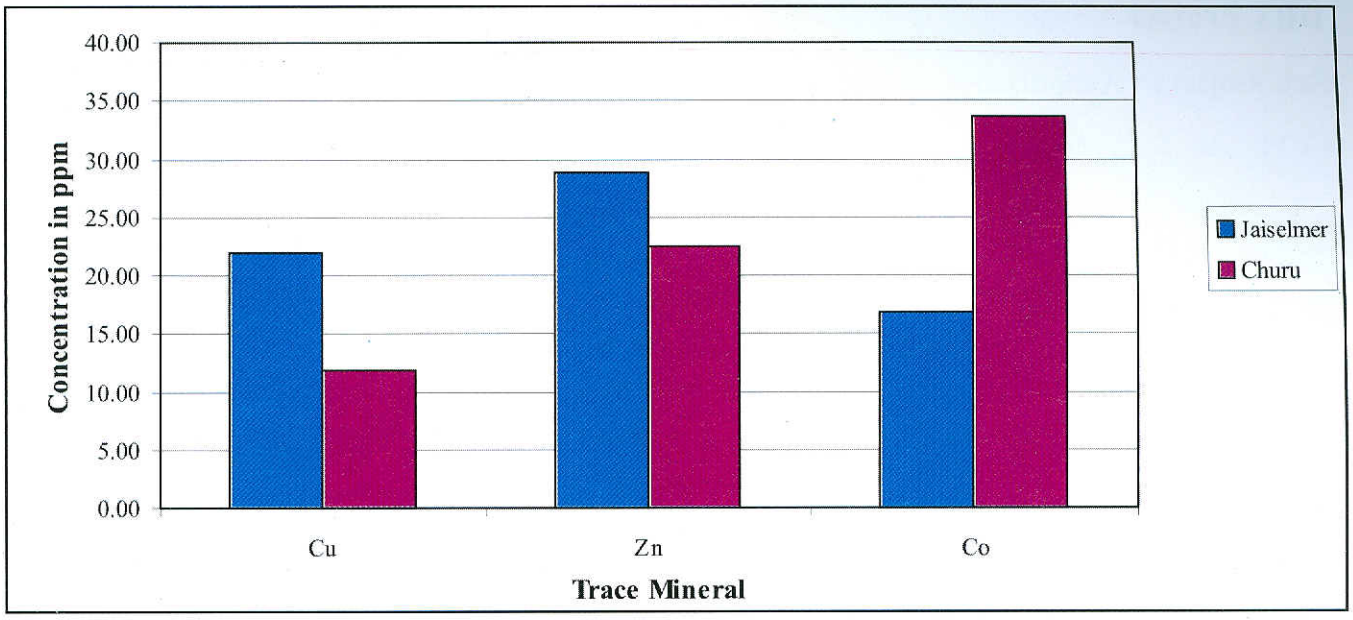


Fig. 4.6.6.1. Comparative Trace mineral in Feed and Fodders of Jaiselmer & Churu District

Table 4.6.6.2 Concentration of Copper, Zinc and Cobalt in feeds and fodder of Jaisalmer district (ppm)

Feeds & Fodder	Cu	Zn	Co
Khejri Long	21.05	27.75	14.20
Channa Straw	23.40	27.30	17.20
Moth Gunna	-	-	27.80
Guar Gunna	4.90	26.90	8.80
Bajara Straw	21.70	32.30	21.82
Guar phalgati	24.54	33.89	20.00
Moth Chara	32.20	29.30	-
Wheat Straw	23.58	28.43	17.50
Moong Straw	22.10	24.60	9.40
Bajara tutra	25.30	26.30	19.20
Sewen Straw	22.66	28.51	17.62
Phog	17.80	29.50	11.40
Bui	21.00	26.60	14.80
Gathiya	19.10	28.30	11.40
Jowar Straw	20.80	34.60	19.00
Til Straw	26.50	26.60	18.60
Esbgol Straw	25.60	31.80	20.40
Average	**22.01**	**28.92**	**16.82**

DBT Project

Sub Project : " A digitized inventory of camel genetic resources."

CCPI : Dr. S. C. Mehta

India has seven breeds/ strains of camel viz. Bikaneri, Jaisalmeri, Kachchhi (or Riverine), Mewari (or Malvi), Sindhi, Mewati and Marwari. NRC on Camel, Bikaner maintains the elite herd of Bikaneri, Jaisalmeri and Kachchhi breeds and has characterized and evaluated them scientifically. The information from the respective breeding tract of these breeds and the scientific information on Mewari and Mewati camels was largely lacking. Under this project extensive surveys were made to know the present status of these breeds in the breeding tract. A breed descriptor on Mewari and Bikaneri breed has been developed. In these descriptors all relevant aspects of camel husbandry, such as habitat, approximate population of the breed in breeding tract, availability of the breedable males and females, specific use of the breed/ species, products, bye-products, commercial values, future perspectives etc. have been included. Limited information on Sindhi camel has also been collected. Recently, biometry of 152 Kachchhi camel was accomplished in the breeding tract and necessary information has been collected for the preparation of breed descriptor of this breed. Survey was also done in the Mewat area but no breed pattern was observed. The camels were either Bikaneri or Mewari depending on the use and community involved in the rearing of camel

Agriculture Farm Unit

The center has total 824 hectares of area and the whole range land has been partitioned into 5 blocks. Paddock fencing has been done partially in block No. 1 & 2. Major agricultural operations had been taken up in these blocks for development of vegetational flora.

In order to improve the fodder resources different fodder trees viz. Zal (*Salvadora oleoides*), Kikar (*Vilayati babool*) Jharbari (*Zizyphus nummularia*) Khejri (*Prosopes cineria*) and Ardu (*Ailanthus excelsa*) numbering about 6500 were managed and various agricultural operations and incorporating manure, fertilizers and insecticide as well as erecting of thorn fencing of 1100 meters under AICRP project were carried out. About 25 hectares pasture of Sewan (*Lasiurus sindicus*) and 4.5. hectare pasture of Gramna (*Panicum antidotalde*) had been managed and about 2000 plants seedlings planted and maintained.

The work of tree plantation taken up since 1999 in collaboration with Rajasthan Forest department Bikaner was continued and about 35,000 tree-seedlings of species- vilayati babool, khejri, jharberi, rohida and neem has been planted. Due care has been provided for their development. Special tree-guard has been designed by the Centre for full protection to road-side plantation from by animals which proved very beneficial in protection of plants as well as its growth.

5. TECHNOLOGY ASSESSED AND TRANSFERRED

Camel fermented milk product (*dahi*)

The process of camel milk fermentation was standardized using different combinations of heat treatments, incubation and starter. The camel milk was boiled for 20-25 minutes, cooled to 30-37^{0}C, addition of starter culture at the rate of 3-4% and incubated for 18-20 hours. The periodical change in pH, acidity and DMC were recorded up to the 20 hrs at 37^{0}C incubation. The quality of fermented milk product was assessed by determination of fat, protein, total solid, moisture, pH, acidity as well as sensory evaluation tests.

Camel milk having pH, acidity and percent total solids ranged from 6.5 to 6.6, 0.138 to 0.145, and 8-10 respectively was processed for the fermentation. The prepared fermented milk (dahi) was chemically evaluated and results were closely related with International Dairy Federation standards.

