

वार्षिक प्रतिवेदन ANNUAL REPORT 2005-2006



राष्ट्रीय उष्ट्र अनुसंधान केन्द्र
जोरबीड़, बीकानेर - 334 001 (राज.)

NATIONAL RESEARCH CENTRE ON CAMEL
JORBEER, BIKANER - 334 001 (RAJASTHAN)

October 2006

Published by

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NRC on Camel, Bikaner-334 001

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Printed by

R.G. Associates
Bikaner-334 001
Ph.:0151-2527323

Hindi Abstract

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वार्षिक प्रतिवेदन
ANNUAL REPORT

2005-2006

निदेशक (कार्यकारी) : डॉ. जी. पी. सिंह
Director (Acting) : Dr. G. P. Singh



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PREFACE



I feel delighted in presenting Annual Report of the centre. During this period research and development activities remained high priority as per mandate of the centre. All the approved procurement of IX and X five year plan were accomplished. Under various projects new laboratories for Camel Health Research, RIA and Molecular Genetics were established. Apart from research, priority was given to farm rangeland development also both in terms of fodder resource through silvipasture and infrastructure which includes Agriculture farm office and new fodder godown. Spray yard of camels, another set of camel corrals and dispensary, post mortem room and pit, road communication and internal paddock were constructed. The other infrastructure completed in at campus area includes Library cum Administrative building, boundary wall with grill of camel corrals, residential quarters, construction of camel museum and extension of guest house. During the year on going works of community centre, new pathology health laboratory and new camel milk parlour were completed.

The Annual Report also highlights the important accomplishment of research under different projects, training to students of Veterinary colleges and Life Sciences from different places and extension activities. The major challenge before the camel husbandry of the country is the rapid decline in camel population more than 25% during last decade, which can be mainly attributed to continuous decline in range and pasture lands, fast mechanization in rain fed agriculture and decline in use of draught camel. There is simultaneous enhancement of human population and command area both under canal and tube well irrigation.

The prosperity in camel milk product technology has shown scope for alternate economic utility of camel in north west arid and semi arid regions.

The reproductive performance of camel herd remained good since last 3 years under natural breeding as compared to past. The research on characterization of all the important breeds of camel (Bikaneri, Jaisalmeri, Kachchhi and Mewari) has been completed. The technology of electrification of traditional two wheel camel cart has been further improved and simplified for its effective large scale utility and to be more cost effective. The core unit Library and ARIS were strengthened with the latest advancements.

At this occasion I express my deep sense of gratitude to all the scientists, technical staff, officers of Administrative and supporting category for their whole hearted support and

cooperation in fulfilling targets. Revenue generation target was achieved by exploring all the possible available sources.

In spite of the limited staff strength, Centre's performance in sports both at Zonal and inter zonal level remained excellent.

In promotion of Hindi in research and extension of Science the centre won two Nagar Raj Bhasa shields and Raj Bhasa Sansthan award during the year.

I am extremely thankful for continuous support and guidance extended by Dr. Mangla Rai, Secretary, DARE & Director General ICAR, Dr. V.K. Taneja, Deputy Director General (Animal Sciences) Dr. O.P. Dhanda, Assistant Director General (AN&P) and all staff of Animal Division of Indian Council of Agricultural Research, New Delhi.



(G.P. Singh)

Director (Acting)

1. सारांश

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र : एक संक्षिप्त परिचय

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र, बीकानेर शहर से लगभग 10 किलोमीटर दूर जोड़बीड़ क्षेत्र में स्थित है। इस केन्द्र की स्थापना 5 जुलाई, 1984 को की गई। इससे पूर्व यह केन्द्र पशु चिकित्सा एवं पशु विज्ञान महाविद्यालय, राजस्थान कृषि विश्वविद्यालय, बीकानेर की संरक्षता में उष्ट्र प्रजनन केन्द्र के नाम से जाना जाता था।

विश्व में उष्ट्र 19.32 मिलियन की तादाद में हैं। अफ्रीका में यह 15.13 मिलियन के साथ सर्वाधिक है। एशिया में यह 4.17 मिलियन है। भारतवर्ष में कुल उष्ट्र संख्या 0.632 मिलियन के रूप में है तथा सोमालिया (6.2 मिलियन), सुडान (3.2 मिलियन), मोरोतिना (1.2 मिलियन), इथोपिया (1.07 मिलियन) तथा पाकिस्तान (0.8) के बाद भारत इस दृष्टि से छठे स्थान पर है।

इस केन्द्र का उद्देश्य ऊँटों की नस्ल सुधार के लिए मूलभूत व्यावहारिक अनुसंधान करना है। इन वर्षों में केन्द्र में अत्याधुनिक प्रयोगशालाएं स्थापित की गई हैं तथा इसके स्वरूप में भी व्यापक विकास हुआ है।

केन्द्र पर ऊँटों की कुल संख्या इस वर्ष के आरम्भ में 239 व अन्त में 261 थी। विभिन्न आयु वर्ग के इन सभी ऊँटों में मुख्यतः बीकानेरी, जैसलमेरी व कच्छी स्थानीय नस्ल के थे।

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र, बीकानेर के प्रमुख पर्यटन-स्थल के रूप में जाना जाता है तथा इसे राजस्थान के पर्यटन मानचित्र में भी स्थान दिया गया। केन्द्र में एक उष्ट्र संग्रहालय भी स्थापित है जो अनुसंधायकों तथा पर्यटकों का ध्यान अपनी ओर आकर्षित करता है। प्रतिवर्ष हजारों विदेशी एवं भारतीय पर्यटक इस केन्द्र का भ्रमण करने आते हैं। संग्रहालय रोजाना अपराह्न 2.30 बजे से सायं 5.30 बजे तक पर्यटकों हेतु खुला रहता है। यह केन्द्र, राजस्थान पर्यटन विकास निगम एवं स्थानीय प्रशासन की ओर से प्रत्येक वर्ष आयोजित किये जाने वाले 'ऊँट-उत्सव' की विभिन्न गतिविधियों में भाग लेता है।

संगठनात्मक स्वरूप

केन्द्र में उष्ट्र फार्म इकाई, अनुसंधान प्रयोगशालाएं, चर भूमि, आवासीय खण्ड और अतिथि गृह सहित 689 हैक्टेयर भूमि है। वर्ष 2005-06 के दौरान विभिन्न वर्गों के अन्तर्गत स्वीकृत पदों की संख्या 76 थी। जिनमें 1 निदेशक, 15 वैज्ञानिक, 20 तकनीकी, 9 प्रशासकीय तथा सहायक कर्मचारीगण सहित 19 कर्मचारी कार्यरत रहे।

बजट

वित्तीय वर्ष 2005-06 में योजना मद में 191.00 व गैर योजना मद में 280.00 लाख रुपये की धनराशि स्वीकृत की गई। दोनों ही मदों में लगभग पूरा व्यय किया गया।



अवसंरचनात्मक विकास के अन्तर्गत ही केन्द्र के पुस्तकालय को और अधिक आधुनिक व समृद्ध बनाया गया। इस वर्ष 643 हिन्दी पुस्तकें तथा 739 विज्ञान आदि विषय से सम्बन्धित पुस्तकों की खरीद की गई तथा कुल 1382 पुस्तकों की खरीद की गई। वर्तमान में केन्द्र के पुस्तकालय में कुल 4889 पुस्तकें उपलब्ध हैं।

अनुसंधान गतिविधियाँ

शुष्क एवम् अर्द्ध शुष्कपरिस्थितियों में ऊँटों की कार्यक्षमता में सुधार

शुष्क एवम् अर्द्ध शुष्क परिस्थितियों में ऊँटों की कार्यक्षमता में सुधार के अन्तर्गत प्रयुक्त ऊँटों की रक्त गैसों एवं अन्य सम्बन्धित प्राचलों पर अध्ययन किया गया। जिसमें 9 स्वस्थ ऊँटों से धमनीय रक्त नमूनें लेते हुए रक्त गैस के साथ विश्लेषित किये गये।

उष्ट्र दुग्ध त्वचा क्रीम

उष्ट्र दुग्ध वसा को मानव त्वचा की देखभाल के लिए एक समरूप मिश्रण के रूप में तैयार किया गया। इसे तीन माह तक विभिन्न स्त्रियों एवं पुरुषों को लगाने हेतु दिया गया और पाया कि त्वचा की चमक व चिकनेपन में क्रीम के उपयोग से निखार आया तथा सूखी/खुरदरी त्वचा को लम्बे समय तक मुलायम बनाए रखने में कारगर साबित हुई।

ऊँटनी के दूध एवं दुग्ध उत्पादों के प्रचार-प्रसार एवं व्यवसायीकरण हेतु मिल्क पार्लर की स्थापना कर इनकी बिक्री प्रारम्भ की गई। विदेशी एवं भारतीय पर्यटकों के साथ ही बाहर के लोगों तथा केन्द्र के स्टाफ में भी इन पदार्थों की स्वीकार्यता के प्रति उत्साहवर्धक परिणाम देखे गये। इससे केन्द्र को राजस्व में भी बढ़ोत्तरी हुई।

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

ऊँटों की शारीरिक भार एवं वृद्धिके अन्तर्गत 3 वर्ष तक की आयु के उष्ट्र की नस्ल व लिंग का, तीन माह के अन्तराल पर शारीरिक भार लिया गया। तत्पश्चात् 20 वर्ष की आयु तक के ऊँटों के वार्षिक भार सम्बन्धी वर्ष 1977-2006 तक की अवधि के आँकड़े विश्लेषित किये गये। ऊँटों में वृद्धि अवस्था उनकी आयु के 4 वर्ष से ऊपर तक निरन्तर रहती है। इसलिए इस वर्ष गहन विश्लेषण किया गया।

ऊँटों की शारीरिक भार एवं आयु के मध्य सम्बन्धों के अन्तर्गत चार आनुवंशिक समूहों एवं दो लिंग के आँकड़े लिए गए।

जनन क्षमता के अनुसंधान के अन्तर्गत समागम एवं वत्स जनन सम्बन्धी वर्ष 2005 से 2006 तक के आँकड़े लिए गए। समग्र वत्स जनन 87.5 प्रतिशत थी जिनमें बीकानेरी 83.33 प्रतिशत, जैसलमेरी 100 प्रतिशत एवं कच्छी 81.82 प्रतिशत रही। गर्भधारण दर 88.24 प्रतिशत रही जो कि पिछले वर्षों की अपेक्षा उच्च थी। इस महत्वपूर्ण सुधार



का कारण ऊँटों में दो बार (शून्य से एवं 72 घंटे के अंतराल पर) समागम निरंतर चयन एवं प्रजनन क्षेत्र में अच्छे नरों की प्राप्ति के कारण हुआ।

नस्ल, लिंग एवं आयुवार मृत्युदर अप्रैल, 2005 से मार्च, 2006 तक के आँकड़ें लिए गए। मादाओं में 45.45 प्रतिशत व नरों में 54.54 प्रतिशत मृत्युदर पायी गई। साथ ही वर्ष के दौरान उष्ट्र दुग्ध प्रोटीन जीन का आण्विक क्लोनिंग, चरित्रण एवं वर्धक विश्लेषण पर कार्य किया गया।

ऊँटों की नस्लों की कार्यक्षमता में सुधार हेतु चयन के अन्तर्गत प्रजनन योग्य नरों का शारीरिक माप/देह मापन लिया गया। जिसके अन्तर्गत ऊँटों की कार्यक्षमता पर शारीरिक लम्बाई एवं सम्बन्धित चिन्ह सार्थक प्रभाव डालते हैं।

ऊँटों की जनन क्षमता में सुधार और जनन अक्षमता के कारणों पर अध्ययन

ऊँटों की जनन क्षमता में सुधार के साथ-2 उपस्थित प्रजनन हारमोन्स का भिन्न अवस्थाओं में सान्द्रता का परीक्षण किया गया। केन्द्र की जनन प्रयोगशाला में ऊँटों की विभिन्न आयु की अवस्था में मद के दौरान व बाद में इस्ट्राडाऑल हारमोन्स का मात्रात्मक व क्रियात्मक अध्ययन में गाय व घोड़ी की ऊँट से तुलना की गई। किये गये प्रयोगों से यह देखा गया कि 8 ऊँटों के दो समूहों में औसत टेस्टोस्टीरोन से महत्वता पाई गई। जबकि सप्ताह में ली गई औसत में काफी अंतर देखा गया तथा साथ ही यह भी पाया गया कि टेस्टोस्टीरोन का लिबीडो तथा गुणांक के साथ कोई महत्व नहीं था।

ऊँट मद काल के दौरान ही 'झूठ' में आता है। यह उसकी वंशानुगत परम्परा है, जबकि वीर्य अधिकतम स्त्राव पर कई प्रयोगों से निष्कर्ष निकाला गया कि जनवरी व फरवरी माह में ही ऊँट से वीर्य अधिकतम मात्रा में प्राप्त होता है।

11 वयस्क ऊँट (जैसलमेरी) जिनकी उम्र 7-11 वर्ष थी, अनुसंधान हेतु केन्द्र से लिये गये तथा उनसे 70 वीर्य नमूने एकत्रित किये गये, जिनमें कुछ तो क्रायो-परिरक्षण हेतु प्रयोग में लिये गये जिनमें वीर्य में शुक्राणु की गतिज का अध्ययन किया गया। निष्कर्ष निकाला गया कि शुक्राणु गति 23.5 से 47.5 प्रतिशत ही रह गई, जब उसे एक बार हिमीकृत किया गया। तुलनात्मक ऊँटों में कोई मूल भिन्नता नहीं पाई गई।

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

अनुसंधान के अन्तर्गत 10 टोरड़ा/टोरड़ी (7-10 माह की आयु के) को दो समूह में बांटा गया। प्रथम समूह को गहन प्रबन्ध प्रणाली के अन्तर्गत रखते हुए सरस गोल्ड पशु आहार व मोठ चारा दिया गया तथा अर्द्ध गहन प्रबन्ध प्रणाली में रखे गये दूसरे समूह को केवल मोठा चारा दिया गया। 120 दिनों के पश्चात दोनों समूहों के तुलनात्मक



अध्ययन में कुल शारीरिक भार वृद्धि गहन प्रबन्ध प्रणाली के समूह में अधिक (65.20 कि.ग्रा.) रही जबकि अर्द्ध गहन में यह 35.60 कि.ग्रा.) पाई गई। आहार अन्तर्ग्रहण एवं पानी अन्तर्ग्रहण, गहन प्रणाली में ही कुछ अधिक रहा तथा 120 दिनों में चारा लागत (प्रति बच्चा प्रति दिन) तुलनात्मक रूप में गहन प्रणाली में अधिक देखा गया। परंतु प्रति कि.ग्रा. शारीरिक भार प्राप्ति हेतु कुल लागत कम थी एवं यह कम खर्चीला रहा। गहन प्रबन्ध प्रणाली में बच्चे का आहार अन्तर्ग्रहण सूची एवं व्यवहारात्मक स्वरूप प्रकट करता है कि 0-2 घंटे की अवधि में सान्द्रता अन्तर्ग्रहण अधिकतम (82 प्रतिशत) रहा जबकि आपूर्ति के 6-8 घंटे के दौरान आहार अन्तर्ग्रहण अधिकतम (57 प्रतिशत) था। साथ ही बच्चों द्वारा चरभूमि क्षेत्रों में व्यवहारात्मक स्वरूप एवं पेड़-पौधे की पसन्द का पता लगाया गया। प्रयोगात्मक समूह द्वारा प्रयुक्त आहार चारे के पौष्टिक मूल्यांकन सम्बन्धित प्राचल पर कार्य प्रगति पर है।

उष्ट्र बालों पर अध्ययन में इनकी उपादेयता के अन्तर्गत देशी नस्ल की विभिन्न आयु वर्ग के ऊँटों के वार्षिक बाल उत्पादन आँकड़ें विश्लेषित किए गए। बीकानेरी नस्ल के ऊँटों द्वारा जैसलमेरी एवं कच्छी नस्ल की तुलना में अधिकतम वार्षिक बाल उत्पादन रहा। न्यूनतम वर्ग विश्लेषण, वार्षिक बाल उत्पादन पर नस्ल एवं लिंग, सार्थक प्रभाव प्रकट करता है।

विस्तार, संचार एवं मानव संसाधन विकास सेवा योजना

किसान दिवस

केन्द्र में 3 मार्च, 2006 को किसान दिवस महत्वपूर्ण उद्देश्य के साथ मनाया गया। इसके अन्तर्गत ऊँट पालकों/किसानों को उष्ट्र प्रबन्धन की नूतन तकनीकी, आहार चारे में सुधार, उष्ट्र जनन, प्रमुख बीमारियों व उनका रोग निदान, नस्ल निर्धारण एवं उष्ट्र उत्पादों – दूध, बाल इत्यादि की जानकारी दी गई। ऊँट पालकों को चारा ईंटें बनाने की मशीन, पारम्परिक ऊँट गाड़े में विद्युतिकरण की जानकारी दी गई।

प्रदर्शनियां

केन्द्र द्वारा वर्ष के दौरान 5 प्रसार प्रदर्शनियों का आयोजन किया गया। इनमें ऊँटों के पालन-पोषण की नई जानकारी, जनन एवं प्रबन्धन तथा केन्द्र द्वारा ईजाद नवीन तकनीकियां प्रदर्शित की गई।

तकनीकी का हस्तांतरण

पारंपरिक ऊँट गाड़े में विद्युतिकरण की तकनीकी के हस्तांतरण/लोकप्रियता हेतु प्रयास/कार्य किया गया। साथ ही उष्ट्र दुग्ध उत्पादों को बनाने के क्षेत्र में फिल्ड स्तर पर कार्य किया गया। सुगन्धित दूध, लस्सी, चीज, पनीर, कॉफी एवं चाय, राष्ट्रीय एवं अन्तरराष्ट्रीय पर्यटकों को पिलाते हुए वैज्ञानिकों द्वारा इस सम्बंध में उनके मत लिये गये।



यह प्रदर्शित किया गया कि केन्द्र द्वारा तैयार विद्युत चालित पारम्परिक दो पहिया ऊँट गाड़ा से, रात्रि समय में ऊँट गाड़े द्वारा होने वाली दुर्घटनाओं की सम्भावनाओं को काफी हद तक रोका जा सकता है।

किसान गोष्ठी

केन्द्र द्वारा वर्ष के दौरान 8 किसान गोष्ठियों के आयोजन के साथ भाग लिया गया। किसानों को इन विभिन्न अवसरों पर ऊँटों के नवीन रख रखाव के बारे में बातचीत तथा लघु पुस्तिकाओं के माध्यम से जानकारी दी गई। वैज्ञानिकों द्वारा किसानों से ऊँट पालन सम्बन्धी पारम्परिक जानकारी का पुनर्निवेशन (फीड बैक) लिया गया।

केन्द्र की अनुसंधान गतिविधियों की जानकारी

इस वर्ष के दौरान केन्द्र में आए विभिन्न प्रशिक्षार्थियों, देशी व विदेशी सैलानियों, वैज्ञानिकों, छात्रों, पशुपालकों, रक्षा अधिकारियों, गैर सरकारी संस्थाओं, भारतीय एवं विदेशी शिक्षार्थियों, पत्रकारों, युवाओं, किसानों तथा कृषक महिलाओं इत्यादि को केन्द्र में चल रहे अनुसंधान कार्यों से जुड़ी गतिविधियों, उष्ट्र पालन तथा नवीनतम तकनीकी संबंधी जानकारी दी गई।

समन्वय

केन्द्र द्वारा वर्ष के दौरान विभिन्न गैर सरकारी संस्थाओं यथा—लोकहित पशु पालन संस्थान, सादड़ी, पाली, उरमूल डेरी ट्रस्ट बीकानेर, कृषि विज्ञान केन्द्र, बीछवाल तथा अन्य जैसे— केन्द्रीय भेड़ एवं ऊन अनुसंधान संस्थान, अहिलानगर तथा राजस्थान कृषि विश्वविद्यालय, बीकानेर से समन्वय स्थापित किया गया। जिसके अन्तर्गत उष्ट्र बालों, दूध, त्वचा के विभिन्न उपयोग को लोकप्रिय बनाने हेतु कार्य किया गया। उष्ट्र बालों, त्वचा इत्यादि से उत्पाद तैयार करने की संभाव्यता का अन्वेषण किया गया।

राजस्व उत्पादन कार्यक्रम

इसके अन्तर्गत पर्यटकों हेतु प्रवेश शुल्क, फोटोग्राफी, उष्ट्र सवारी तथा उष्ट्र दूध तथा बालों की बिक्री आदि के द्वारा राजस्व एकत्रित किया गया।

उष्ट्र बीमारियों का पर्यवेक्षण, निगरानी एवं नियंत्रण

उष्ट्र सर्ज की सीरम व्यापकता एवं संयुग्मी का उत्पादन एवं मान्यकरण

इसके अन्तर्गत उष्ट्र से विलगित ट्रिपोनासोमा एलबिनो चूहों में आंतर पर्युदर्या संरोपण हेतु रखे गये। परजीवी तरल नाइट्रोजन के रूप में 196° से. व 80° से. न्यूनतम पर भी रखे गये।

इसके अन्तर्गत कुल 413 रक्त नमूनों में केन्द्र से लिए गए 215 रक्त नमूनों में परजीवी की दृष्टि से ट्रिपेनोसोमा



संक्रमण में नकारात्मक पाये गये। शेष 198 अन्य फार्म क्षेत्रों/गाँवों से लिए गए। इनका आर्द्र आलेप जाँचते हुए 2 नमूनें ट्रिपेनोसोमा संक्रमण में सकारात्मक पाये गये तथा सक्रिय गति में देखे गये।

प्रतिवेदन की अवधि में 88 उष्ट्र सीरम, ट्रिपेनोसोमासिस में प्रतिरक्षी की मौजूदगी का विश्लेषण किया गया।

इसमें प्रतिजन, नियन्त्रण, प्रतिरक्षी नियन्त्रण, संयुग्मी नियन्त्रण जैसे उचित नियन्त्रण वर्तमान अध्ययन में शामिल रहे। साथ ही ट्रिपेनोसोमोसिस के आण्विक निर्धारण के अन्तर्गत शोध कार्य किया गया।

स्वदेशी सूत्र द्वारा निर्मित औषधियों से प्रभावित ऊँटों का उपचार

अनुसंधान के अन्तर्गत खुजली रोग के उपचार हेतु पूर्व में तैयार दो मिश्रण निरन्तर जारी रखते हुए केन्द्र के अधिकाधिक ऊँटों पर इन्हें मूल्यांकित किये गये। चरणबद्ध रूप में इन सूत्रणों के क्लिनिकल (रोग लक्षण) एवं औषधीय गुण के आधार पर इन्हें केन्द्र तथा केन्द्र के अलावा इनका उपयोग करने वालों को दिये गये। केन्द्र पर प्रारम्भिक अध्ययन के पश्चात इनके आशाजनक परिणाम की पुष्टि के अन्तर्गत औषधीय अभ्यास हेतु ग्रामीणों, पशु चिकित्सा केन्द्रों एवं ऊँट पालकों से सम्पर्क साधते हुए कार्य किया गया।

इसके अधिशोधन एवं भेषजगुण विज्ञानीय अध्ययन से पूर्व औषधि की प्रभाविता तथा इसके प्रति वास्तविक पुनर्निवेशन प्राप्त किया गया।

वर्ष के दौरान प्रथम सूत्रण में तैयार औषधि जिज्ञासा लिए हुए रही।

द्वितीय सूत्रण में तैयार औषध समान विस्तार में रही परंतु इस हेतु और अभ्यास किया जाना अपेक्षित है।

दोनों सूत्रण में तैयार औषध तीव्र खुजली, त्वचा प्रगाढ़न एवं वलीयन, त्वचा-विदारण में उपयुक्त पाई गई।

चर्मोदभिद/जीवाणु में चयनित औषध का चिकित्सीय स्पेक्ट्रम एवं प्रतिरक्षा मोल्डटरी भूमिका के अध्ययन के अन्तर्गत त्वचा छीलन लेते हुए शोध कार्य किया गया साथ ही विभिन्न वनस्पतियों की औषधीय उपयोगिता का भी मूल्यांकन किया गया।

ऊँटनियों में थनैला रोग पर अनुसंधान

ऊँटों में आंतरस्तन संक्रमण में प्रति ऑक्सीकारक खनिज आहार के प्रभाव के अन्तर्गत इन्हें दो समूहों में बांटा गया। 30 दिनों की समाप्ति पर खनिज आहार समग्र 54.4 प्रतिशत (12/2) संक्रमण में स्पष्ट पाया गया जबकि नियन्त्रित समूह में संक्रमण का 15 प्रतिशत स्वयं साध्य (3/20) पाया गया। स्थानीय उपलब्ध औषधीय पौधों के प्रति जीवाणुक एवं प्रति कवकी गुणधर्म के अध्ययन के अन्तर्गत एलोवेरा, नींबू, करेला एवं प्याज की अपेक्षा लहसुन में समग्र संवेदनशीलता अधिक प्रकट हुई।



ऊँटों में अनुकूलतम उत्पादन हेतु चारा आवश्यकताओं एवं चारा स्रोतों के मूल्यांकन पर अध्ययन

शोध के अन्तर्गत गर्भित मादा ऊँटनियों की निष्पादकता एवं उनके नवजात बच्चों के जन्म भार ऊर्जा एवं प्रोटीन का भिन्न-2 स्तर पर प्रभाव के अन्तर्गत कुल 12 मादाओं के समूहों में 564.67 कि.ग्रा. शारीरिक भार वाली मादाओं को चुना गया। इन्हें ग्वार भूसा, मूँगफली चारा एवं सांद्रता मिश्रण (समूह 1-9 प्रतिशत कच्ची प्रोटीन एवं 50 प्रतिशत कुल पाचक तत्व, समूह 2-10.5 प्रतिशत कच्ची प्रोटीन एवं 55 प्रतिशत कुल पाचक तत्व, समूह 3-12 प्रतिशत कच्ची प्रोटीन एवं 60 प्रतिशत कुल पाचक तत्व) की खुराक पर रखे गये। इन्हें अच्छे हवादार बाड़ों में, सुबह 1 घंटा रोजाना घुमाना तथा स्वच्छ पानी के आधार पर रखा गया। तीनों समूहों में ऐच्छिक शुष्क पदार्थ अन्तर्ग्रहण/100 कि.ग्रा. शारीरिक भार बराबर मूल्य का देखा गया।

भिन्न-2 समूहों में शुष्क पदार्थ एवं अन्य निकटस्थ सिद्धांत का पचनीयता गुणक (EE को छोड़कर) लगभग समान देखा गया। यह प्रकट करता है कि राशन में प्रोटीन का स्तर एवं ऊर्जा, पौषक तत्व की पचनीयता पर सार्थक प्रभाव नहीं डालता है।

वर्तमान अनुसंधान में समूह 1 में पौष्टिक तत्व की तुलना अन्य चारा मानकों के साथ देखी गई। समूह 1 में सीपी एवं एमई अन्तर्ग्रहण 85 प्रतिशत, दो समूह में सीपी लगभग समान एवं एमई अन्तर्ग्रहण 90 प्रतिशत था जबकि समूह तीन में सीपी अन्तर्ग्रहण 113 प्रतिशत तथा 95 प्रतिशत था। तीनों समूह की गर्भित ऊँटनियों में वजन प्राप्ति सांख्यिकी दृष्टि से सार्थक देखी गई।

समूह 1,2 व 3 में शारीरिक भार प्राप्ति (1.01,1.22 एवं 1.44 कि.ग्रा./दिन) प्रकट करती है कि सीपी एवं एमई आहार सार्थक भूमिका अदा करते हैं।

परिणाम दर्शाते हैं कि तीनों राशन पौष्टिक तत्व उपयोगिता में समान है तथा ऊँटों के बच्चों को पौष्टिक तत्व आपूर्ति करने में सक्षम पाये गये तथा शारीरिक भार प्राप्ति में भी उत्तरदायी है। यद्यपि पेड़ों की पत्तियों की अधिक मात्रा का समावेश लागत घटक के रूप में उच्च लागत के रूप में शामिल हैं।

पशु उत्पादन के लिए पोषक तत्वों की उपयोगिता व चारा स्रोतों में सुधार

ए.आई.सी.आर.पी. के अन्तर्गत मरुप्रदेश के चार कृषि क्षेत्रों जिसमें लगभग 8 जिलों का व्यापक सर्वेक्षण किया गया। जिलों की लगभग 16 तहसीलों से मृदा, खून व चारे के खनिज संगठन हेतु नमूने एकत्र किये गये। जिसके आधार पर यह निष्कर्ष निकाला जा सकता है कि लगभग 67.2 प्रतिशत प्रक्षेत्र में बारानी खेती होती है व 32.8 प्रतिशत प्रक्षेत्र में सिंचाई की जाती है। लगभग 320 किसानों का, जो ऊँट रखते हैं, साक्षात्कार किया गया जिसमें से लगभग 41.25 प्रतिशत किसानों के पास 3 से 5 हैक्टेयर के बीच जमीन है, लगभग 46.88 प्रतिशत किसान, ऊँट अपने घरेलू



इस्तेमाल के लिए ही पालते हैं, ये किसान लगभग (90 प्रतिशत) ऊँटों को नमक खिलाते हैं।

सर्वेक्षण के दौरान किये गये मृदा परीक्षणों से यह तथ्य सामने आया कि दीर्घ तत्व कैल्शियम 1.3 मिली मिइक्वी. / 100 ग्राम मृदा, मैग्नीशियम 14.0 पीपीएम तथा फॉस्फोरस 10.5 किलो प्रति हैक्टेयर पाये गये जो कि प्रचुर मात्रा में थे। इसी के साथ सूक्ष्म पोषक तत्वों का विश्लेषण करने पर यह पाया गया कि चारों कृषि जोन में औसतन लोहा 3.5 पीपीएम, मैगनीज 5.49 पीपीएम व सिलेनियम 3.50 पीपीएम पाया गया जो कि एक प्रचुर मात्रा है, जबकि कोबाल्ट 0.3 पीपीएम, जिंक 0.46 पीपीएम तथा कॉपर 0.22 पीपीएम पाये गये जो कि सामान्य मात्रा से कम है।

रक्त के नमूनों का परीक्षण करने पर यह पाया गया कि लोहा (3.7 माइक्रोग्राम प्रति एम एल) को छोड़कर जिंक, कॉपर व कोबाल्ट की मात्रा सामान्य से कम आंकी गई। उष्ट्र प्रबन्धन का अध्ययन करने पर यह निष्कर्ष निकाला गया कि 59.38 प्रतिशत ऊँट पालक घर पर बनी दवाइयों का प्रयोग करते हैं जबकि कुल में से 40.63 प्रतिशत पशु चिकित्सालय से ऊँटों का ईलाज कराते हैं।

प्रत्येक क्षेत्र में पांव (38.13 प्रतिशत) बीमारी सबसे अधिक देखी गई। लगभग 43.13 प्रतिशत उष्ट्र पालक 2-5 उष्ट्र रखते हैं। इनमें से 20 प्रतिशत प्रजनन के लिए ऊँटों का उपयोग करते हैं। इन ऊँट पालकों में 76.50 प्रतिशत चराई के लिए ऊँटों को चरागाह में भेजते हैं।

अधिकतर किसान लगभग 60 प्रतिशत ऊँटों को एक ही तरह का चारा देते हैं। 39 प्रतिशत उष्ट्र पालक मिश्रित चारा ऊँटों को खिलाते हैं। सर्वेक्षण में यह भी पाया गया कि जोन 2 के अतिरिक्त कोई भी उष्ट्र पालक, ऊँटों को हरा चारा नहीं खिलाता है। गर्भावस्था के दौरान सांड को मेथी व गुड़/तिल, गुड़/तेल, बाजरी का आटा, अजवाइन इत्यादि लगभग 63 प्रतिशत किसानों द्वारा दिया जाता है।



2. EXECUTIVE SUMMARY

During 2005-06. The staff strength of centre was 64 as against approved cadre strength of 76. It consists of one RMP, 15 Scientists, 20 Technical, 9 Administrative and 19 Supporting. The budget allocation under Plan was. Rs. 191.00 lakhs and under Non plan Rs.280.00 lakhs which was fully utilized. The revenue resource of centre was. Rs. 16.66 lakhs as against target of Rs.15.00 lakhs.