The fermented milk product (dahi) was served in three different taste viz. (I) addition of cumin and salt, (ii) rose and sugar and (iii) without any flavor to Indian and foreign citizens during their visit of this center. Sensory evaluation test was carried out and 85 percent acceptability was recorded as normal or above the normal.

The technology is economically viable as no involvement of additional input as compared to fermentation of cattle and buffalo milk and feasible even in rural and field conditions.

6. EDUCATION AND TRAINING

SCIENTISTS			
Name and Designation	**Training**	**Place**	**Date**
A.K. Nagpal Sr. Scientist	Recent Advances in Animal Nutrition	IVRI, Bareilly	March, 5 –25, 2003
S. K. Ghorui Sr. Scientist	First International Caliber- 2003 Entitled maping technology on Library and people	Ahemedabad	Feb. 13 - 15, 2003
S. K. Dixit Sr. Scientist	Information Technology in Agricultural	NAARM, Hyderabad	July, 31 - Aug. 20, 2002
R. Singh Sr. Scientist	International Training on "Entrepreneurship and small business management in rural Sector"	CIAE, Bhopal	June, 30 - July, 12, 2002
	Summer school on "Analytical techniques in Dairy Chemistry with special reference to chemical quality of milk and milk products"	NDRI, Karnal	June, 3 - 23, 2003
S. C. Mehta Sr. Scientist	Refresher course on information technology in agriculture	NAARM, Hyderabad	June, 12 - July, 2, 2002

7. AWARDS AND RECOGNITION

Dr. Umesh Kumar Bissa, Senior Veterinary Officer (T-9) has been awarded Ph.D. degree from Rajasthan Agricultural University, Bikaner on Selectivity, longevity and productivity in Indian camels (*Camelus dromedarius*).

Sports

Runner place in Volleyball- shooting and Discuss throw

The volleyball (shooting) team of the Centre participated in the ICAR Inter zonal sports meet (2002-2003) which was held from 28th April-1st May, 2003 at Central Inland Fisheries Research Institute, Barrackpore, Kolkatta-700120 and secured runner place. The team members were, Sarvashri Mohan Singh (Captain), Ashok Yadav, Kanwar Pal Sharma, Ram Kumar Suri, Jamil Ahmed, Anil Kumar, V.K. Soni, Mahendra Kumar Rao, Prabhu Dayal, Nemi Chand and Satnam Singh.

Shri Mohan Singh, T-4 (Livestock Assistant) who secured first place in Zonal Tournament participated in the discuss throw event and secured second place in Inter Zonal Event.

8. LINKAGES AND COLLABORATIONS

I. National Level

- RAU, Bikaner : Research work of MVSc and Ph.D student
- CCSHAU, Hissar (Haryana) : Research work of MVSc and Ph.D student
- MAFSU, Nagpur (Maharastra) : Research work of MVSc and Ph.D student
- NDRI, Karnal (Haryana) : Camel milk analysis especially on protective proteins
- CSWRI, Avikanagar (Raj.) : Camel hair its utilization in form of blends
- CIAE, Bhopal (M.P.) : Camel drawn implements & their Performance
- S.P. Medical College, Bikaner : Camel milk as nutritional adjuvant in treatment of Tuberculosis & type-I diabetes
- AIIMS, New Delhi : Structure of protective proteins & its functional activity

II. International level

- CIRAD-EMVT, France : Research and training

Colloborative project on "Structural and functional studies on camel signaling proteins"

Dr. T.P. Singh, (AIIMS, New Delhi)
Dr. M.S. Sahani (NRCC, Bikaner)
Dr. Raghvendar Singh (NRCC, Bikaner)

Camel mammary gland secretion was collected during involution stage of lactation from eight female camels. The sample were processed for the isolation of camel signaling protein (SPU-40) in order to understand the precise role of this proteins during lactation and non-lactation transition period

in camels and its protective role in breast cancers. This protein acts as a protective signaling factor that determines which cells are to survive the drastic tissue remodeling that must occur during involution. The detail study in this line is under progress. Further camel milk and colostrum samples were collected and lactoferrin was isolated, purified and lyophilized in order to study its role as an anti-diabetic factor and biochemical study.

MVSc Theses Rajasthan Agricultural University

Genetic polymorphism in Indian camel breeds using microsatellite marker

M.V.Sc. Scholar : Praveen Garhwal
Advisor : Dr.C.K. Murdia
Co-advisor : Dr.S.C.Mehta

ABSTRACT

An investigation was done to study microsatellite profile of the Indian camel breeds using microsatellite markers. Ten microsatellite markers used in South American Camelids were selected and used in the present investigation comprising 150 unrelated camels, 50 each of Jaisalmeri, Kachchhi and Bikaneri breed.

PCR was employed for amplification of microsatellite loci. The amplified DNA was resolved on 6% denaturing urea-PAGE and stained with silver nitrate. Alleles were scored manually and their size was estimated using 50 bp ladder DNA. The number of alleles ranged from one to seven in the Indian camel for different microsatellite loci. Most polymorphic markers were VOLP-67 and YWLL-08, in which seven alleles were observed at each locus. The allele size and frequency obtained was used for estimation of heterozygosity, PIC and genetic distances. Mean allele sizes ranged from 135.00-235.88 bp for different loci. Expected heterozygosity ranged from 0.332-0.403 for LCA-56 and 0.796-0.816 for YWLL-08. The loci LCA-66, LCA-63, YWLL-08 and VOLP-67 were highly informative (PIC value > 0.5). It was observed that genetic polymorphism in Indian dromedary is relatively less as compared to South American Camelids and Arabian dromedary.

Genetic distances were estimated using software packages Microsat2 and Phylip3.6. Using Phylip3.6, Nei's genetic distance pooled over loci ranged from 0.0699 to 0.0811 in the three Indian camel breeds. The Chord distance (D_c) pooled over loci ranged from 0.0435 to 0.0764 and the Reynolds's distance (F_{st}) ranged from 0.0386 to 0.0469 in the three camel breeds.

Bikaneri & Kachchhi breeds formed a cluster on the phylogenetic tree, which reveals a closer relationship between these two breeds as compared to that with Jaisalmeri. The present study gives substantial information regarding the relationship among Indian camel breeds and can serve as a baseline for further studies in this direction. The information derived in the present investigation is of immense importance to the researchers, planners and policy makers. Apart from individual and parentage identification, the technique of microsatellite profiling can be use for characterisation, conservation and production enhancement in different species. It is therefore concluded that this study

may help in the characterisation and conservation of indigenous camel breeds and objective evaluation of genetic variation and better utilisation of camel genetic resources.

Molecular studies in Kachchhi breed of camel using microsatellite markers

M.V.Sc.Scholar : Ajay Goyal
Advisor : Dr. C.K. Murdia, RAU, Bikaner
Co-advisor : Dr.S.C. Mehta

ABSTRACT

An investigation was done to study microsatellite profile of the Kachchhi breed of camel using microsatellite markers. Ten microsatellite markers used in South American Camelids were selected and used in the present investigation comprising 50 unrelated camels of the Kachchhi breed.

PCR was employed for amplification of microsatellite loci. The amplified DNA was resolved on 6% denaturing urea-PAGE and stained with silver nitrate. Alleles were scored manually and their size was estimated using 50 bp ladder DNA. The number of alleles ranged from one to five in the Kachchhi breed of camel for different microsatellite loci. Most polymorphic markers were VOLP-10 and YWLL-38, in which five and four alleles respectively were observed at each locus. The allele size and frequency obtained was used for estimation of heterozygosity and PIC. Allele sizes ranged from 104 to 264 bp for different loci. Maximum expected heterozygosity (0.7402) was observed for locus VOLP-10 with minimum expected heterozygosity {0.3432}for locus YWLL-09. The loci YWLL-38 and VOLP-10 were highly informative (PIC value > 0.5). It was observed that genetic polymorphism in Kachchhi breed of camel is relatively less as compared to South American Camelids and Arabian dromedary.

The information derived in the present investigation is of immense importance to the researchers, planners and policy makers. Apart from individual and parentage identification, the technique of microsatellite profiling can be use for characterisation, conservation and production enhancement in different species. It is therefore concluded that this study may help in the characterisation and conservation of indigenous camel breeds and objective evaluation of genetic variation and better utilisation of camel genetic resources.

Ph.D Thesis Rajasthan Agricultural University, Bikaner

Selectivity, longevity and productivity in Indian camel (*Camelus dromedarius*)

Ph. D. Scholar : U. K. Bissa
Advisor : S.B.S. Yadav
Co-advisor : M.S. Sahani

ABSTRACT

The present study was conducted to investigate the data on 200 camels of 16 sires for the life time traits and 1063 calves of 30 sires for sex ratio, mortality and culling and replacement rate at National Research Centre on Camel, Bikaner form 1960-2001.

The average longevity of camel was 4526.47± 1`43.50 days (12.4 years). Half of the camels left the herd before 12 years of herd life. The average age at first calving was 1975.99± 38.35 days (5.4 years). About 65% of the females matured between 4 to 6 years of age. The average productive herd life of camel was 2551.47± 146.96 days (6.99 years). The effect of period of birth was significant on longevity and productive herd life at P≤ 0.1 and significant at P≤ 0.05 on age at first calving but the month of birth did not affect on any of these traits.

In selectivity the average number of total calves, male calves, female calves and male and female reaching maturity, the estimated coefficient of gene replication was 3.35± 0.17, 1.74±0.11, 1.60±0.11, 0.55±0.06, 0.55±0.07 and was 0.27±0.035, thus each camel could not replace herself. The maximum for total calves born was 10 (by only 1% she camels) for male calves born was 5 (by only 4% of the she camels) and for female calves born it was 6 (by only 1% of the she camels) and they were significantly (P≤0.01) affected by the period of birth. The number of male and female calves reaching maturity and the coefficient of gene replication were not affected by the period of birth. The month of birth could not affect any of the traits.

The average number of service required per conception in this herd was 1.62± 0.07. The average incidence of repeat breeders was 47.7% for which average number of services required per conception was 2.21±0.07. The period of birth had significant effects where as month of birth had no effect. The average sex ratio for this herd was 49.71%. The period of birth and month of birth had no significant effect on sex ratio.

The loss of female calves from birth to age at first calving due to death and culling was 21.9% and 33%, respectively. The effect of period of birth was highly significant on mortality and culling but the month of birth was highly significantly only on the mortality. The effect of birth weight was non-significant on any of the loss. Age specific mortality was maximum (8.6%) in 0-3 month of age group. Period of birth was significant on mortality in 3 month to 1 year and 1-2 year age group. Month of birth had significant effect at 0-3 month and at 2-3 years. In age, specific culling maximum calves (11.9%) were culling 1-2 year age group period of birth was found to have significant effect on culling in 3 m to 1 year, I to 2 years and 2 to 3 years age group. The month of birth had highly significant effect on 1 to 2 year age group.

The replacement rate on female calf basis and on total calf basis was 45% and 22.9%. The result indicated that 4 to 5 pregnancies are required to replace each female. The effect of period of birth and month of birth were highly significant (P≤ 0.01) on replacement on both bases. Replacement rate on birth weight varied from 34.48 to 48.38%, there was on effect of birth weight.

Loss rate of adult females was lost from the herd either due to death or culling in 1st parity was 22.5% and was increasing with increasing number of parities. The survival rate was more than 65% up to 5th parity. Expected herd life and parity specific survivorship gradually decreased along with parities. Reproductively value was 1.652 for the camels, which belonged to first parity.

Lifetime table statistics indicated that the average probability of a female being lost from the herd was 0.29 per female per parity. The mean age of camels present in the herd was 2.87 parities and the mean age of camels being lost from the herd was 3.42 parities. Average life expectancy of a camel at first lactation was 2.92 lactation and the average net reproductive rate for lifetime in this herd was 1.65which means that each camel produced 1.65 female calves. The generation interval was estimated as 5.48 years.

The losses of adult camels in different parities indicated that 24% of camels died and rest 76% were culled from the herd. Parity had significant effect on culling rate and total loss but no effect on mortality rate. The annual mortality in adult camels varied from 0.75 to 6.43%. The annual culling rate varied from 0.68 to 18.3%. The effect of year was not significant on mortality where as culling was significantly affected by the year. The overall replacement index was found to be little less than one (0.86) indicating that the heifer calving were 86% of the number of adult camels left the herd during the entire period hence the herd size reduced to that extent.

The average birth weight was 40.95± 1.43 kg. The effect of period of birth and sex was significant ($P \leq 0.05$) on this trait whereas the effect of month of birth and effect of sire were highly significant ($P \leq 0.01$). The overall mean body weight of adult camel was 510.02±13.98 kg. The effect of period of birth was non- significant whereas the effect month of birth and sire were higher significant at $P \leq 0.01$. The heritability estimate was 0.656±0.295.

Draught parameters had mean values for males and females, respectively as 2.280±0.037 and 2.239±0.21 MJ/hr, work potential 489.80±10.24 and 478.60±5.82 Newton force with a power of 377.32±10.03 and 366.91±5.70 Nm/sec equivalent to 0.86±0.014 and 0.831±0.08 British horsepower. These camels were having a draught potential of ploughing area of 489.97±3.17 and 486.50±1.80 square meter per 100 kg body weight for male and females, respectively, under the sandy soil of arid zone in Bikaner. The effect of period of birth was not significant on any draught parameters whereas the effect of month of birth was highly significant ($P \geq 0.01$) on different draught parameters.

Sire had no significant effect on longevity, productive herd life total number of calves born, total female calves and female calves reached to maturity and the heritability estimates were 0.090±0.180, 0.264±0.227, 0.028±0.161 and 0.090±0.179. Sire effect was significant ($P \leq 0.05$) only on age at first calving and heritability estimate was 0.370±0.253. In sire wise replacement rate and its components, the overall mortality was 28.6% and it varied from 10.0 to 78.8% among the female calves of 28 sires. Sire had highly significant effect ($P \leq 0.01$) on calf mortality and age group wise mortality on 3 month to 1 year and 3 years to AFC. The heritability of mortality from birth to AFC was 0.378±0.0014. The heritability was low for 0-3m, 1-2 year and 2-3 year as 0.054±0.078, 0.067±0.098 and 0.018±0.1013, respectively. The heritability was 0.262±0.143 and 0.414±0.221 for mortality in 3m to 3 year and 3 year to AFC age group.