The opening and closing strength of farm camel herd was 239 and 261, respectively which belongs to mainly 3 breeds Bikaneri, Jaisalmeri, Kachchhi and a few crossbred camels. A total 11 camels died and 7 were auctioned due to old age and other reasons. Breeding input was provided through superior studs to the she camels of camel owners of near by villages free of cost during the breeding season.

Research on six major projects, AICRP Scheme and collaborative programmes were carried out.

Physiology

(a) Blood gas profile and other related biochemical para-meters of working camels were estimated.

(b) Technology testing of "Camel milk skin cream" has shown encouraging result in 3 months trail both in ladies and gents of different age groups with marked improvement in fairness of skin & its smoothness and decline in roughness of skin. The spread of cream per unit area was excellent. Cream can be easily preserved safely for 3 months period with the preservative used.

(c) Technology of camel products" (Kulfee, Lassie, Flavoured milk and Coffee etc.) after its final improvement and testing was opened for sale by opening a camel milk parlour at the main gate of centre for its popularization. The overall response was very encouraging, sale of camel milk & products have also been started by poly packaging.

Genetics breeding

(d) Analysis of body weight data at 3 months interval upto 3 years of age and annual body weights upto 20 years of age over the years indicated that growth phase in camel continue upto 90 to 100 months and its relationship between body weights and age is non linear.

This year, the reproductive performance of farm herd remained excellent. The overall calving was 87.5% and in Bikaneri 83.33%, in Jaisalmeri 100% and in Kachchhi 81.82%. The conception rate was 88.24% per cent whcih was better than previous years.

Based on body length and other related traits were having significant effect on draughtability 5 Bikaneri, 4 Jaisalmeri and 3 Kachchhi males were selected for breeding purpose during the year.



(e) The α lactalbumin and β casein gene promoter fragments were amplified and characterized. The *Ecoli* JM109 line was procured and competent cells were prepared.

The respective promoter fragments were successfully cloned and the inserts were released and characterized.

Reproduction

(f) Plasma estradiol 17 beta concentration in unmated female camel during follicular phase 20-21 days of breeding was studied. The present finding shows that concentration of the hormone remained high in unmated females throughout breeding season compared to cow and mare.

Correlation analysis reveals that copulation time and volume of semen are correlated with changes in plasma testosterone concentration. The result indicates that it takes several weeks time to improve libido after onset of endocrine surge. Similarly it takes several weeks time to improve for cessation of libido after withdrawal of testosterone surge.

(g) Post thaw motility of different semen samples varied from 0-55% and 37% semen samples were adjudged to be fit for insemination based on post thaw motility. Post thaw motility of duplicates of same semen samples varied significantly. The post thaw motility was maintained for relatively shorter period when incubated at 37°C as compared to at 4°C.

(h) Ultrasound monitoring of post parturient, females and rebreeding by virile studs after 45 days can be beneficial in improving reproductive efficiency in 30-35%, females and thus can reduce inter calving period by 270-300 days.

Camel Management

(i) The calf rearing under different management systems reveals that under semi intensive system, calves devote 70% time for grazing and 30% time for resting during 6 to 7 hours period in range-land area, browsing pattern indicated first preference for khejari followed by Jal tree etc, where as under intensive system, the concentrate intake was maximum 82% during 0-2 hours, and fodder intake was highest 57% during 6-8 hours of supply.

(j) Under extension activity "Kisan Divas" was organized on 3rd March, 2006 at the centre during the year, 5 in and out campus exhibitions and 7 Kishan Gosthies were arranged at the time of livestock fairs, camel festival etc. Three handouts were released.

Camel Health

(k) Out of 413 blood samples examined (of which 215 were collected from farm) were found parasitologically negative for trypanosome infection and remaining 198 samples collected from field, two samples were found positive and five more samples were found positive after rat inoculation.



Detection of parasite specific DNA confirmed the active carrier status of infection. Amplification and further characterization of cysteine protease gene may help in study of insigent parasite in greater extent.

The effect of antioxidants, mineral feeding on intra mammary infection in camel reveals that 30 days of mineral feeding could clear, 54.4% of infection, where as in control group self cure of 15% was observed only.

(l) The Ig content was observed to be highest in colostrum after parturition 15.82 mg/ml and decreased gradually by 4 week 2.33 mg/ml. The experimental trail on 3 groups of calves fed with colostrum, other group camel milk and 3rd group received herbal immuno modulator reveals that apart from feeding milk alone till 3 months of age some supplements / immuno modulators can be given so that better growth rate can be achieved.

Nutrition

(m) Comparison of 3 different rations in advance pregnant female camel indicates almost similar nutrient utilization and were able to meet the nutrient requirement of camel calved with reasonable body weights gains. The average birth weight of new born calves in 3 groups was 43.25, 42.25 and 44.2 kg respectively. The average weight gain of pregnant she camels in Bikaneri, Kachchhi and Jaisalmeri varied between 65.7 to 75.2 kg. during last 3 months. However, cost factor of ration is important.

Survey of macro and micro minerals in soil and fodders was carried in eight north west districts of the state which comes under 5 agro ecosystem. In all 320 respondents were interviewed. The concentration of Copper in the soil was deficient in all the zones. Zinc contents in the soil of zone II and I were at marginal level where as in other zone it was deficient. Iron, Manganese inclusive of selenium content in soil were sufficient.

During the year 20 research articles were published, about 29 abstracts were submitted for presentation in seminars / symposia / workshop and 15 popular articles were published.

About 48 Biotechnology students form various colleges had undergone one month training about 29 post graduate students of Biotechnology and microbiology were provided 2 months training and 8 postgraduate students under gone 4 months training during the year.



3. INTRODUCTION

The National Research Centre on Camel, Bikaner is located in the Jorbeer area at a distance of about 10 km from Bikaner city. The geographical location is 28.3° North Latitude and 73.5° East Longitude at MSL of 234.84 m. The topography of the area is arid undulating desert with vast range of sand dunes. The soil type is mostly loose and sandy. The climate is mostly dry and hot with an average annual rainfall of around 25 mm. The temperature ranges between 30 to 46 °C in summer and between 4 to 28°C in winter season. Centre was established on 5th July 1984. Prior to that the Centre was known as Camel Breeding Farm under the aegis of College of Veterinary and Animal Sciences Rajasthan Agricultural University, Bikaner and earlier to that with Animal Husbandry Department, Govt. of Rajasthan, Jaipur.

The camel population of the world is 19.32 million. Africa is having the highest camel population of 15.13 million and in Asia it is 4.17 million (FAO 2002). Population of camel in India is 0.632 million (Livestock Census, 2003) and it ranks sixth in the world after Somalia (6.2 million), Sudan (3.2 million), Mauritania (1.2 million), Ethiopia (1.07 million) and Pakistan (0.8 million)

The Centre has the mandate to conduct basic and applied research for the improvement of camel. Over the years, NRCC, Bikaner has developed excellent modern laboratory facilities and infrastructure. The Centre has generated substantial scientific databases and technologies on various aspects of Indian camel. An elite herd of important indigenous camel breeds viz., Bikaneri, Jaisalmeri and Kachchhi have been developed and maintained at the Centre. The Centre has also generated useful data on double humped camel found in Nobra Valley of Laddakh region of Jammu & Kashmir (India) for its conservation and future utility.

The Centre has been identified as one of the important tourist places of Bikaner and is included in the tourist map of Rajasthan as well as in various foreign tourist guides. The Centre has developed an excellent camel museum, which attracts the attention of researchers and tourists. Every year thousands of foreign and Indian tourists visit the Centre. The Centre's museum remains open on all days from 2.30 PM to 5.30 PM for the visitors and also provides Camel ride facility on payment basis. The Centre regularly participates in the Camel Festival organized by Rajasthan Tourism Development Corporation and Local Administration, every year.

3.1 Mandate

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



3.2 Past achievements

Draught and Work Physiology

- Useful baseline data have been generated on draughtability, riding, ploughing capacity and fatigue index of Indian camel.
- Bikaneri camels are superior than Jaisalmeri and Kachchhi for endurance, draught, whereas, Jaisalmeri breed performs better for riding/race.
- Heart girth, height at wither, body weight and body length of camel are positively correlated with horsepower and draught.
- The work rest cycle indicated 2 hours rest to be sufficient after 4-6 hours continuous work. The indices for formulating a fatigue index card have been identified.
- Best camel can pull camel drawn harrow for a maximum of 1 hour, while under similar conditions, a 2 Tyne plough can be pulled continuously for 4 hours.
- Colostrum showed higher lysozyme activity than milk.
- Camel milk products (kulfee, coffee, flavoured milk, lassie & soft cheese) have been developed, improved and are available for sale at center's milk parlour with good encouraging response.
- Camel milk skin cream developed at the Centre was evaluated & improved it showed positive response in imparting lustre and smoothness to skin with fast spreading.

Camel Genetics and Breeding

- Characterization of indigenous Bikaneri, Jaisalmeri and Kachchhi breed was done on the basis of phenotypic appearance, biometry, body weight, milk, hair production and molecular aspects.
- An elite herd of three important indigenous breeds of camel viz., Bikaneri, Jaisalmeri and Kachchhi has been developed.
- The restriction enzyme digestion of camel genomic DNA indicated probable existence of higher equimolar concentration of satellite DNA and probable internal periodicity spanning of about 100-200 bp.
- The RAPD-PCR showed enough genetic variation between and within dromedary breeds. Reproducible Polymorphic bands with varying frequencies among the three breeds of camel were obtained with five primers.
- Camel hair and its blends with wool, silk waste and polyester showed good future prospects and can be an additional source of income for the rural cottage industry. Various products viz., shawls, twine



and floor coverings can be prepared. The hair quality and production was superior in Bikaneri followed by Jaisalmeri and Kachchhi breeds.

- The average milk production is about 4.0 litres per day in Bikaneri camels. Morning milk production was higher as compared to evening and lactation length can continue up to 14-16 months without any supplementation.
- In the microsatellite analysis of three Indian camel breeds, 16 loci have been studied. The number of alleles ranged from 2 to 7. The Nei's expected heterozygosity ranged from 0.289 to 0.815 and the polymorphic information was from 0.267 to 0.791. The genetic distances between the three Indian breeds indicated close phylogenetic relationship between Bikaneri and Kachchhi breeds as compared to Bikaneri and Jaisalmeri and Kachchhi and Jaisalmeri.
- Six databases viz., Inventory of the camel herd, biometry database, breeding tract database of Jaisalmeri camel, Reproduction database, Health database, and Production database, have been developed and are being updated regularly.
- PCR-RFLP analysis at k-casein and MHC-DRB3 loci in livestock species was carried out.
- Body weight data revealed significant breed effect at 9, 12 and 24 months of age.
- PCR amplification of α -lactalbumin gene promoter fragment using camel DNA was standardized, at annealing temperature of 62°C and a PCR product of 880 bp was obtained, eluted and characterized with BamHI, HaeIII and HinfI.

Camel Reproduction

- Camel semen has been successfully cryo-preserved, though success rate is yet to be improved. Sonographic monitoring of pre-ovulatory follicle, induction of ovulation with exogenous hCG and AI with frozen thawed semen was attempted in limited number of females and successful conception at day 40 has been confirmed.
- Techniques of superovulation, embryo collection and transfer in camel have been attempted successfully and two camel calves have been borne after transplantation.
- Studies on poll glands indicated higher cellular activity and large quantity of androgens during breeding season. It is closely associated with male reproductive function.
- Reproductive efficiency of camel can be increased by 10 to 15 per cent by providing two matings at 0 hr and second at 72 hr interval with average calving percentage of 75 to 80.
- Screening of farm herd against brucellosis by Rose Bengal Plate Test for the whole herd was found to be negative.



Camel Nutrition

- Analysis of commonly available local feed resources (fodders, trees & bushes) in Bikaner region indicated higher crude protein values in tree leaves followed by bushes/shrubs, leguminous crops and grasses.
- Nutrient intake and utilization of growing calves, dry, pregnant, lactating camels and breeding studs have been worked out.
- During scarcity of grazing in the field, feeding of guar phalgati along with green jaal @ 5 kg/camel/day can sustain the body weight of the grazing camel calves.
- For optimum and economic utilization of available feed resources, feed blocks have been prepared and which have been successfully utilized by the camels.
- Feeding complete feed block was adjudged to be advantageous over dry fodder in respect to milk production, reduced feed wastage, body weight gain, nutrient intake and metabolic profile in female camels and reduced body weight loss, higher protein, energy and nutrient utilization in rutting males.
- Status of micro and macro minerals were estimated in fodder and soil in different arid and semiarid districts of Rajasthan.

Camel Health Research

- Mortality in new born calves can be reduced considerably at farm following improved management and health care practices, as compared to field where it is around 20 to 30%.
- Disease surveillance in camels indicated that sarcoptic mange and trypanosomosis are the major parasitic infections. Mange incidence can be reduced significantly by adaptation of regular grooming and monthly washing of each animal.
- The preliminary studies on role of raw camel milk as nutritional adjuvant in human tuberculosis were undertaken. The patients were given standard therapy along with raw camel milk @1 lt/day as supplement. Emphatically improved appetite and body weight, no pus formation, radiological improvement in terms of lung expansion was found in patients supplemented with camel milk. A significant increase in Hb%, reduction in ESR and TLC was noticed in patients. The level of micro mineral (Zinc) increased significantly in patients supplemented with camel milk.
- Immunoglobulin absorption was maximum up to 72 hours after parturition in calves while slight alteration was noticed thereafter till one month.



- *In vitro* antibacterial sensitivity of commonly available herbs (vegetables) against intramammary infections revealed maximum antibacterial sensitivity by garlic followed by karela and onion whereas aloe vera didn't exhibit any antibacterial activity.

Camel Management

- Comparative study of camel carting vs. bullock carting under hot arid region indicated that camel carting is more profitable for the small and marginal farmers due to higher cost benefit ratio and short pay back period.
- Camel carting is a subsidiary source of income of unemployed rural youth during lean and draught period for turning their economy viable in hot arid Thar desert.
- The average cost of rearing camel is Rs 40-50/camel/day when it is used under carting and the average daily income from carting ranges from Rs. 250 to 300/- in cities and around Rs. 150/- in villages.