The effect of sire on culling rate was significant ($P \leq 0.05$). The heritability estimate of culling rate of female calves up to age at first calving was 0.1625±0.0832. Sire had highly significant effect ($P \leq 0.01$) on replacement rate on female calf basis and on total calf basis. The heritability estimate of replacement rate was 0.48±0.167 for female calf basis and 0.209±0.0046 on total calf basis.

Breeding values of sires were estimated for age at first calving and adult body weight. It is suggested that preliminary selection of breeding bulls based on their dams age at first calving might be a useful strategy for improving adult body size, reproductive efficiency, longevity, productivity and draughtability.

9. AICRP/COORDINATION UNIT/ NATIONAL CENTRES

Network Collaborative Programme on crop based Animal production system

(now merged in AICRP on "Improvement of Feed Resources and Nutrient Utilization in Raising Animal Production")

P.I. : M. S. Sahani

Associates : N. Saini, Ram Kumar

SRFs : Raja Purohit, Baldev Dass Kiradoo

Monthly meteorological data from April 2002 to March 2003 with respect of maximum and minimum temperature, relative humidity and rainfall are presented in Table 9.1. The minimum and maximum temperature was recorded in the month of January and May i.e. 0.7°C and 46.6°C. It was a drought year. The total rainfall during the period was 57.5 mm., very low than the average and pattern was erratic. The minimum and maximum rainfall was recorded in month of June and August i.e. 4.2 mm and 14.2 mm respectively.

The soil fertility status of silvipasture area- The soil data of silvipasture area indicated alkaline nature of soil and sandy loam type. The pH of soil is 8.25±0.05 and EC averaged 0.22 ± 0.02. The organic carbon content was found to 0.26% indicating poor nitrogen content of soil. Mean available phoshphate and available potash was 28.26±4.90 and 312.0 ± 24.30 kg/ha respectively.

Table: 9.1 Month wise meteorological data of Bikaner (2002-2003)

Months	Temperature (^{0}C)		Humidity (%)		Rainfall (mm)
	Max	Min	Max	Min	
April 2002	45.8	26.2	73	52	5.8
May	46.6	29.8	81	50	10.4
June	46.5	31.8	72	49	4.2
July	43.3	30.5	78	35	0.00
August	43.3	24.2	83	67	14.2
September	40.5	21.2	93	82	Trace
October	41.7	20.8	57	19	0.00
November	35.9	19.9	91	54	7.3
December	31.5	4.1	94	35	8.0
January 2003	30.7	0.7	89	46	11.4
February 2003	34.0	7.0	88	52	27.2
March 2003	38.4	21.2	68	21	0.6

Exp. 1 Performance of camel calves kept on silvipastoral browsing/grazing management system.

To determine the sustainability of camel under hot arid conditions, 3 male Bikaneri camels (4 yrs age) were kept on silvipasture area (16 ha). The average initial body weight was 428.0±10.56 kg. The camels were supplemented 7.0 kg/camel/day lopped Jal green tree leaves existing within silvipasture plot. The final body weight of calves was 446.0±14.56 with average daily gain of 98.97 g/d. (Table 9.2, Fig. 9.1).

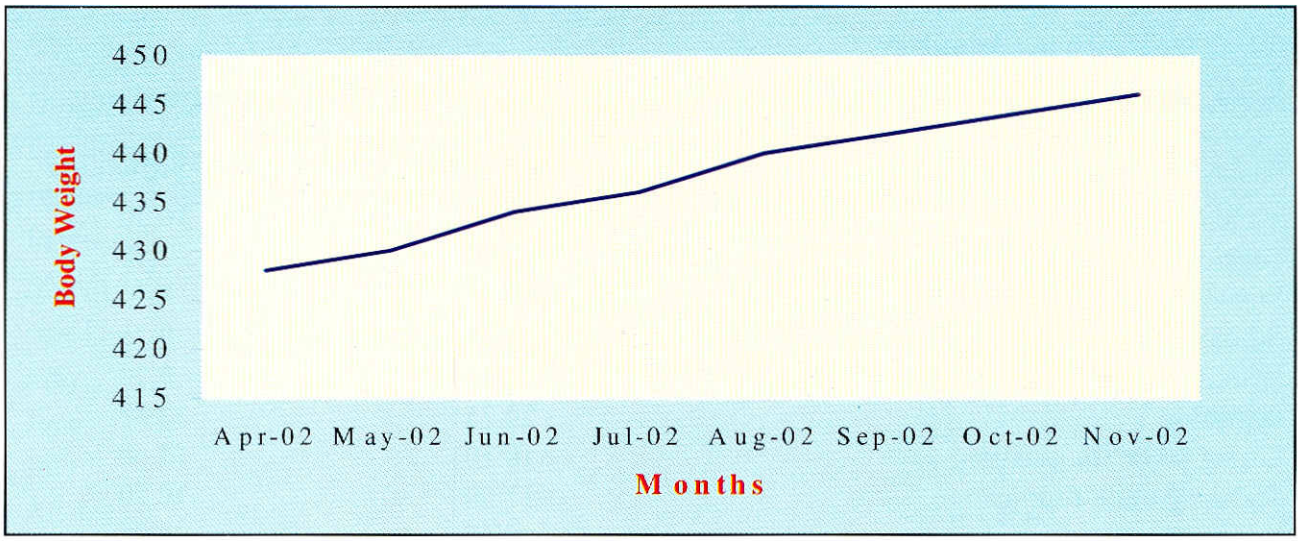


Fig. 9.1 : Change in monthly average body weights of camel calves under silvipasture grazing (April to November, 2002)

Table-9.2: Month-wise average body weights (kg) of male camel calves (4 yrs) kept under silvipasture grazing

Months	Body weight (Mean ±SE)
April	428.0 ± 10.56
May	430.4 ± 14.80
June	434.6 ± 15.60
July	436.0 ±16.68
August	440.0 ± 11.86
September	442.5 ± 13.50
October	444.5 ± 15.50
November	446.0 ± 14.56

Average daily gain = 98.97 gm/d

The observations on behaviour pattern of camel calves during different quarters of year (April-June, July-September) in sivilpasture area were recorded. The behaviour was studied in respect of nine major activites i.e. only walking, grazing, standing, sitting, walking while grazing, browsing, sitting while rumination, standing while rumination and drinking. The average percent time spent on various activities for two quarters are depicted in Table 9.3 & Fig. 9.2. Study clearly indicated that camels mainly spent their time in browsing activity ranging from 29.25 to 32.40 % during the lean months (April to June) and rainy season (July- September) being a drought year and can easily sustain on the available vegetation in silvipasture.

Table-9.3:Quarter wise grazing behavior of camel calves under 3 tier Silvipasture (% time)

Major activities	April-June	July-September
Walking	18.40	16.30
Grazing	2.30	3.50
Standing	7.45	8.40
Sitting	6.25	9.25
Walking while Grazing	2.80	5.70
Browsing	29.25	32.40
Sitting while Rumination	16.10	13.60
Standing while Rumination	17.00	10.50
Drinking	0.45	0.35

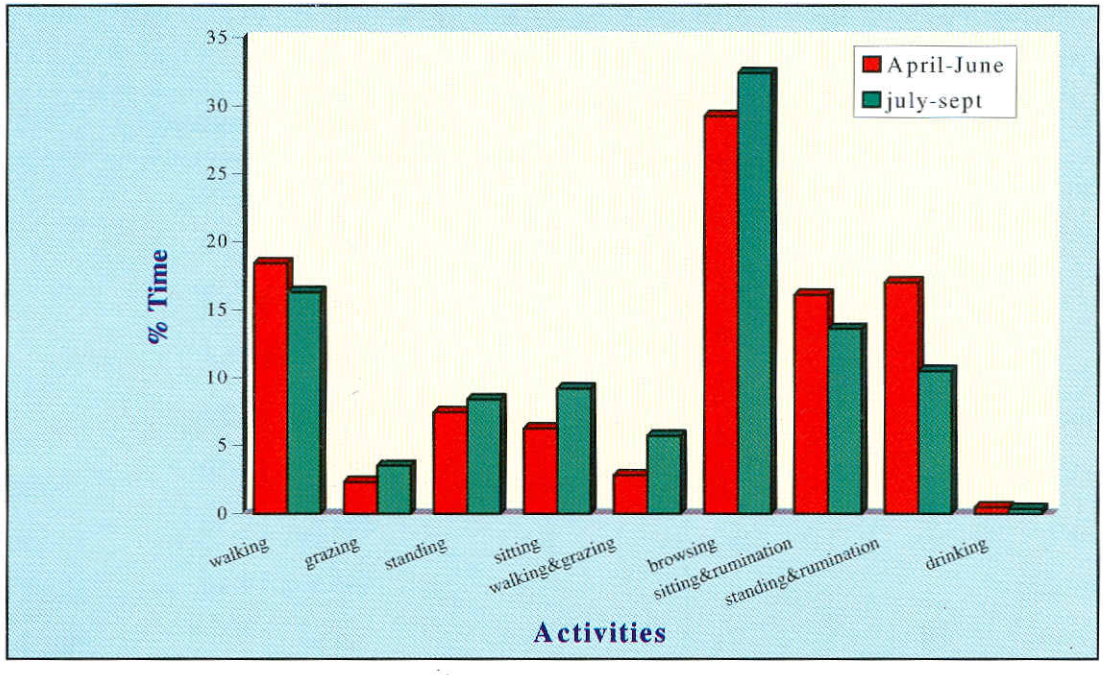


Fig. 9.2: Grazing behaviour of camels

Exp. 2 Growth performance of camels kept under village rangeland system.

The study on twenty-five camels of different age groups (growing calves, adult females & male) on similar pattern as followed by camel keepers in the village area upto Oct.2002. Camels could maintain body weights in the natural rangeland and available around village areas indicating that camel utilizes the various edible biomass available for sustenance of growth of camels. (Table 9.4, Fig. 9.3).

Table-9.4: Month wise average body weight (kg) of camel kept under rangeland area. (25 camels)

Months	Body weight
November, 2001	322.0 ± 7.20
December	319.5 ± 6.84
January, 2002	319.0 ± 6.72
February	317.0 ± 7.02
March	318.0 ± 6.60
April	321.0 ± 7.36
May	325.6 ± 7.56
June	330.8 ± 8.80
July	334.5 ± 8.20
August	342.6 ± 8.60
September	345.0 ± 9.26
October	348.8 ± 8.69

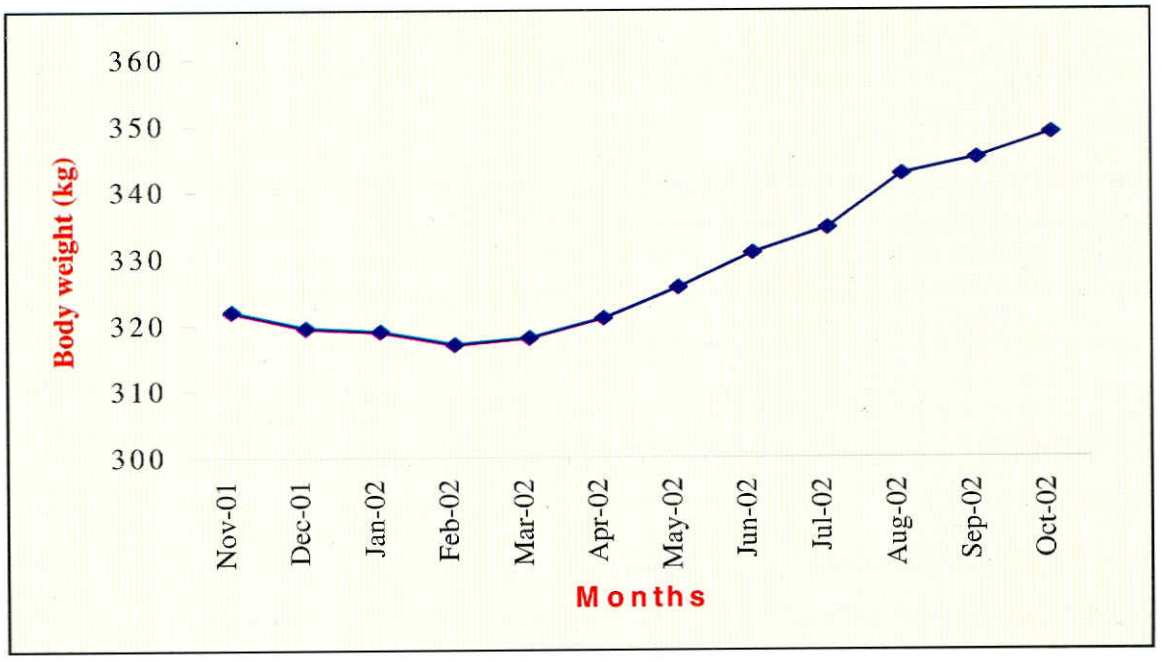


Fig. 9.3 : Change in monthly body weights of camels in the range land grazing system under village conditions

To evaluate the fertility status of soil as influenced by grazing, representative samples were collected from 0-15 cm depth from different sites before and after grazing. Soil samples are analysed for various fertility parameters. The loss of nutrient due to grazing was 0.04 units in percent carbon, 16.0 kg/ha of available potosh and 6.0 kg/ha of available phosphate.

Availability of vegetation in rangeland during different quarters of year was recorded & is presented in Table 9.5. During Octber-December Pala (38.50%) was highest followed by Jal (19.30%) and Khejri (18.70%). In Jan-March Pala was (26.50%) followed by Phog (20.0%). During April-June Phog was (25.80%) followed by Jal (19.30%) and Khejri (18.70%).

Table-9.5: Quarter-wise percent availability of vegetation in natural rangeland village conditions

Name	Quarter wise (%) vegetation			
	Oct-Dec	Jan-Mar	Apr-Jun	Jul –Sep
Pala (*Zizyphus nummularia*)	38.50	26.50	18.00	24.00
Jal (*Salvodora oleidus*)	19.30	19.30	19.30	19.30
Khejri (*Prosopis cineraria*)	18.70	18.70	18.70	18.70
Phog (*Calligonum ploygonoides*)	10.40	20.0	25.80	22.50
Israeli babool (*Acacia tortilis*)	10.40	8.80	10.20	11.50
Ker (*Capparis decidua*)	8.80	6.70	10.00	12.00

Observation on preference of vegetation by the camels revealed that during October-December quarter preference of Pala was higher 50.35% followed by Jal and Khejri i.e. 17.20%, 15.40 % respectively. During January-March preference of Phog was higher 28.70 % followed by Pala and Jal i.e. 23.80%, 20.10 % respectively. During quarter April-June camels preferred Phog i.e. 32.20% followed by Khejri i.e., 22.10% where as during July–September camels preferred Khejri i.e., 30.80% followed by Pala i.e., 21.0%. (Table 9.6).