Extension activities

- Free breeding input is provided to she camels belonging to camel keepers/farmers, which are brought from nearby villagers every year through genetically improved sires during breeding season.
- Free distribution of genetically improved studs to Panchayat samities/herd owners through State Animal Husbandry Department, Jaipur (Rajasthan).
- Animal Health Camps in adopted village, Kisan Gosthies and Kisan Divas at the Centre were organized.
- Centre participated in the local Camel Festival and other National and State level Livestock Fairs and exhibitions.

3.3 Infrastructure

The infrastructure facilities include Livestock Farming Unit, Research Laboratories, Small Animal House-cum laboratory, ARIS cell, Agricultural Farm Unit & Farm Rangeland, Residential complex, Guest House, Camel Museum, New Library cum Administrative building. New Pathology laboratory along with New Community Centre and Milk Parlour have been added during the year.

Livestock farm: The farm maintains a camel herd of about 260 camels comprising of three indigenous breeds viz. Bikaneri, Jaisalmeri and Kachchhi. The unit is equipped with one camel Dispensary and a field Disease Diagnostic Laboratory, 6 sheds, 3 camel boxes, one separate metabolic shed with provision of individual feeding. The unit also has feed and fodder godown and two weigh bridges (one mechanical and other electro-mechanical). The farm rangeland area, (block No.1 & 2)



have alternate unit of 4 camel corrals, dispensary, new fodder godown, spray yard for camels, post-mortem room & pit, with road connectivity.

Laboratories: NRC on Camel has excellent modern laboratories at 2 different locations. The main complex is having Camel Physiology cum Biochemistry, Molecular Genetics, Camel Reproduction, Camel Health Research, Milk and RIA laboratories. Another complex has Camel Nutrition and Field Camel Reproduction laboratories. The main complex also has one conference hall with a capacity of 120 seats. During the year Genetics and Camel Health Research laboratory has been renovated and modified. Separate Small Animal laboratory & new building of Pathology laboratory have been added.

Library: During the year library has been shifted to the new administrative cum library building. It possesses total of 4889 books. It provides Internet, documentation, reference, current awareness services, CD-ROM literature scanning through CD-ROMs of VETCD, AGRIS and other publications. The library also provides photocopying, document scanning and printing facility. During the year a total of 1382 books were procured of which 643 Hindi and 739 were Scientific Books.

ARIS Cell: It provides Internet connectivity with email facility to all sections through VSAT. Windows based 20 nodes Local Area Network (LAN) is successfully running at Centre under Window Back Office Server. The E-mail server named nrccamel has been created. The ARIS Cell is maintaining various databases. Centralized Laser, Inkjet black and colour printing facilities have been provided to all sections. In addition it also has broadband connectivity facility.

Rangeland: The NRC on Camel has a total of 689 ha. land partitioned in 5 blocks with two tube wells located in Block No.1 & 2. About 35 ha. of land has been brought under perennial silvipasture comprising of grasses, shrubs and trees. Main grasses are sewan (*Lasiurus indicus*) and Blue panic (*Panicum antidotale*). About 3000 plants planted by the unit were provided care along with 7000 plants planted by Rajasthan Forest Department, Bikaner which were handed over to the Centre while performing requisite agricultural operations along with 4000 plants of AICRP. Sowing of fodder crop seeds in about 25 ha. was carried out in paddock No. 1 and 2, under AICRP scheme. Various agricultural operations performed in the direction to improve the fodder resources on long-term basis keeping in view of the grazing behaviour of camel and its requirements. Manuring of farm area was carried out under AICRP.

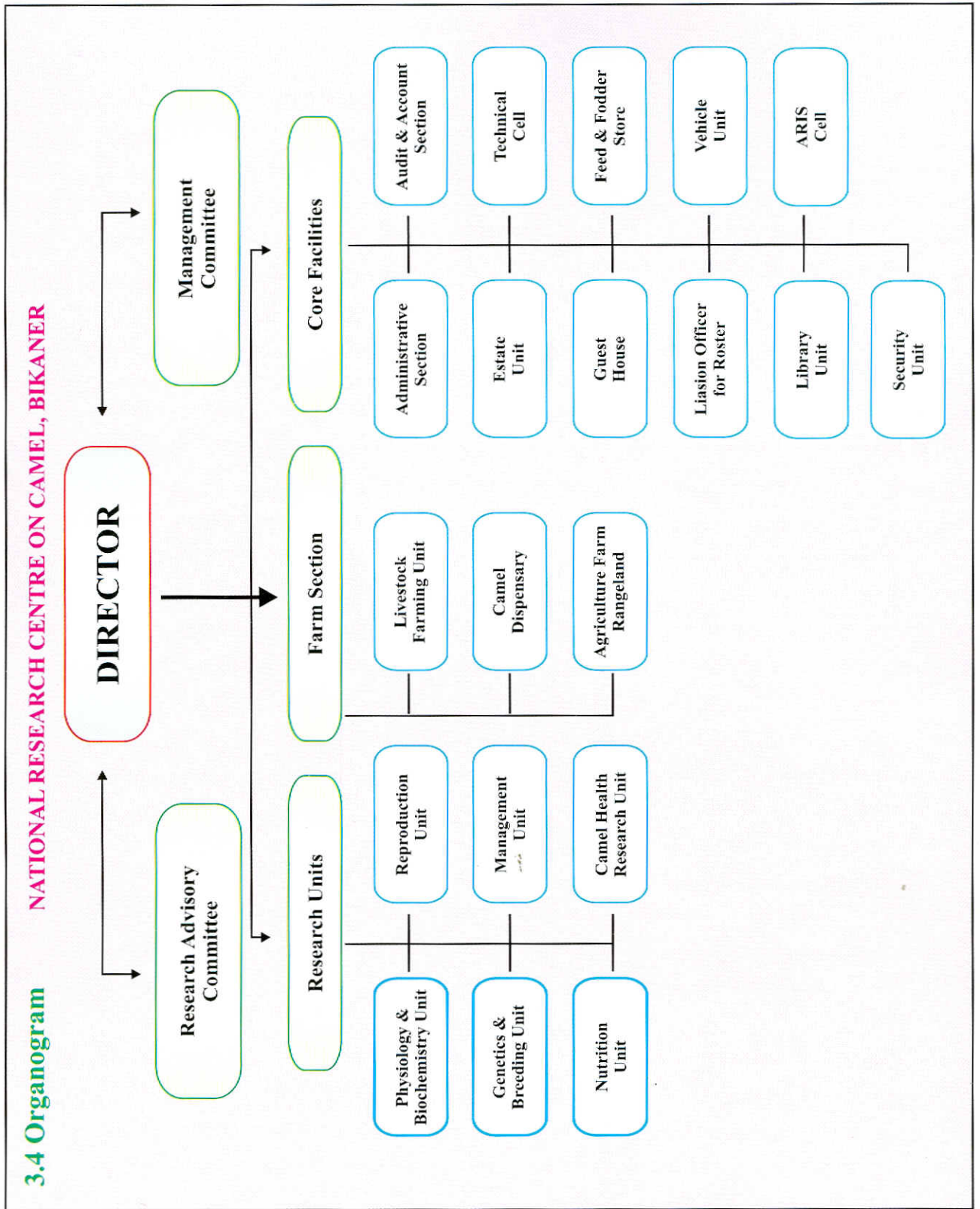
Residential complex: Residential colony of Centre possesses a total of 36 quarters at two locations which includes 2 type V, 5 type IV, 6 type III, 9 type II and 14 type I staff quarters.

Guest House: Centre has a small guesthouse with a total of 6 rooms which includes two VIP suits, 2 AC rooms & 2 other rooms non AC & it can accommodate 12 guests. A new lobby has been added in the guest house during the year.



INTRODUCTION

3.4 Organogram NATIONAL RESEARCH CENTRE ON CAMEL, BIKANER



3.5 Staff Position (2005-06)

Cadre	Sanction	In position	Vacant
RMP	01	01	-
Scientist	25	15	10
Technical Category I	10	09	01
Category II	07	07	-
Category III	04	04	-
Administrative	10	09	01
Supporting	19	19	-
Total	76	64	12

3.6 Financial Statement and revenue receipt (2005-06)

(In Lakhs)

Head of account	Non Plan		Plan	
	Budget	Expenditure	Budget	Expenditure
Estt. Charge	148.00	147.99	-	-
Wages	-	-	19.97	14.41
O.T.A	0.20	0.23	-	-
T. A	1.45	0.96	2.50	1.48
HRD	-	-	3.00	2.90
Other Charges including Equipment	27.00	27.04	180.88	180.28
Works	14.35	14.35	73.65	73.65
Total	191.00	190.57	280.00	272.72

Revenue receipt/ generation 16.66 lakhs. Achieved more than the target it did not include the recovery from P. loans.



4. RESEARCH ACHIEVEMENTS

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

Sub-project 1 : Studies on blood gases and other related parameters in working camel

Project leader : Aminu Deen

Associate : Gorakh Mal

Arterial blood samples were collected from 9 healthy camels and were analyzed with blood gas analyzer (pHOx plus C; Nova Biomedical). Average values (Table 4.1.1) for pH, pCO₂, pO₂, SO₂, Na⁺, K⁺, Cl⁻, HCO₃⁻ and TCO₂ were 7.23±0.26, 35.07±6.88mm Hg, 109±9.37mm Hg, 93.23±4.23%, 151.62±11.64 mmol/l, 4.17±0.58 mmol/l, 124.12±12.88 mmol/l, 17.16±7.37 mmol/l and 18.31±7.22 mmol/l respectively.

Table 4.1.1 : Blood values from normal healthy camels (MeanSE)

pH	pCO ₂ (mmHg)	pO ₂ (mmHg)	SO ₂ (%)	Na ⁺ (mmol/l)	K ⁺ (mmol/l)	Cl ⁻ mmol/l)	HCO ₃ ⁻ (mmol/l)	TCO ₂ (mmol/l)
7.23± 0.26	35.07± 6.88	109± 9.37	93.23± 4.23	151.62± 11.64	4.17± 0.58	124.12± 12.88	17.16± 7.37	18.31± 7.22

Sub-project 2 : Evaluation of camel milk proteins and their applications

Project leader : Raghvendar Singh

Associates : Aminu Deen, S. K. Ghorui, S.K. Bhure, M.S. Sahani

4.1.1. Production of camel milk casein enriched powder

To evaluate the health benefit effect of camel milk protein, about 6 Kg camel milk casein enriched powder was prepared by standardized protocol. The camel milk was filtered, pasteurized by HTST method and cooled to 2-5°C for overnight. The calcium chloride was added at the rate of 0.02 percent followed by 50 percent diluted HCl at the rate of 4ml per liter and heated to 21°C. After addition of rennet at the rate of 50 mg per litre, it is kept for setting at 25°C for an hour. The primary and secondary phases of rennet coagulation, the hydrolyzed casein enriched camel milk coagulum called as curd is formed. It was further processed for cooking at 42°C, de-wheyng, washing at 26°C, 15°C and 10°C, drying at 50 to 80°C and finally followed by grinding of dried curd and was used as test diet in assessing its role in anti type-1 diabetes. The detailed evaluation of amino acids, mineral and other biochemical properties are under progress.



4.1.2. Camel milk skin cream:

The camel milk fat has potential for development as natural food and cosmetics products, since the milk fat is different from other animals. The average diameter of camel milk fat globule is comparatively smaller (2.70 micron) and distributed evenly in the milk during standing. The unique feature of camel milk fat globule is that it exhibits the highest surface area (2.29 m² for 1 g of fat) and represents highest average creaming parameter as compared to other dairy animals. The ratio of fat to solids average is 40.9. The percent by weight values of fatty acid analysis viz, butyric acid, caproic acid, caprylic acid, capric acid, lauric acid, myristic acid, myristoleic acid, palmitic acid, palmitoleic acid, stearic acid, oleic acid, linoleic acid and arachidic acid ranged from 0.31-0.75, 0.2-0.6, 0.2-0.3, 0.2-0.4, 1-1.8, 15.9-25.2, 1.7-4.5, 35-29.5, 6.1-19.1, 1.9-11.7, 6.8-24.9, 0.9-2, and 0.6-3.4 respectively. Camel milk has lower Reichert value of 16.4, low content of short chain fatty acids and high concentration of volatile fatty acids especially linoleic acid and the polyunsaturated fatty acids that are medicinally beneficial.

Formulation and its composition:

Whole fresh raw milk was collected from healthy lactating camel herd maintained under semi intensive management system at the NRCC, Bikaner. The milk was processed by centrifugation at 4000 rpm at 4°C for 10 minutes and the upper cream layer was separated. The cream was analyzed for moisture content to standardize the formulation and accordingly the percent of other ingredients glycerol, preservative (methyl and propyl paraben and BHA), sandal powder, perfume, deionized water and ethanol were added followed by homogeneous mixing. The preparation was kept overnight for its settlement and saturation. Finally it was packed as per requirement in suitable packaging material for further use in skin care.

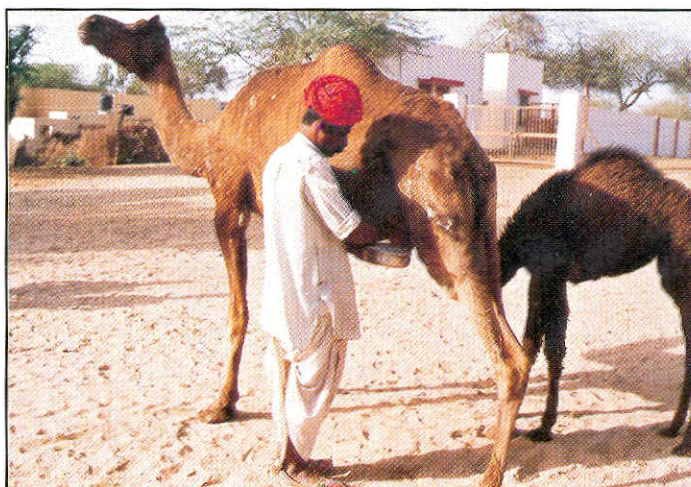


Fig.4.1.1 Camel milking

Test Trial:

Considering high content of some trace minerals, essential fatty acids, antioxidant property and smaller fat globule size and quality of fat, camel milk skin cream was formulated. The formulated camel skin cream was evaluated as "human skin care cream" and given to the different age groups of males and females for its application on their skin. The feed back was recorded after 3 months of its applications. Three month initial trials were very encouraging and it was observed that it improves the shining and smoothness of skin. There was no irritation, sensitization reactions of skin. Two applications per day were more beneficial and do not impart any oily effect on the skin. It



has shelf life of three months at room temperature. Further research to extend the shelf life and the improvement in formula for 100% natural components as well as to test against different skin ailments is ongoing. For better results, before application of cream it should be rubbed thoroughly by hand palm.

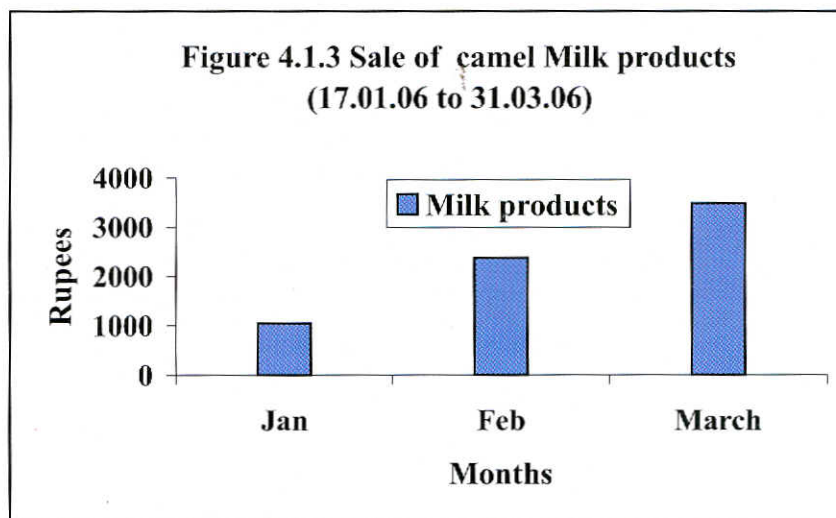
4.1.3 Assessment of commercial viability of camel milk and its value added products:

Considering the merits of camel milk various value added camel milk products were developed, standardized and evaluated at the Center successfully.