Table 9.6. Quarter-wise preference of vegetation (%) by the camels under natural rangeland (village conditions)

Name	Oct-Dec	Jan-Mar	Apr-Jun	Jul -Sep
Pala (*Zizyphus nummularia*)	50.35	23.80	15.20	21.00
Jal (*Salvodora oleidus*)	17.20	20.10	20.00	18.70
Khejri (*Prosopis cineraria*)	15.40	18.90	22.10	30.80
Phog (*Calligonum ploygonoides*)	10.45	28.70	32.20	17.00
Israeli babool (*Acacia tortilis*)	4.63	6.50	7.00	10.40
Ker (*Capparis decidua*	2.00	2.50	3.80	1.80

Grazing behaviour study conducted under village rangeland in different quarters of year on 25 camels of different age groups. In November-December, the maximum time was spent in browsing activity (29.73%) followed by walking, grazing, walking while grazing 21.53%, 15.08%, 10.73% respectively. During January-March, the maximum time was spent in browsing i.e. 26.46% followed by walking, walking while grazing standing 20.20%, 14.66%, 10.46% respectively. During April-June, the maximum time was spent in browsing (33.70%) followed by walking, sitting while rumination and standing while rumination i.e., 18.50%, 15.40%, 8.30% respectively. During July-September, the maximum time was spent in browsing (35.40%) followed by walking, sitting while rumination and standing i.e., 20.10%, 15.70%, 6.35% respectively. (Table 9.7) The results clearly indicated that camels mainly depend on browsing during different quarters of year and the browsing activity is highest during the lean months (April to June) and during drought period (July to September).

The major health problems observed during the rangeland grazing were Pica, Diarrohea and Wounds. Deworming of all the camels was done (Table 9.8).

Table 9.7. Quarter-wise grazing behavior (%) of camels under natural rangeland (village condition)

Major activities	Nov –Dec	Jan-Mar	Apr-Jun	Jul-Sep
Walking	21.35	20.20	18.50	20.10
Grazing	15.08	7.30	5.10	6.25
Standing	5.22	10.46	7.28	6.35
Sitting	6.80	7.96	6.25	4.60
Walking while Grazing	10.73	14.66	5.15	6.20
Browsing	19.73	26.46	33.70	35.40
Sitting while Rumination	7.20	6.53	15.40	15.70
Standing while Rumination	3.52	6.08	8.30	5.10
Drinking	0.36	0.33	0.32	0.30

Table 9.8. Incidence various disorders/disease (%) observed in camels in rangeland grazing

Diseases	**No. of camels (%)**
Diarrhoea	16
Wounds	8
Impaction of rumen	4
Pica	12
Mange	24
Nematodises	20

Exp. 3. Utilization of Bui (*Aerva tomentosa*) an unconventional plant resource as camel feed.

Under this experiment 9 camels calves of same sex and age (3 years) were taken and divided into three groups. Each group having 3 female calves; first group, the controlled fed 8.0 kg dry gaur phalgeti for one month and after 6-days digestibility trail was conducted in first phase. In second phase 20% and 30% conventional gaur phalgeti was replaced with dry leaves of bui and offered to camel calves for one month followed by 6-day digestibility trial. The results revealed no significant difference between 2 phases in respect of DM intake kg/d, DMI%, digestibility of proximate components, nutrient intake of DM, DCP, and ME/ kg w 0.75 and water intake l/d. This will help in reducing the feed cost to around (25%) during the stress and drought for sustenance of camel in this region. (Table 9.9)

Table- 9.9: Proximate composition of feed (%)

Feed	DM	CP	EE	CF	TA	NFE
Guar phalgati (*Cyamopsis tetragooloba*)	95.00	7.20	0.78	30.40	9.10	52.45
Bui (*Areva tomentosa*)	28.00	13.10	2.60	13.80	14.30	50.25

10. LIST OF PUBLICATION

10.1. Research Papers Published

Bhakat C. 2002. Sustainability of pastoralists through camel management in hot arid Thar desert. Indian farming, 52 (11): 14-17.

Bhakat C. 2002. Camel-a boon to hot arid agro ecosystem. Agri Gold Swarna Sedyam, 6 (12): 48-49.

Bhakat C., Chaturvedi, D and Sahani, M.S. 2002. Camel Versus bullock carting and it's economics in the hot arid region of Thar desert. Drought Animal News. 37:21-26.

Deen, A., Mal, G., Tuteja, F.C. and Sahani, M.S. 2002. Muscular weakness and anorexia due to overload exertion in a camel: A case report. Journal of Camel Practice and Research.9: 167-170

Deen, A., Vyas, S., Jain, M. and Sahani, M.S. 2002. Effects of carting on libido and semen production in camel. Journal of Camel Practice and Research, 9(2) : 151-152.

Dixit, S.K., Tuteja, F.C., Kumar, R, Singh, R., Sharma, N. and Ghorui, S.K. 2002. Indigenous Formulation against mange in Dromedary camel. Veterinary Practitioner.3: 159-169.

Mehta, S.C., Bithu, H.K., Poonia, S.R. and Sahani, M.S. 2002. Disease profile of the Jaisalmeri camel in the breeding tract. Veterinary Practitioner. 3(2): 116-119.

Mehta, S.C., Bithu, H.K., and Sahani, M.S. 2002. Camel : An over view. Journal of Indian Veterinary Association. 7(2) : 46-47.

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Mehta, S.C. 2002. Advances in information technology and database management. Published and released by the Director, NRCC, Bikaner, 2002.

11. LIST OF APPROVED ONGOING PROJECTS (IX PLAN)

11.1 Genetic characterization, evaluation and conservation of indigenous camel breed.

11.2 Improvement of the working efficiency of camel under arid and semi arid conditions.

11.3 Improvement of reproductive efficiency and to study the causes of reproductive failure in camels.

11.4 Studies on feed requirement and feed resources evaluation in camel for optimum production.

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

11.6 Surveillance, monitoring control of camel diseases.

12. MANAGEMENT COMMITTEE, RAC, SRC MEETING

I. Composition of I.M.C. of NRCC, Bikaner

The Institute Management Committee for the year 2002-03 was held on 24.03.03. The following members participated in the meeting which was convened under the Chairmanship of Dr. M.S. Sahani, Director, NRC on Camel, Bikaner.

1. Dr. K.C. Purohit, Joint Director, Animal Husbandry Deptt., Bikaner : Member
2. Sh. Dil Sukh Rai Choudhary, Ex-MLA, Lasmangarh, Sikar : Member
3. Sh. A.K. Gangwani, AF&AO, CAZRI, Jodhpur : Member
4. Sh. P.K. Tiwari, AF&AO, NRCC, Bikaner : Member
5. Sh.A.K. Mallick, AAO, NRCC, Bikaner : Member Secretary

II. RAC

The research advisory committee for the center was constituted :

1.	Dr. N. R. Bhasin	:	Chairman
2.	Dr. N. D. Khanna	:	Member
3.	Dr. A. K. Rai	:	Member
4.	Dr. S. P. Agarwal	:	Member
5.	Sh. D. R. Choudhary	:	Member
6.	Dr. Aminu Deen	:	Member secretary

III. QRT

The new QRT team was constituted to review the research work of the Centre for the period from 1997 to March 2003 the composition of committee:

1. Dr N. R. Bhasin : Chairman
2. Dr K. Pradhan : Member
3. Dr G. R. Purohit : Member
4. Dr O.P. Mathur : Member
5. Dr J.S. Bhatia : Member Secretary

The first meeting of QRT was held on 24th February 2003 at 11.00AM at DDG (AS) office, ICAR, Krishi Bhawan, New Delhi. Chairman welcoming all the members of QRT requested Dr. V. K. Taneja, DDG(AS) to extend his views/suggestions considering the priorities of NRCC, Bikaner. DDG (AS) in his opening/ remarks welcomed Chairman and all the members and expressed that prioritization of on going research programmes is necessary considering the specific issues with regard to camel, he also desired to look in to the mandate of Centre and may be revised as per requirement, DDG (AS) also desired that in certain specific areas of research viz; Camel milk, health, immunology inter-institutional linkages should be developed with concerned institute viz; NDRI, IVRI or others. In case of any help of DDG (AS) is required, it may be indicated considering the limitation of facilities and manpower in small institutes.

Chairman QRT in his remarks also emphasized need to develop for proper linkages/ collaboration with large and small institutes in specific research areas. There is need to have regular liaison among institutes, so that it is fully operative between institutes. He desired to provide important research achievements carried out in different disciplines and technologies generated and action taken for verification of technologies and its economic impact. In order to perform duties of QRT, Dr. J. S. Bhatia, member of QRT was nominated as member secretary. He may have direct liaison with center. Dr. K Pradhan, member expressed that linkages/ collaborations with other institutes/SAUS should be clearly defined along with its progress and impact.

IV. SRC meeting

Annual meeting of scientific research council was held on 20.5.2003 to discuss the research activities of the centre under the Chairmanship of Director, NRCC, Bikaner following subject matter experts participated:

1. Dr. G. R. Purohit, Prof & Head, Deptt. Animal Nutrition CVAS, Bikaner
2. Dr. K. M. L. Pathak, Prof & Head, Deptt. Of Parasitology, CVAS, Bikaner
3. Dr. P. K. Pareek, Prof & Head, Deptt. Of Vet. Cynae, Obst. & Reprod., CVAS, Bikaner

The research work carried during the year 2002-2003 under the various approved research projects and scheme of the institute were discussed in light of RAC recommendations and Vision 2020.

13. PARTICIPATION OF SCIENTIST IN CONFERENCES, MEETINGS, WORKSHOPS AND SYMPOSIA

SCIENTISTS			
Name and Designation	**Seminar/Symposium**	**Place**	**Date**
M. S. Sahani Director	Int. Cong. of Asian Australasian Assoc. for Anim. Prod. Soc. (AAAP)	New Delhi	September, 22-27, 2002
G. P. Singh Pr. Scientist	IV Biennial Conf. of Animal Nutrition Association, INDIA	Kolkatta	November, 20 -22, 2002
	4th Asian Buffalo Congress	New Delhi	February, 25- 28, 2003
	4th National Seminar for Popularisation of Oilmeal Usage in Compound Cattle, Poultry and Aqua Feeds	Chandigarh.	January, 16,2003
	32nd Dairy Industry Conference	IDA, Chandigarh	March, 7 - 9, 2003
Aminu Deen Pr. Scientist	18th Annual convention of Indian Society for Studies on Animal Reproduction (ISSAR)	IVRI, Izatnagar (U.P.)	November, 14-16, 2002
A.K. Nagpal Sr. Scientist	4th National Seminar for Popularisation of Oilmeal Usage in Compound Cattle, Poultry and Aqua Feeds.	Chandigarh	January, 16, 2003
S. K. Ghorui Sr. Scientist	Ist Int. Caliber-2003" Mapping technology on library and people"	Ahmedabad	February 13-15, 2003
	XIII National Congress of Veterinary Parasitology	W.B.U.A & F. Sc, Kolkatta	December 14-16,2002
	Library improvement and Net working within ICAR and SAU Libraries	IASRI, New Delhi	June 17-19,2002

	Int. Conf. On "Alternatives to the use of Animal in Research and Education	New Delhi	February 18-20,2003
S. K. Dixit, Sr. Scientist	XXI Annual Convention of ISVM	GAU, Anand	February 7-9,2003
A.K. Roy Sr. Scientist	13th Annual convention of SAPI and National symposia- Constraints and strategies for augmenting lactation in Dairy Animal	NDRI, Karnal	February 6-7,2003
Sumant Vyas Sr. Scientist	18th Annual convention of Indian Society. for Studies on Animal Reproduction (ISSAR)	IVRI, Izatnagar (U.P.)	November, 14-16, 2002
R. Singh Sr. Scientist	32nd Dairy Industry Conference	IDA, Chandigarh	March, 7-9, 2003
S. C. Mehta Sr. Scientist	Indian Society of Sheep & Goat Production & Utilisation	Avikanagar	Dec, 30-31,2002
	4th Asian Buffalo Congress	New Delhi	February 25-28,2003
	Conference on Engineering for library and information centre	Jaipur	February, 14-16,2002
F. C. Tuteja Scientist, Sr. Scale	XXI Annual Convention of ISVM	GAU, Anand	February 7-9,2003
	National workshop on organic Animal Husbandry standards	IVRI, Izatnagar	November 26-27,2002

14. WORKSHOP, SEMINAR, SUMMER INSTITUTE

Workshop on Promotion of camel and goat milk Utilization

A two days workshop was organized on March, 15-16, 2003, under NATP Project "Improving the shelf life of milk and milk and milk products of camel and goat" in order to promote camel milk and milk product utilization. Dairy experts were invited from NDRI, Karnal; CIRG, Makhdoom; CAZRI, Jodhpur; HAU, Hisar; URMUL, Dairy, Bikaner and, scientists and technical officers of the center participated and express their views and suggestions for further improvement and areas of camel and goat milks. A kisan ghosthi was also organized in Gadwala village to share know how of camel milk utilization and distributed technical bulletins on camel milk dahi and camel milk soft cheese to the farmers. The major emphasis was given by the experts to develop mozzarella and cheddar cheese, fermented and flavored milk products technology. Evaluation of casein and whey proteins is potential research area of study along with pharmaceutical and dairy industry uses.

Short Course on Advances in Diagnosis, Treatment and Control of Camel Diseases

The centre organized a short course entitled "Advances in Diagnosis Treatment and control of camel diseases" for ten days duration w.e.f. Sept. 16-25, 2002 (Fig. 14.1). The financial assistance was made available from ICAR, New Delhi. Twenty five participants – Senior Asstt. Professor, Asstt. Professor, Technical Officers from SAUs, Asstt. Directors, Sr. Veterinary Officer from the state of Rajasthan, Haryana, Gujarat, Maharastra, Jammu & Kashmir and personnel from Indian Army and Border Security Force participated in the course. The course covered both theory of important diseases of camel its treatment, control, and practical demonstration of recent developments in diagnosis. The subject matter specialists from different organization took keen interest and wholehearted approach while delivering the lectures and interacting with the participants. The center published the compendium of lectures delivered during the course for referral studies. The dignitaries from college of Veterinary Science (RAU), CARRI, Regional station NRCE (Production Unit, Bikaner) and other state Department graced both inaugural and valedictory function and offered their valuable comments and expressed the importance of organizing such short course on species oriented specific topics.