In order to popularize and promote the utilization of camel milk and its products at commercial level and to assess the sustainability of camel in future, “Camel milk parlour” (Fig.4.1.2) was started by the Center as facility for sale of exclusively camel milk and milk products viz. lassie, soft cheese or powder, flavored milk, kulfee, tea and coffee. It will also be a source for revenue generation in future and help in creating large scale awareness about camel milk and its products among the people. Overwhelming response in sale and the acceptability of these camel dairy products is being received from national and foreign tourists visitors as well as other outsiders and students. (Fig 4.1.3).



Fig.4.1.2 Camel milk parlour



RESEARCH ACHIEVEMENTS



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

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

Project Leader : S.C.Mehta

Associates : M.S.Sahani, U.K.Bissa, B.L.Chirania, C.Bhakat, F.C.Tuteja and S.K. Bhure

Body weight and growth

The body weight of camel breeds and sexes were initially recorded at an interval of three months up to the age of 3 years. Thereafter, annual weights were taken up to the age of 20 years. The data were analysed for the period 1977-2006. (Table 4.2.1-4.2.3). As proposed earlier that the growth phase in camels continue beyond 4 years of age and hence this year analysis was carried out. Initially the data for the camels of 6 and more than 6 years of age was pooled and the growth phase was considered up to the age of 5 years as per the previous contention. The relationship between body weight and age of the camel for the four genetic groups and two sexes has been presented in Figure 4.2.1 and 4.2.2 showing that the relationship is almost linear. Subsequently the data were analysed up to the age of 20 years and seven different mathematical equations viz. Linear, Quadratic, Cubic, Compound, Growth, Exponential and Logistic were utilized and the coefficients were calculated (Table 4.2.4, Figure 4.2.3). The R^2 values were also calculated to select the best fit. The Gompertz curve (Fig 4.2.4) was also drawn to assess its suitability for the explanation of body weight in camel on the basis of age of the animal. It was found that the growth phase in camel continues up to 100 months and the relationship between the body weight and age is non-linear. The Cubic regression curve showed the best fit and the R^2 values ranged from 0.985 to 0.993 for the four genetic groups and from 0.993 to 0.994 for the both sexes (Table 4.2.5 and Figure 4.2.5).

Reproductive parameters

The information on mating and calving performance of the Center's herd for the year 2005-2006 is presented in Table 4.2.6. This year the reproductive performance remained excellent. The overall calving was 87.5%, with Bikaneri 83.33%, Jaisalmeri 100% and Kachchhi 81.82%. The conception rate was 88.24% which is better than the previous six years performance (Figure 4.2.6). The reasons for this significant improvement can be attributed to two mating at zero and 72 hours interval along with the continuous selection and procurement of good males in time from the breeding tract. Out of the she camels bred under the research schemes, 24 were conceived. This year there were 3 abortions and 8 new born calves died. The majority of the calves which succumbed to death were born in the month of April and May, 06. This year April and May months were very hot. The stress management may be paid attention to reduce such mortality in future.



Mortality at NRCC herd

Breed, sex and age wise mortality for the period April, 2005 to March, 2006 is presented in Table 4.2.7. In all 3 Bikaneri, 5 Jaisalmeri, 2 Kachchhi and one Arab cross camel died. The involvement of digestive and reproductive systems was 36.36% each. One camel (9.09%) died due to the involvement of cardio-vascular system. The mortality was 45.45% in females and 54.54 % in males. The age group wise classification indicated 63.63% mortality in camels greater than 3 years of age followed by 18.18 % each in calves up to 1 year of age and 1 to 3 years of age.

Field improvement

The opening balance of Centre's herd was 239 camels and the closing balance was 261 camels. From March 1985 to March, 2006 this Centre has distributed 74 Bikaneri, 7 Jaisalmeri and 1 Kachchhi male for genetic improvement in the field. (Table 4.2.8).

Table 4.2.1: Growth of camel calves birth to 27 months (weight in kg)

Age	Bikaneri	Jaisalmeri	Kachchhi	Crossbred	Male	Female	Pooled
0	37.61	36.89	36.35	35.54	37.11	37.07	37.09
3	87.56	84.89	82.62	81.09	81.96	88.43	85.67
6	147.90	151.45	146.42	132.33	143.01	151.96	148.43
9	180.25	187.60	185.04	165.25	187.15	179.38	182.52
12	210.01	211.71	203.33	185.55	211.13	206.78	208.56
15	228.35	236.19	235.00	201.09	235.03	227.53	230.77
18	239.39	245.16	243.67	183.25	242.73	237.07	239.23
21	256.73	263.85	262.47	179.60	261.38	254.62	257.02
24	265.31	277.69	273.20	218.67	267.34	270.23	269.09
27	287.74	302.16	300.29	245.40	302.65	287.23	292.96



Table 4.2.2. Growth of Camel 30 to 120 Months (weight in kg)

Age	Bikaneri	Jaisalmeri	Kachchhi	Crossbred	Male	Female	Pooled
30	303.23	306.42	317.33	300.00	317.84	298.01	305.64
33	325.81	325.51	318.82	298.00	328.16	320.51	323.13
36	345.92	347.95	343.81	339.11	349.00	344.45	346.14
48	409.89	405.25	383.90	376.11	408.85	400.51	403.37
60	467.86	457.44	461.55	376.00	469.50	456.09	460.16
72	508.78	527.74	492.44	411.33	545.83	488.44	510.19
84	531.71	569.53	516.06	479.00	581.62	509.56	541.76
96	548.26	597.95	558.67	508.00	614.33	528.69	569.80
108	567.80	596.03	558.63	544.67	638.32	526.81	575.97
20	574.67	595.76	548.50	530.50	636.53	541.55	575.88

Table 4.2.3. Growth of Camel - 132 to 240 Months (weight in kg)

Age	Bikaneri	Jaisalmeri	Kachchhi	Crossbred	Male	Female	Pooled
132	599.14	594.61	553.38	595.00	644.74	551.80	585.73
144	594.48	559.46	533.33	560.33	622.52	549.33	569.83
156	581.00	566.30	556.50	569.43	635.73	547.86	570.98
168	584.81	546.82	500.00	581.75	648.44	550.41	566.45
180	581.20	555.60	542.67	578.86	645.20	560.30	569.73
192	548.00	541.78	541.00	561.20	609.60	538.94	547.56
204	596.83	552.20	470.00	568.00	647.33	568.86	576.22
216	596.93	535.58	-	572.00	651.60	552.79	569.83
228	582.40	536.40	554.00	-	716.00	551.43	558.91
240	541.60	598.67	518.67	-	654.67	523.38	548.00



Table 4.2.4. Regression coefficients and R² values in different mathematical models.

Dependent	Mth	R ²	b0	b1	b2	b3
POOLED	LINEAR	0.715	237.086	1.9068		
POOLED	QUADRATIC	0.962	126.419	6.1302	-0.0192	
POOLED	CUBIC	0.993	77.2785	9.5583	-0.0580	0.0001
POOLED	COMPOUND	0.520	204.354	1.0061		
POOLED	GROWTH	0.520	5.3199	0.0060		
POOLED	EXPONENTIAL	0.520	204.354	0.0060		
POOLED	LOGISTIC	0.676	700.00	0.0032	0.9871	

Table 4.2.5. Regression curve estimates for prediction of body weight of different breeds and both sexes of camel

Dependent	Mth	R ²	b0	b1	b2	b3
BIKANERI	CUB	.993	75.9396	9.6501	-.0600	.0001
JAISALMERI	CUB	.990	71.4556	10.2883	-.0652	.0001
KACHCHHI	CUB	.986	78.7486	9.5559	-.0604	.0001
CROSS	CUB	.985	73.7315	7.6061	-.0376	.0006
MALE	CUB	.993	71.7684	9.9951	-.0568	.0001
FEMALE	CUB	.994	77.1550	9.6433	-.0656	.0001



Table 4.2.6. Reproductive Performance of the Camel Herd (2005-2006)

Year	Traits	Bikaneri			Jaisalmeri			Kachchhi			Pooled
		Farm	R	Total	Farm	R	Total	Farm	R	Total	
2005	Mating	22	-	34	11	-	26	14	-	16	47+R
	Conception	18	2	20	11	9	20	11	1	12	40+12
		(81.82%)			(100%)			(78.57%)			(85.11%)
	Calving M	10	0	10	5	7	12	7	1	8	22+8
	F	5	0	5	6	2	8	2	0	2	13+2
	Total	15	0	15	11	9	20	9	1	10	35+10
		(83.33%)			(100%)			(81.82%)			(87.50%)
2006	Mating	16	-	31	12	-	19	6	-	12	34+R
	Conception	13	1	26	11	7	18	6	4	10	30+24
		(81.25%)	³		(91.67%)			(100%)			(88.24%)

R- She camels bred under various research schemes.

Table 4.2.7 : Breed, Sex and Age Wise Mortality at NRCC, Bikaner (2005-2006)

System	Breed				Sex		Age group			Pooled
	Bikaneri	Jaisalmeri	Kachchhi	Arab cross	M	F	0-12 Months	1-3 Years	Above 3 Years	
Digestive		3	1		2	2	1		3	4
Respiratory	2	1		1	3	1	1		3	4
Cardio-vascular			1			1			1	1
Genital										
Urinary										
Nervous										
Others	1	1			1	1		2		2
Total Mortality	3	5	2	1	6	5	2	2	7	11



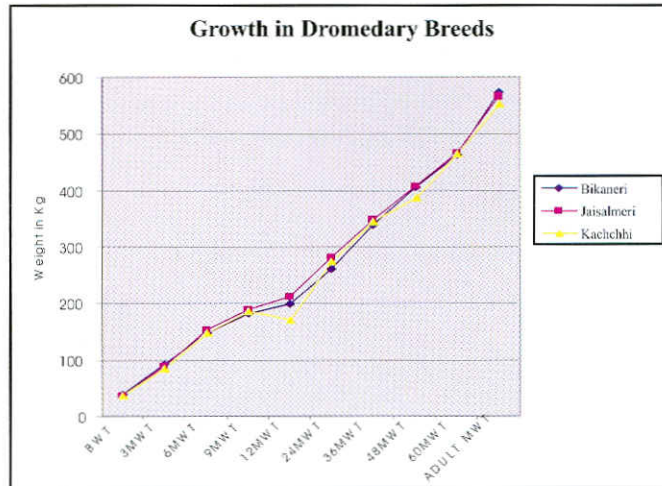


Fig 4.2.1. Growth in dromedary breeds.

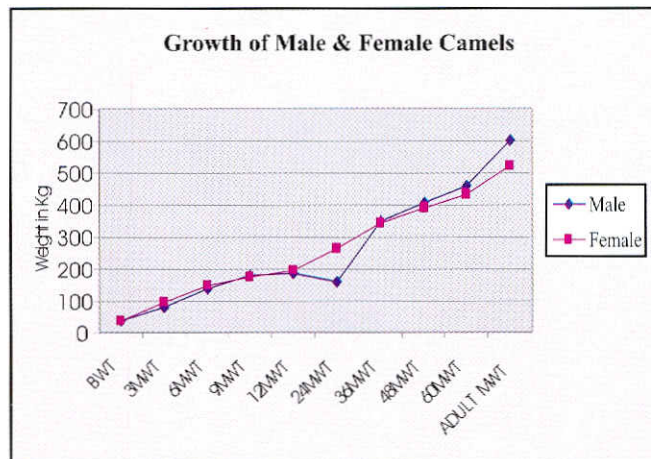


Fig 4.2.2. Growth of male and female camels

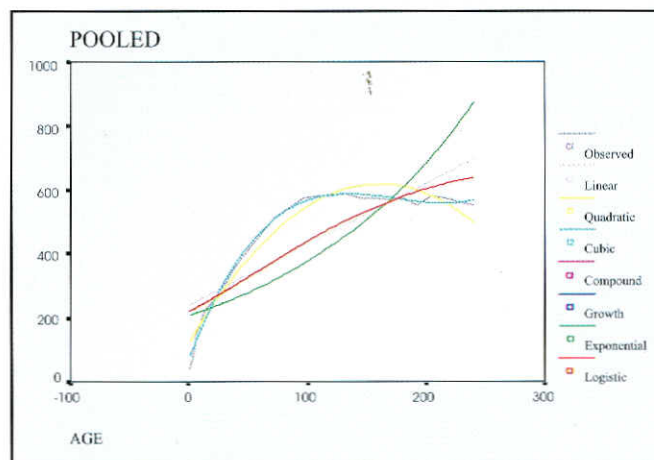


Fig 4.2.3: Comparison of observed growth pattern with different regression curve estimates (pooled breeds).



Table 4.2.8. Camel herd strength (2005-2006)

Breed Age	Opening 1-04-05		Calving		Purchased		Raj. Govt.	Died		Auction		Closing 31.03.06	
	M	F	M	F	M	F	M	M	F	M	F	M	F
Bikaner													
0-1 Yr	3	8	8	4								8	4
1-2 Yr	3	6							1			3	8
2-3 Yr	6	8										3	5
3-4 Yr	3	5					1					6	8
>4Yr	12	42						1	1	1		12	46
Total	27	69	8	4			1	1	2	1		32	71
Jaisalmeri													
0-1 Yr	4	2	11	8					1			9	6
1-2 Yr	5	3						1				6	3
2-3 Yr	1	-										4	3
3-4 Yr	4	1										1	-
>4Yr	30	38						3		5		26	39
Total	44	44	11	8				4	1	5		46	51
Kachechi													
0-1 Yr	3	1	7	2								7	2
1-2 Yr	6	3										3	1
2-3 Yr	2	2								1		6	3
3-4 Yr	-	2										2	2
>4Yr	5	21							2			5	21
Total	16	29	7	2					2			23	29
AxB													
0-1 Yr	3	-	1					1				1	-
1-2 Yr	-	-										2	-
2-3 Yr	-	-										-	-
3-4 Yr	-	-										-	-
>4Yr	2	5								1		1	5
Total	5	5	1					1	1	1		4	5
Grand Total	92	147	27	14	-	-	1	6	5	7		105	156



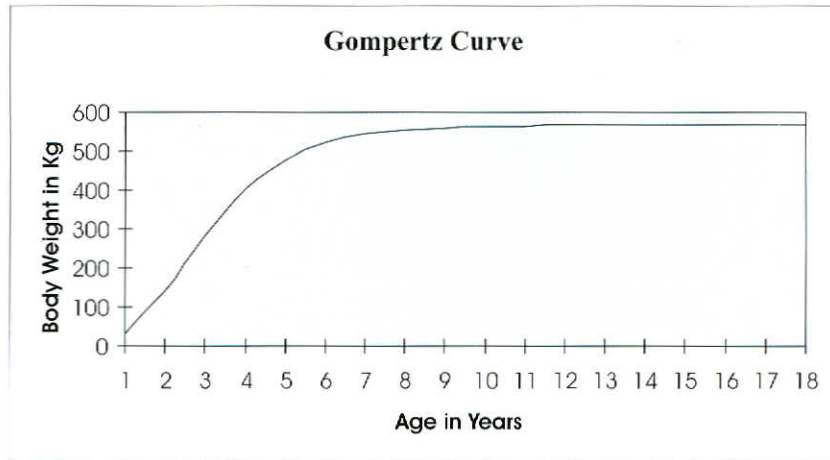


Fig 4.2.4. Gompertz curve of dromedary growth data.

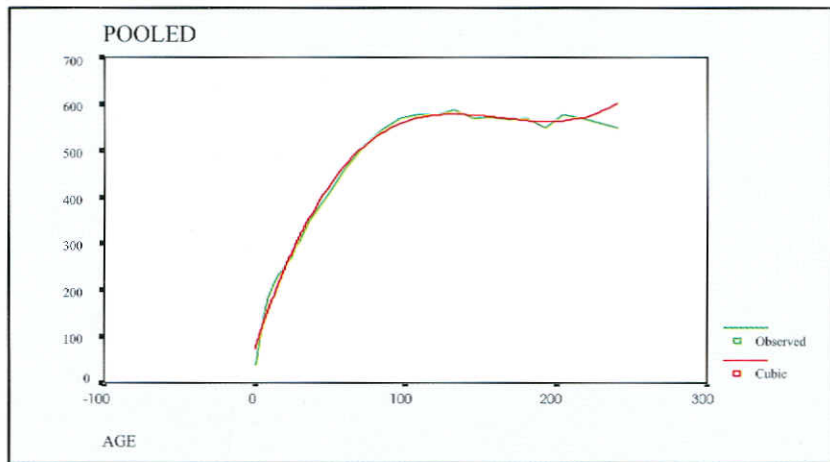


Fig 4.2.5. Observed and cubic regression curve of growth of camels (pooled).

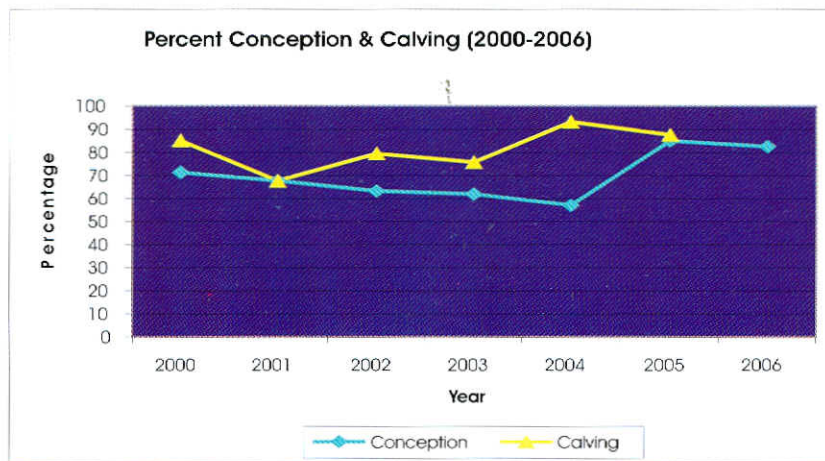


Fig 4.2.6. Reproductive performance of Centre's camel herd

RESEARCH ACHIEVEMENTS



Sub project 2 : Selection for the improvement of draughtability of camel breeds

Project Leader : S.C.Mehta

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

Body measurements of all breedable males of the Centre were recorded in November, 2005. The effect of breed, age and sex on body measurements were given in the earlier reports. Based on the literature the body length and related traits have significant effect on draughtability, 5, 4 and 3 males, respectively of Bikaneri, Jaisalmeri and Kachchhi breed were selected mainly on the basis of body length (Table 4.2.9) and following independent culling level for the other two traits. Of these one male of Bikaneri and one of Jaisalmeri breed was not used for farm breeding.

The number of available females has increased due to post partum breeding of females under reproduction experiment. The growth of herd is thus expected to increase significantly.

BREEDING PLAN

After selection of breeding males of the three breeds, the pedigree of the breedable females was studied and following suggestions were given for breeding Centre's camel herd:-

Avoid herd mating.

Farm born stud should not be used on a female related to it either through sire or dam

Table 4.2.9. Breeding plan for the year 2005-2006.

Breed	Available females (Approx)	Studs to be used for breeding	Sire	Dam	Females Bred
Bikaneri	21	620 Godu	Purchased		12
		622 Modu	Purchased		11
		624 Rodu	Purchased		5
		474 Sohanki ka beta	285	151	
		480 Kajalki ka beta	47	78	3
Jaisalmeri	12	228 Fatiya	Purchased		6
		218 Punia	Purchased		3
		232 Champia	Purchased		10
		222 Hatiya	Purchased		
Kachchhi	8	90 Anchi ka beta	213	305	3
		114 Patel	Purchased		1
		116 Ghantel	Purchased		8



Sub Project 3 : Molecular genetic studies in Indian camel.

Project Leader : S.C. Mehta

Associates : S.K. Bhure and M.S. Sahani

21 samples of Kachchhi and 13 samples of Jaisalmeri were collected from the breeding tract and included in the experiment. The CVRL series of microsatellite was analysed. Five microsatellites were polymorphic and three were monomorphic. The number of alleles ranged from 3 to 5. The observed and expected heterozygosity along with PIC was calculated. So far 33 microsatellite primer pairs were procured and 28 were successfully amplified and analysed. 18 were found polymorphic in Indian camel breeds. The analysis of entire data is in progress.

Sub Project 4 : Molecular cloning, characterization, and promoter analysis of the camel milk protein gene(s)

Project Leader : Dr. Sanjeevkumar Bhure (up to 6.2.2006)

Dr. S. C. Mehta (From 7.2.2006)

Associates : Dr. Raghvendar Singh, Dr. M.S.Sahani

The α -lactalbumin and β -casein gene promoter fragments were amplified and characterised. The *E.Coli* JM 109 line was procured and the competent cells were prepared. The transformation reagents were prepared and the cells were transformed successfully. The respective promoter fragments were successfully cloned and the inserts were released and characterized. Sequencing of the cloned fragments was carried out. Two sequences have been deposited in the NCBI GenBank with accession numbers AM259943 (1799bp) and AM 259960 (812 bp). The alphalactalbumin gene promoter in dromedary has now been amplified up to 1800 bp and this sequence will be *de novo*.

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

Sub project 1 : Plasma Estradiol-17 beta concentration in unmated female camels in follicular phase during 20-21 days of breeding season :

The average daily oestradiol profiles in peripheral plasma harvested at 6 h intervals of 4 unmated female camels over 20-21 days have been presented in Table 4.3.1. It varied from 10.3 ± 9.9 to 373.5 , 48.1 ± 7.1 to 241.0 ± 60.6 , 41.5 ± 12.2 to 303.8 ± 155.6 and 36.2 ± 7.3 to 240.3 pg/ml plasma in different animals. The statistical analysis of the levels of oestradiol 17 beta revealed that differences were not significant over different days in 2 animals, while a few significant differences over the days were observed in remaining 2 animals. In general, the concentration of this hormone observed in present study was greater than those reported previously.



Table 4.3.1: Daily (Mean ± S.E.) Estradiol-17 β profiles of 4 female camels over 20 days

Animal No.	D 1	D 2	D 3	D 4	D 5	D 6	D 7	D 8	D 9	D 10
349	10.3 ±9.9	44.3 ^a ±5.9	55.8 ^b ±13.7	48.2 ^c ±2.9	71.2 ±28.2	72.7 ±16.4	78.0 ^{c,**} ±8.1	45.5 ^{d,**} ±7.8	68.6 ±9.5	74.0 ±12.6
345	131.2 ±31.4	155.4 ±3.3	131.2 ±31.6	212.3 ±19.3	172.2 ±73.0	204.4 ±72.6	168.0 ±67.4	241.0 ±60.6	208.9 ±76.0	74.4 ±7.1
109	90.1 ±15.4	64.4 ±9.4	73.7 ±18.2	67.6 ±7.7	57.4 ±4.5	72.2 ±17.2	63.8 ±6.7	303.8 ±155.6	213.3 ±113.4	56.1 ±4.1
489	36.2 ±7.3	53.3 ±18.7	42.0 ±10.2	113.4 ±42.6	60.6 ±12.4	65.1 ±25.7	41.2 ±2.8	36.3 ±4.3	48.8 ±1.7	47.5 ±2.6
D 11	D 12	D 13	D 14	D 15	D 16	D 17	D 18	D 19	D 20	D 21
80.3 ^e ±10.9	83.4 ±19.6	88.0 ±23.9	57.7 ±7.0	104.5 ^B ±25.4	95.0 ^{A,D} ±18.2	48.5 ^E ±2.4	102.0 ±45.1	65.8 ±17.0	120.9 ±66.2	373.5
76.9 ±7.7	48.1 ±7.1	107.0 ±8.9	64.3 ±8.3	53.5 ±4.3	89.4 ±20.5	72.1 ±7.6	66.8 ±8.7	79.3 ±8.9	116.7 ±22.9	159.06 ±68.8
75.8 ±15.3	88.1 ±15.1	99.4 ±21.5	130.6 ±60.7	159.1 ±72.8	81.5 ±38.7	127.3 ±31.9	118.5 ±44.3	87.3 ±17.0	54.0 ±3.8	41.5 ±12.2
65.5 ±19.3	46.0 ±4.4	49.0 ±1.7	151.5 ±79.9	94.8 ±45.2	73.8 ±30.5	53.1 ±7.0	67.0 ±9.5	74.9 ±37.7	128.7 ±	240.3

The present study findings also verify the concept that concentration of this hormone remained high in unmated female camels throughout breeding season. Compared to the cow and the mare the levels of estradiol in the estrous cycle of camel were higher. It is possible that higher level of estradiol in the camel is due to development of more follicles in the estrous cycle. This phenomenon is probably associated with the fact that the camel does not have a luteal phase and its ovaries are consistently producing active follicles. It is expected that high levels of this hormone in non-pregnant female camels can only be possible due to ovarian follicles secreting this hormone in peripheral circulation. This gives an indication that follicles capable of estradiol secretion are almost always present in an unmated female camel during the breeding season.

Sub project 2 : Abolition of sexual drive in male camels after rut- correlation with testosterone profiles

To evaluate “ If the libido and sexual function differences in male camels during post rut phase viz. abolition of libido vs. good libido is due to their current testosterone profiles?

Collection of semen was accomplished by artificial vagina method. The libido, copulation in AV and semen donation during mid January- February months was adjudged to be equivalent in all the camels. But at post rut stages, i.e. mid April to mid June, the sexual drive of these camels



differed greatly. Based on their copulation reaction (Good/ Poor), copulation time, volume of semen ejaculate and pattern of semen ejaculation during mid April- mid June 2004, the animals were divided into 2 groups of 4 camels each. Group A comprised of 4 male camels which maintained sexual drive and performed in artificial collection of semen equivalently well to that of rut period. Group B comprised of another 4 male camels which exhibited continual loss of sexual drive, erectile dysfunction of penis, less powerful thrust in artificial vagina, low copulation time and no or low ejaculate volume. Blood was collected from these animals at ½ hr intervals for 6 hrs continually once in a week over 8-9 weeks period of study for analysis of testosterone by Radioimmunoassay (RIA). Means of copulation time and semen ejaculate volume of 2 groups were compared by students-t test. One way analysis of variance was used to compare overall average testosterone profiles of 2 groups for 8-9 weeks period, average weekly testosterone profile and average overall individual testosterone profile of 8 camels.

Results on copulation reaction, copulation time, erectile penile dysfunction, volume of semen ejaculate, number of no, low and normal ejaculate in 8 camels of 2 groups of post rut phase have been presented in Table-4.3.2.

Table 4.3.2 : Copulation reaction, copulation time, erectile penile dysfunction and semen ejaculation in 8 camels of 2 groups during post rut phase.

Group/ Camel No.	No. of attempts for semen collection	Copulation reaction			Copulation time (Sec)	Number of erectile penile dysfunction	Volume of semen (ml)	No ejaculates	Low ejaculates	Normal ejaculates
		Good	Fair	Poor						
Group A										
1	10	8	1	1	249.9 ± 22.2	0	3.25 ± 0.47	0	4	6
2	7	7	-	-	281 ± 49.9	0	3.14 ± 0.49	0	2	5
3	6	4	6	1	264.6±62.7	0	2.91±0.52	0	0	6
4	6	6	-	-	197.1±24.5	0	1.55 ±0.18	0	1	5
Total	29	25	2	2	249.4±19.4	0	2.79±0.25	0	7	22
Group B										
5	8	-	-	8	152±40.6	2	0.71±0.18	2	6	0
6	7	-	-	7	105.3±9.9	1	0.42±0.23	4	3	0
7	7	-	-	7	51±24.9	5	0.45±0.42	5	1	1
8	3	-	-	3	43.3±43.8	2	0.33±0.33	2	1	0
Total	25	-	-	25	95±18.4	10	0.51±0.14	13	11	1



Copulation reaction:

There was no significant difference during peak of rut in 2 groups of camels. But during post rut stages the performance of 2 groups was not similar. On average Group A camels were adjudged to exhibit good, fair and poor grade copulation in AV on 25, 2 and 2 out of 29 occasions, respectively, which was much better than the performance of Group B camels which were adjudged to exhibit good, fair and poor grade of copulation in AV on 0, 0 and 25 out of 25 occasions, respectively.

There was no significant difference during peak of rut in 2 groups of camels. But during post rut stages the performance of 2 groups was not similar. Average copulation time in seconds of Group A camels (249.4 ± 19.4) was significantly higher ($P < 0.01$) than Group B camels (95 ± 18.4).

It was not observed in any of the 2 groups of camels during peak of rut phase. But during post rut phase, it was different in 2 groups. Group A camels never (0%) showed erectile penile dysfunction, while Group B camels exhibited complete erectile penile dysfunction on 10 out of 25 attempts (40%).

The ejaculate volumes during peak of rut were equivalent in both the groups. But, during post rut phase, it was different between 2 groups. Average volume of semen ejaculate measured significantly greater ($P < 0.01$) (2.79 ± 0.25 ml) in group A camels than group B (0.51 ± 0.14). No, low and normal volume ejaculate were observed to be 0/29 (0%), 7/29 (24.1%) and 22/29 (75.8%) in Group A as compared to 13/25 (52%), 11/25 (44%) and 1/25 (4%) in Group B camels.

Testosterone profile

The mean \pm S.E. of plasma testosterone concentration for the two groups of camels has been presented in Table 4.3.3. The overall mean \pm S.E. of plasma testosterone profiles was measured 1641.7 ± 77.5 and 2253.7 ± 110.5 pg/ml in two groups, respectively. Analysis of variance revealed that average testosterone profiles in group B were significantly higher ($p < 0.01$) than group A.

Overall mean \pm S.E. of individual profiles of 8 camels of two groups, analysis of variance and critical difference have been presented in Table 4.3.4, which indicate significant individual differences in testosterone profiles within and between groups. In both the potent as well as impotent groups, individuals with relatively high (208), group A (2509.6 ± 212.2), (222 (2353.8 ± 151.3) and 226 (4200.7 ± 250.7) of group B), middle (218, Group A (1648.0 ± 123.0)) and low testosterone (224 (1113.3 ± 85.1) and 214 (1149.5 ± 77.9) Group A, 128 (1109.5 ± 75.3) and 122 (823.1 ± 46.8) of group B) concentrations were observed.

Individual weekly mean \pm S.E. profiles of camels along with critical differences at 5 and 1 % levels are presented in Table- 4.3.5 and it is obvious that the variation between and within animals are evident in majority of the animals.