Fig. 14.1: Participants & faculty members of short course

हिन्दी चेतना मास, 2002

केन्द्र में 14 सितम्बर, 2002 हिन्दी दिवस के उपलक्ष पर दिनांक 14.09.2002 से 11.10.2002 तक हिन्दी चेतना मास का आयोजन रखा गया। इस अवसर पर केन्द्र के अधिकारियों एवम् कर्मचारियों हेतु हिन्दी में निबन्ध प्रतियोगिता व एक दिवसीय कार्यशाला का भी आयोजन रखा गया। आयोजित मास के समापन कार्यक्रम पर मुख्य अतिथि के रूप में डॉ0 मदन केवलिया, पूर्व उप प्राचार्य,

डूँगर महाविद्यालय, बीकानेर को आमन्त्रित किया गया। समारोह की अध्यक्षता केन्द्र के निदेशक डॉ0 मोहन सिंह साहनी ने की। इस अवसर पर मुख्य अतिथि महोदय ने हिन्दी भाषा की सरलता की बात कही। डा0 साहनी ने केन्द्र के अधिकारियों/कर्मचारियों को राजभाषा हिन्दी का अपने–अपने कार्यक्षेत्र में प्रयोग करने की ओर प्रोत्साहित किया। अंत में प्रतियोगिता में स्थान प्राप्त करने वाले प्रतिभागियों को पुरस्कार प्रदान किये गये।

15. VISITS OF DIGNITARIES

15.1. संसदीय राजभाषा समिति की दूसरी उप समिति द्वारा केन्द्र का निरीक्षण

14 सितम्बर, हिन्दी दिवस, 2002 के अवसर पर संसदीय राजभाषा समिति की दूसरी उप समिति द्वारा केन्द्र का निरीक्षण किया गया। समिति के संयोजक श्री राम रघुनाथ चौधरी एवं अन्य गणमान्य सदस्यों का केन्द्र आगमन पर निदेशक डा0 मोहन सिंह साहनी व भाकृअप के हिन्दी निदेशक श्री अनिल कुमार दुबे व केन्द्र के वरिष्ठ अधिकारियों द्वारा माल्यार्पण कर स्वागत किया गया। निरीक्षण के दौरान केन्द्र की ओर से प्रस्तुत निरीक्षण प्रश्नावली के सन्दर्भ में समिति सदस्यों द्वारा कई बिन्दुओं को उजागर किया गया, जिनका संतोषजनक रूप से लागु करने का आश्वासन दिया गया।

संसदीय राजभाषा समिति की दूसरी उप समिति द्वारा केन्द्र का निरीक्षण

15.2. Ashish Chopra, Director, Institute of Environment Management & Social Development, "This is a premier institute of Asia doing research on camel. This research at a later stage will prove very useful in micro enterprise development".

15.3. Lt general K. Chiman Singh, PVSM, Nawal Niketan Sadul Ganj, Bikaner, "The institute is extremely well equipped with competent scientists to man them. The amount of research done is very vast and is very useful for the rural people who are dependent on the camel for all their daily needs. I have no doubts that the institute will prove a great boon to the farmers of Rajasthan in years to come".

15.4. Arvind Prasad, Secretary, Deptt. of Institutional Finance, Govt. of Bihar, Patna, "I am really impressed by the various research work done for the breeding of camel and utility of camels milk. I am sure research will lead to wider use of camels".

15.5. Mr Satveer Chaudhary, state senator, Minnesota, USA, "The research team is doing very important work to persuade the history, culture and utilization of this noble creature- the great ship of desert".

Dignitaries were impressed with comprehensive approach the quality of research work and detailed analysis/ examination being conducted at the center on various aspect of camel.

16. PERSONNEL

Name of staff members (2002-2003)

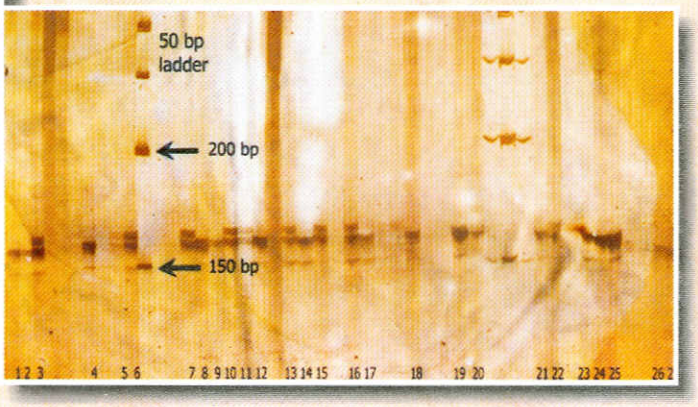
Dr. M. S. Sahani	Director
Scientific	
Dr. G. P. Singh	Principal Scientist (Ani. Nut.)
Dr. Aminu Deen	Principal Scientist (Ani. Rep.)
Dr. A. K. Nagpal	Sr. Scientist (Ani. Nut.)
Dr. S. K. Ghorui	Sr. Scientist (Vet. Para.)
Dr. S. K. Dixit	Sr. Scientist (Vet. Med.)
Dr. A. K. Roy	Sr. Scientist (Ani. Phy.)
Dr. Sumant Vyas	Sr. Scientist (Ani. Rep.)
Dr. R. Singh	Sr. Scientist (Ani. Biochem.)
Dr. S. C. Mehta	Sr. Scientist (AG&B)
Dr. Rajender Kumar	Scientist Sr. Scale (Vet. Para.)
Dr. C. Bhakat	Scientist Sr. Scale (LPM)
Dr. F. C. Tuteja	Scientist Sr. Scale (Vet. Med.)
Sh. Gorakh Mal	Scientist (Ani. Bio.) on study leave
Dr. D. Suchitra Sena	Scientist (Vet. Med.) on study leave
Dr. Nirmala Saini	Scientist (Ani. Nut.) on study leave
Technical	
Dr. U. K. Bissa	Sr. Vet. Officer, T-8
Dr. N. Sharma	LSF, T-7
Sh. Ram Kumar	Farm Manager, T-7
Dr. B. L. Charania	Vet. Officer, T-7
Sh. Dinesh Munjal	Tech. Officer, T-5
Administration	
Sh. A. K. Mallick	Asstt. Admin. Officer
Sh. P. K. Tiwari	Asstt. Fin. & Account Officer

17. INFRASTRUCTURAL DEVELOPMENT

New works have been awarded and taken up for administrative and library building, small animal house, vehicle stand, sentry post and community centre.

कार्यशाला के उद्घाटन समारोह पर मुख्य अतिथि डा. एस. सिंह सम्बोधित करते हुए

केन्द्र में आयोजित लघु पाठ्यक्रम, 2002 में प्रतिभागी,
केन्द्र के निदेशक डा. एम. एस. साहनी व अन्य वैज्ञानिकों के साथ



NATIONAL RESEARCH CENTRE ON CAMEL

POST BOX No. - 07, BIKANER - 334 001 (RAJASTHAN)

Phone : 0151 - 2230183 (Director) 0151 - 2230070 (EPBX)
Fax : 91 - 151 - 2231213 E-mail : nrccamel@hub.nic.in
Website : www.icar.org.in/nrccm/home.html