These results indicate that the testosterone concentration is not positively correlated ($r = -0.185$) with libido and potency at this particular time period.

Table 4.3.3 : Mean \pm S.E. of plasma testosterone profiles (pg/ml) of potent (Group A) and impotent (Group B) groups of camels during post rut period of mid April to mid June.

Groups	No. of camels	No. of observations	Mean \pm S.E.	F value
Group A	4	374	1641.7 \pm 77.5	20.8**
Group B	4	358	2253.7 \pm 110.5	

** represent significance at 1% level

Table 4.3.4 : Mean \pm S.E. and critical difference of plasma testosterone profiles (pg/ml) of 8 camels individually for 2 groups.

Camel No.	Mean \pm S.E. over 8-9 weeks of study	F Value	Critical difference at 5 and 1%	
Group A				
208	2509.6 \pm 212.2	55.179	429.8	564.9
224	1113.3 \pm 85.1			
218	1648.0 \pm 123.0			
214	1149.5 \pm 77.9			
Group B				
128	1109.5 \pm 75.3			
226	4200.7 \pm 250.7			
222	2353.8 \pm 151.3			
122	823.1 \pm 46.8			



Table 4.3.5 : Mean ± S.E. of Plasma testosterone profiles (pg/ml) of camels over 8-9 weeks of study

Group and identification of camel	Testosterone (pg/ml) / Weeks									Critical difference	
	1	2	3	4	5	6	7	8	9	5% level	1% level
Group - I											
208	1144.3 ± 219.7	4710.3 ± 849.3	634.2± 181.6	5657.9 ± 684.7	2192.6 ± 443.2	2950.6 ± 275.3	1119.4 ± 255.9	2082.8 ± 135.6	1649.3 ± 53.2	1130	1485
218	516.9± 121.7	2066.8 ± 403.9	711± 110.5	3092± 405.9	730.1± 84.7	2375.1 ± 286.1	563.8± 48.0	1956.6 ± 282.6	2316.5 ± 226.2	671	883
214	1545.6 ± 217.6	908.9± 156.1	884.1± 147.7	402.3± 39.8	1787.3 ± 207.0	884.9± 178.4	2025.5 ± 217.6	981.9± 176.1	--	437	574
224	1017.4 ± 103.1	1042.2 ± 111.4	1911.4 ± 359.3	508.3± 114.1	1205.6 ± 135.3	469.4± 262.2	379.8± 85.2	1694± 371.6	668± 108.5	552	726
Group-II											
222	4025.5 ± 567.2	1592± 159.6	3396.5 ± 509.4	1795.4 ± 125.7	2637.6 ± 453.9	2208.1 ± 402.5	3555.4 ± 395.6	1370.1 ± 427.6	1204.8 ± 99.0	929	1221
128	1389.1 ± 307.7	440.1± 55.7	1276.3 ± 173.2	1351.3 ± 77.4	684.5± 81.4	1903.6 ± 163.0	1044.1 ± 265.0	916.4± 132.0	--	439	577
122	535.1± 107.1	344.5± 52.9	816.2± 78.4	1212.8 ± 121.5	1140.9 ± 108.6	870.9± 145.4	909.7± 119.8	680.8± 66.4	--	269	353
226	4038.0 ± 835.3	5953.5 ± 805.9	3414± 597.4	4395.0 ± 700.9	4733.9 ± 989.9	6078.3 ± 722.8	3807.0 ± 398.3	2575.1 ± 578.1	2867.7 ± 606.6	1882	2474

Sub project 3. Testosterone profiles in male camels and its correlation with sexual libido

Camel is sexually active during a particular part of the year called rutting season. It has been observed under artificial collection of semen program that libido; copulation in AV, copulation time, thrusts and donation of semen is at peak during mid January- February in this arid tract of Western Rajasthan, India. Following this peak period, libido is observed to vary in different males. Some male lose sexual drive, refuse to mount female or else if mount exhibit weak thrusts during copulation or show erectile penile dysfunction and ejaculate no or little semen. While some other male continue to exhibit good sexual drive and perform equivalently well as during rut in regards to copulation in AV, thrusts, erection of penis and ejaculation of semen for another 2-3 months.



Testosterone is an important male sex steroid hormone. Rutting behavioral changes exhibited by male camel and artificial semen production are associated with an endocrine surge in peripheral plasma testosterone concentration. A study was conducted on 4 Jaisalmeri male camels, which were well trained for copulation in artificial vagina and donation of semen for the past two years. The study comprised of monthly monitoring of plasma testosterone profiles at intervals of 10 minutes to 4 hours. The testosterone hormone profiles were correlated with sexual libido.

Monthly mean \pm S.E. of peripheral plasma testosterone profiles has been presented in Table 4.3.6. Peripheral plasma testosterone profiles were relatively low during July, August and September months in 3 and up to end of November months in remaining one animal. It started increasing by the end of October in 3 and quite later by the end of December in remaining one animal. It continued to increase steadily and reached peak levels by the end of December in one, by the end of January in yet another and by the end of February in remaining 2 animals. Peak levels between animals were significantly ($p < 0.01$) different. After peak, the hormone concentration start declining slowly and reached low pre-rut levels by the end of March in one, and by the end of April in another two. In remaining one animal the testosterone levels were still relatively and significantly ($p < 0.01$) higher than pre rut period by the end of April month. In this particular animal the onset of increase was also delayed. Monthly variation within animals during increase and decrease period were significant ($p < 0.01$).

Sexual Libido:

All the 4 camels had no appreciable sexual libido during months of October and November as evident by data on copulation time and semen volume ejaculated for a total of 113 attempts during the period, taking 20-29 attempts from individual male. The libido did not improve substantially in the month of December in 3 of the 4 animals while one animal exhibited significant improvement during this period. Individual variations were observed in libido pattern. Libido improved in animal No. 1 in January month and reached peak in February followed by gradual and consistent decline in subsequent months. In Animal No. 2, libido improved in January, reach peak in February and maintained substantially in March, April and May months. In animal no. 3, it improved slowly in January and February months, peaked in March and maintained substantially in April and May. In animal No.4, libido improved in December month, at peak in January, February and March months and decline slowly afterwards.

Analysis of variance between months revealed that peripheral plasma testosterone concentration, copulation time and volume of semen ejaculated varied significantly ($p > 0.01$). Animal wise Pearson correlation coefficients between plasma testosterone concentration, copulation time and volume of semen have been presented in Table 4.3.7 and 4.3.8. Correlation analysis revealed that copulation time and volume of semen are correlated with changes in plasma testosterone concentration. Similarly copulation and volume of semen are correlated.



Table 4.3.6. Mean \pm S.E. of monthly peripheral plasma testosterone (pg/ml) profile in Jaisalmeri male camels over a period of 10 months.

Camel No.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
1	-	931.5 ± 37.2	1081.5 ± 96.3	1288.6 ± 48.6	2389.2 ± 134.2	7457 ± 271.9	5595.8 ± 422	1547.5 ± 89.6	948 ± 74.1	242.3 ± 49.0	172.43 ± 13.85
2	852.4 ± 30.1	1007.8 ± 31.7	398.6 ± 35.6	1557.4 ± 55.6	1726.8 ± 149.6	7000.5 ± 484.8	6786.6 ± 453.4	15204.2 ± 954.3	2819.7 ± 150.9	916.6 ± 73.1	683.953 ± 7.59
3	926 ± 74.9	908.1 ± 54.8	625.4 ± 41.2	1167.2 ± 34.7	517.6 ± 37.4	3012.3 ± 141.6	7293.7 ± 509.7	7624.5 ± 666.9	5111.5 ± 445.6	2776.1 ± 204	291.32 ± 19.36
4	1012.6 ± 33.3	677.5 ± 35.2	607.9 ± 43.1	5204.3 ± 162.7	4139.3 ± 261.9	7836.9 ± 521.6	14644.6 ± 936.4	9819.4 ± 726.6	1666.2 ± 116.2	821.8 ± 62	1329.98 ± 53.08

Table 4.3.7. Range of monthly Mean \pm S.E. of Peripheral plasma testosterone profiles (pg/ml) and consequent sexual performance in terms of copulation time (seconds) and volume of semen (ml) of 4 camels.

Month	Plasma testosterone (pg/ml)	Month of semen collection	No. of attempts semen collection	Copulation time (Seconds)	Volume of semen (ml)
September end	1081.5 \pm 96.3	October	10-11	6.81 \pm 4.60	0.028
October end	1288.6 \pm 48.6	November	17-18	2.7 \pm 2.7	0
November end	2389.2 \pm 130.2	December	6-8	83.25 \pm 13.98	0.34 \pm 0.11
December end	7457 \pm 271.9	January	8-9	237.44 \pm 32	1.88 \pm 0.32
January end	5595.8 \pm 422	February	2-6	288.25 \pm 27.3	2.5 \pm 0.28
February end	1547.5 \pm 89.6	March	10-14	200.8 \pm 35.71	1.95 \pm 0.41
March end	948 \pm 74.1	April	9-12	138.8 \pm 24.66	1.49 \pm 0.47
April end	242.3 \pm 49.0	May	5-6	119.6 \pm 13.79	1.8 \pm 0.43
May end	172.4 \pm 13.85	June	--		



Table 4.3.8: Monthly Mean \pm S.E. of Peripheral plasma testosterone profiles (pg/ml) and consequent sexual performance in terms of copulation time (seconds) and volume of semen (ml) of camel No. 2

Month of hormone analysis	Plasma testosterone (pg/ml)	Month of semen collection	No. of attempts semen collection	Copulation time (Seconds)	Volume of semen (ml)
September end	398.6 \pm 35.6	October	10	13.3 \pm 13.3	0.05 \pm 0.05
October end	1557.4 \pm 55.6	November	18	5.94 \pm 5.94	0.01 \pm 0.01
November end	1726.8 \pm 149.6	December	6	206 \pm 49.2	0.91 \pm 0.32
December end	7000.5 \pm 484.8	January	8	332.5 \pm 38.1	1.87 \pm 0.49
January end	6786.6 \pm 453.4	February	2	360.5 \pm 20.5	4.66 \pm 1.78
February end	15204.2 \pm 954.3	March	11	292.7 \pm 24.0	2.18 \pm 0.38
March end	2819.7 \pm 150.9	April	9	290.7 \pm 45.8	2.77 \pm 0.61
April end	916.6 \pm 73.1	May	6	239.6 \pm 32.5	2.41 \pm 0.58
May end	683.9 \pm 37.5	June			

Table 4.3.9 Monthly Mean \pm S.E. of Peripheral plasma testosterone profiles (pg/ml) and consequent sexual performance in terms of copulation time (seconds) and volume of semen (ml) of camel No. 3

Month of hormone analysis	Plasma testosterone (pg/ml)	Month of semen collection	No. of attempts semen collection	Copulation time (Seconds)	Volume of semen (ml)
September end	625.4 \pm 41.2	October	11	8.09 \pm 8.1	0.018 \pm 0.018
October end	1167.2 \pm 34.7	November	17	5.82 \pm 5.82	0.014 \pm 0.014
November end	517.6 \pm 37.4	December	6	106.83 \pm 27.59	0.75 \pm 0.31
December end	3012.3 \pm 141.6	January	8	137.1 \pm 21.5	1.34 \pm 0.20
January end	7293.7 \pm 509.7	February	5	203 \pm 60.2	2.4 \pm 1.36
February end	7624.5 \pm 666.9	March	10	224.5 \pm 26.9	2.6 \pm 0.38
March end	5111.5 \pm 445.6	April	11	199.2 \pm 29.6	2.97 \pm 0.61
April end	2776.1 \pm 20.4	May	5	172.2 \pm 26.7	3.4 \pm 0.82
May end	291.3 \pm 19.36	June			



Table 4.3.10. Monthly Mean \pm S.E. of Peripheral plasma testosterone profiles (pg/ml) and consequent sexual performance in terms of copulation time (seconds) and volume of semen (ml) of camel No.4

Month of hormone analysis	Plasma testosterone (pg/ml)	Month of semen collection	No. of attempts semen collection	Copulation time (Seconds)	Volume of semen (ml)
September end	607.9 \pm 43.1	October	11	16.09 \pm 10.94	0.09 \pm 0.06
October end	5204.3 \pm 162.7	November	18	60.44 \pm 15.35	0.23 \pm 0.11
November end	4139.3 \pm 261.9	December	8	323 \pm 32.8	2.12 \pm 0.41
December end	7836.9 \pm 521.6	January	9	313 \pm 32.7	3.27 \pm 0.64
January end	14644.6 \pm 936.4	February	6	352.6 \pm 49.5	4.41 \pm 0.49
February end	9819.4 \pm 726.6	March	14	336.2 \pm 22.7	2.64 \pm 0.54
March end	1666.2 \pm 116.2	April	12	203.4 \pm 30.3	1.89 \pm 0.45
April end	821.8 \pm 6.2	May	5	139 \pm 21.6	1.3 \pm 0.30
May end	1329.98 \pm 53.08	June			

Table 4.3.11. Animal wise Pearson Correlation Coefficient between Testosterone concentration, Copulation time and volume of semen

Animal No.	Testosterone with Copulation time	Testosterone with volume of semen	Copulation time with volume of semen
1	.550	.343	.861
2	.510	.316	.745
3	.536	.393	.894
4	.503	.402	.758

Plasma testosterone concentration were low during summer months prior to rut, it increased and at peak during winter months of rutting season followed by decline to pre rut level at variable periods. The sexual libido was almost negligible during October and November months. Following endocrine surge of testosterone, libido started to improve but appreciable improvement in sexual libido were observed after elapse of several weeks of endocrine surge. The libido was in peak during winter months of January and February coinciding with peak of testosterone. Decline in testosterone concentration were more abrupt, these were associated with reduced sexual libido in terms of low copulation time and volume of semen ejaculated but complete cessation of libido occurred several weeks after the declined hormone concentration. In previous studies on abolition



of libido after rut, we have observed that concurrent testosterone profiles during post rut phase were not correlated with concurrent sexual libido. These combined with present study results indicates that it takes several weeks time to improve the libido after onset of an endocrine surge. Similarly it takes several weeks time for cessation of libido after withdrawal of testosterone surge.

Sub project 4 : Cryopresavation of camel semen

Eleven adult and trained Jaisalmeri camels of this Centre, age varying from 7-11 years were taken for this study and a total of 70 semen samples with good pre freeze motility were subjected to freezing, each sample in duplicate. Semen samples were harvested during winter, which is rutting season for camel in this country. Samples were collected at an interval of 2-3 days from individual camels. Cryo-preserved samples were subjected to post thaw motility studies as mentioned in objectives.

One way analysis of variance was used to study the effect of animals on pre-freeze motility of 70 samples from 11 male camels. Post thaw motility of duplicate vials of same semen sample frozen in same batch and preserved in same conditions was compared by paired t-test. Post thaw motility of semen vials incubated in 2 different conditions after thawing was also compared at different time intervals after thawing.

Pre freeze sperm motility (PFM)-

Of the 70 semen samples from 11 male camels, selected for cryopreservation studies, the average pre freeze sperm motility varied from 47.00 ± 4.37 to 70.00 ± 4.08 percent and it did not differ statistically among male camels (Table-4.3.9).

The maximum post thaw motility observed in different samples after thawing ranged from 0-55%.

As mentioned in Table 4.3.9, 26/70 (37%) cryopreserved semen samples exhibited > 30 % post thaw motility, another 10/70 (14%) exhibited 20-30 % post thaw motility while remaining 34/70 (48%) exhibited lower or nil post thaw motility revival. Overall mean \pm S.E. for post thaw motility and grading wise mean \pm S.E. for individual animals have been shown in Table 4.3.12.

A comparison of pre thaw motility and post thaw motility for 11 camels have been presented in Fig. 4.3.1, which shows that sperm motility decreased from 23.5 to 47.5 % as a result of single freeze thaw procedure of camel spermatozoa.

Post thaw motility in duplicate vials of same semen sample frozen in same batch:

Post thaw motility of same semen sample cryopreserved in duplicate vials in same batch differed significantly as revealed by 49 duplicate sample studied, results of which are presented in Table 4.3.10 and depicted in Fig.4.3.2. Out of 49 duplicate samples studied, 20 samples exhibited wide variation and difference was significant in 4/11 males.



Longevity of 35 post thaw motility : Semen samples, which exhibited greater than 25 % post thaw motility were incubated either at 37°C (n=17) or at 4°C (n=18) and sperm motility was examined at 0, 1, 2, 3, 4 and 24 hr after thawing. The results are presented in Table 4.3.11 and depicted in Fig.4.3.3, which shows that sperm motility preserved for longer time at 4°C as compared to 37°C. As shown in the Table 4.3.14, at 0 hr, the post thaw motility in the 2 groups (34.7 ± 1.63 vs. 35.5 ± 1.89) was not different but at 1, 2, 3, 4 and 24 hr of incubation it was significantly greater (P > 0.01) in samples incubated at refrigeratory temperature than at 37°C. At 37°C, the reduction in motility was about 50% than at 0hr. At 2,3,4 and 24 hr after incubation, almost 93, 99 and 100 % spermatozoa lost motility. At 4°C incubation, the percent decline was 17, 30, 35.8, 44.1 and 65.5%, at 1, 2, 3, 4 and 24 hr of incubation.

- Post thaw motility of different semen samples varied from 0-55%.
- 37% semen samples were adjudged to be fit for insemination based on post thaw motility criteria.
- Post thaw motility of duplicates of same semen sample varied significantly.
- Post thaw motility was maintained for relatively shorter period when incubated at 37°C as compared to at 4°C.

Table 4.3.9 : Pre Freeze and post thaw motility of semen from camels

CAMEL No.	No. of samples	Pre- freeze motility Mean ± S.E.	No. of samples with PTM > 30%	No. of samples with PTM 20 %-< 30%	No. of samples with PTM < 20%
1	9	60.55 ± 3.76	6	2	1
2	5	47 ± 4.37	0	0	5
3	7	64.28 ± 3.85	3	1	3
4	9	62.77 ± 3.23	2	3	4
5	4	70 ± 4.08	2	0	2
6	3	68.33 ± 10.14	1	1	1
7	5	57 ± 5.84	1	0	4
8	6	65.83 ± 2.72	3	1	2
9	6	64.33 ± 3.54	1	2	3
10	8	56.87 ± 4.73	3	0	5
11	8	59.28 ± 5.45	4	0	4
Total	70		26 (37%)	10 (14%)	34 (48%)



Table 4.3.10 : Variability in post thaw motility of 49 cryopreserved duplicate semen samples

S. No.	N	PFM (%)	PTM-1 (%)	PTM-2 (%)	T Value	Significance
1	7	60.55 ± 3.76	17.85 ± 5.65	32.85 ± 4.86	3.074	.05
2	2	47 ± 4.37	2.5 ± 2.5	10.0 ± 5.0	3.000	NS
3	5	64.28 ± 3.85	10.00 ± 5.26	25.4 ± 4.14	3.405	.05
4	7	62.77 ± 3.23	11.71 ± 4.97	20.71 ± 5.28	3.163	.05
5	2	70 ± 4.08	10.00 ± 7.07	22.5 ± 12.5	1.667	NS
6	3	68.33 ± 10.14	12.33 ± 5.36	25.00 ± 11.54	1.952	NS
7	3	57 ± 5.84	6.66 ± 4.40	16.66 ± 10.13	1.000	NS
8	5	65.83 ± 2.72	16.2 ± 4.11	31.00 ± 6.20	4.09	.05
9	5	64.33 ± 3.54	8.4 ± 3.23	19.4 ± 7.73	2.32	NS
10	3	56.87 ± 4.73	21.00 ± 9.45	33.35 ± 12.01	1.939	NS
11	7	59.28 ± 5.45	14.85 ± 6.29	22.14 ± 6.38	1.722	NS
Overall	49		12.83 ± 1.72	24.46 ± 2.12	8.09	.01

PFM : Pre freeze sperm motility

PTM : Post thaw motility



Table 4.3.11: Post thaw motility of 35 cryopreserved camel semen samples at various intervals after thawing at 37°C & 4°C incubation

S.No.	37° C	4° C	37° C	4° C	37° C	4° C	37° C	4° C	37° C	4° C	37° C	4° C
	0 h	0 h	1 h	1 h	2 h	2 h	3 h	3 h	4 h	4 h	24 h	24 h
1	40	40	10	35	0	35	0	35	0	30	0	18
2	30	40	15	40	8	40	0	30	0	25	0	20
3	40	35	18	30	0	30	0	25	0	20	0	3
4	30	35	2	30	0	15	0	15	0	10	0	3
5	30	30	25	25	2	20	0	20	0	20	0	10
6	30	40	18	35	3	20	0	20	0	20	0	20
7	35	25	10	25	0	25	0	15	0	10	0	10
8	30	35	18	30	0	30	0	25	0	20	0	3
9	40	45	37	40	0	40	0	40	0	40	0	25
10	45	25	30	15	2	8	0	8	0	8	0	5
11	25	35	2	20	0	15	0	15	0	10	0	8
12	45	25	38	20	20	8	2	18	0	18	0	18
13	25	35	10	15	1	10	0	8	0	6	0	5
14	35	25	25	20	2	15	0	13	0	12	0	12
15	35	50	5	50	0	40	0	40	0	40	0	10
16	45	40	30	35	0	35	0	28	0	20	0	2
17	30	50	15	40	0	40	0	40	0	35	0	35
18		30		25		22		15		13		13
Over all	34.7 ± 1.63	35.5 ± 1.89	18.11 ± 2.73	29.44 *± 2.28	2.23 ± 1.21	24.88 *± 2.75	0.11 ± 0.11	22.77 *± 2.52	0	19.8 3*± 2.49	0	12.22* ± 2.11

*Significantly different



Table 4.3.12: Animal wise overall and grade wise Mean \pm S.E. of post thaw motility

Camel No.	Overall mean \pm S.E. post thaw motility (range)	Mean \pm S.E. for samples >30% motility (range)	Mean \pm S.E. for samples >20% but <30% motility (range)	Mean \pm S.E. for samples <20% motility (range)
1	25.6 \pm 3.6(0- 45)	38.1 \pm 1.6 (30-45)	21.2 \pm 1.2 (20-25)	5 \pm 2.0 (0-10)
2	6.1 \pm 1.8 (0-15)	-	-	6.1 \pm 1.8 (0-15)
3	15.5 \pm 3.7 (1-35)	31.2 \pm 1.2 (30-35)	20	6 \pm 1.5(1-12)
4	15.7 \pm 3.2 (0-40)	33.7 \pm 2.3 (30-40)	21.6 \pm 1.6(20-25)	5.7 \pm 1.3(0-10)
5	20 \pm 4.9 (5-35)	33.3 \pm 1.6 (30-35)	20	10 \pm 2.0(5-15)
6	18.6 \pm 6.4 (2-45)	45 (25-45)	20 \pm 2.9(20-25)	3.5 \pm 1.5(2-5)
7	9.3 \pm 4.6 (0-35)	35	-	5.7 \pm 2.5(0-5)
8	21.4 \pm 4.4 (0-45)	40 \pm 2.9(35-45)	22.5 \pm 1.4(20-25)	6.5 \pm 3.6(0-15)
9	13.5 \pm 4.3 (2-45)	45	21.6 \pm 1.6(20-25)	5.5 \pm 1.3(2-10)
10	22.1 \pm 5.5 (1-55)	45 \pm 4.5 (35-55)	25	6.5 \pm 2.1(1-15)
11	20.6 \pm 4.7 (1-50)	40 \pm 3.8 (30-50)	-	7.6 \pm 1.9(1-18)

Fig. 1: Pre-freeze and post-thaw motility of cryopreserved camel semen from eleven camels

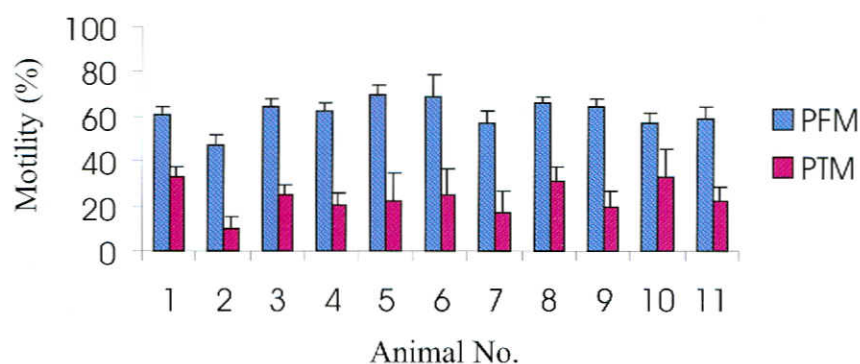


Fig 2: Post-thaw motility of camel semen differs in duplicate vials of semen sample cryopreserved in same batch

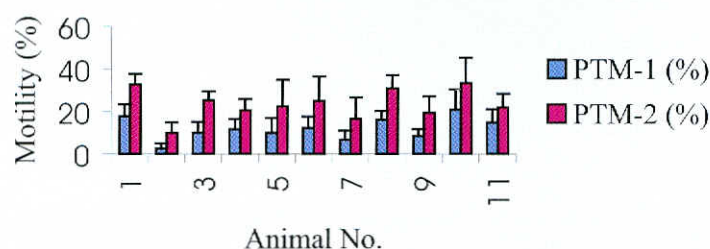
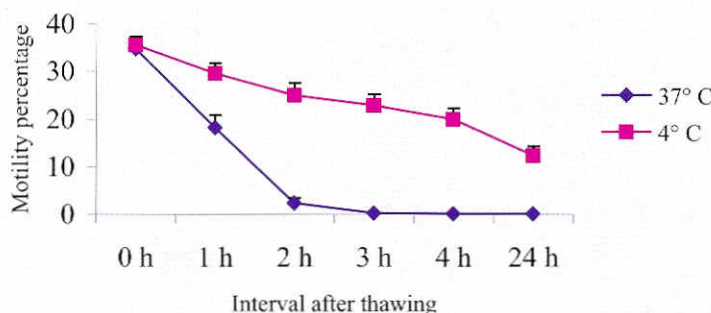


Fig. 3: Motility profiles of frozen and thawed camel semen at different intervals after thawing incubated at 37°C vs 4°C celcius



Evaluation of camel semen in the laboratory

Artificial collection of semen from camels is routinely practiced in breeding season every year since 1999. Egg yolk tris fructose citrate caffeine dilutor is used for dilution of camel semen. Physical characteristics of camel semen were noted and microscopic observations of sperm rich fraction, which settles down in the bottom of the tube were regularly conducted and video graphed.

Physical characteristics of camel semen:

Camel semen is thick, frothy and gel like in consistency (Fig. 4.3.4 & 4.3.5). Its color varies from sparkling white to off white. Volume varies with age and sexual libido of the animal. In young animals, it may be 1-2 ml, which increases to 3-5 ml in middle aged and 5-10 ml in old aged animals. Similarly, in the beginning of rut period, when sexual libido of the camel is weak, the ejaculate volume is low. At the peak of the rut, the average volume is between 5-10 ml and it may reach up to 20 ml in some cases.



Physical Problems in diluting camel semen:

Camel semen does not mix with physiological buffers and egg yolk based tris buffer extenders. If we add semen extender in a collection tube containing freshly ejaculated camel semen, it floats up to lie on the top of the semen extender, which occupies bottom part and two remain non-miscible (Fig. 4.3.6). This indicates that freshly ejaculated camel semen is lighter than semen extender. After few hours of storage, we observe remarkable changes, as a result of which, not only, 2 layered semen and semen extender are converted into 3 layered structure but semen and extender also exchange their seats. The semen, which initially floated on to the top of the tube on addition of semen extender, now settles down in the bottom of the tube, while, extender which was settled initially in the bottom of the tube, now rises above the semen (Fig. 4.3.7). On the top, a thin clear transparent layer of fluid is observed (Fig. 4.3.8). It appears probable that freshly ejaculated camel semen, which is lighter than semen extender, undergoes certain biochemical changes, as a result of which, it gets divided into 2 parts viz. sperm containing heavy fraction, which settles in the bottom and sperm less lighter fraction, which forms a clear transparent layer on the top.

Qualitative Laboratory Evaluations:

Qualitative laboratory evaluation of camel semen is difficult and certain evaluation tests are merely impossible.

Mass Motility Examination:

Camel semen does not exhibit mass motility due to entrapment of spermatozoa, because spermatozoa in camel semen are entrapped into discrete packets (Fig. 4.3.9). These packets can be compared with tightly packed and sealed containers. Entrapped spermatozoa do not find any space to move, as such there can be no mass motility, as observed in cattle, sheep, goat and buffalo, in form of swirls and waves.

Individual Sperm motility:

Individual sperm motility is observed only when spermatozoa are released from enclosed packets. The entrapped camel spermatozoa are released slowly by an unknown mechanism. The rate of release of spermatozoa is too slow, hence individual sperm motility evaluation can be possible on a small fraction of total sperm contents. Packets containing spermatozoa, when get emptied of it, are converted into an empty vacuole like structure (Fig. 4.3.10). The process of release of spermatozoa is too slow, as evident from microscopic examination of stored spermatozoa in which packets full of spermatozoa can be observed for several days and weeks.

Sperm concentration

Microscopic structure of discrete packaging units of entrapped spermatozoa itself is self explanatory that sperm concentration by hemocytometric method is not possible as spermatozoa are

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neither separated to enable their counting, nor an uniform distribution on dilution can be ensured. As such, an exact enumeration of sperm concentration is impossible in camel semen.

There is no mass activity in freshly ejaculated camel semen due to entrapped spermatozoa. For the same reasons, it is not possible to enumerate sperm concentration in camel semen. Similarly, individual sperm motility examination can be performed on diluted semen after a lapse of few hours when spermatozoa are rendered free.

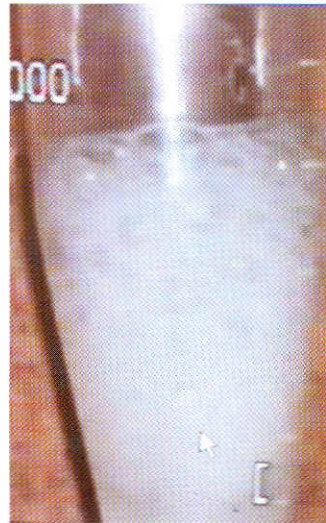


Fig. 4.3.4 & 4.3.5 Camel semen consistency (Gel & frothy)



Fig.4.3.6 Non-miscible layer of semen with extender



Fig.4.3.7 Semen changes after setting

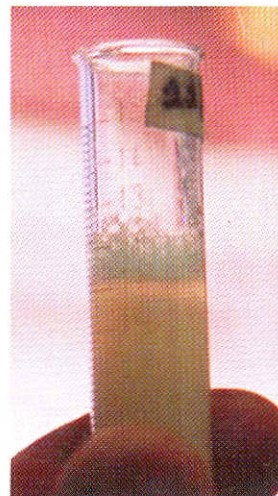


Fig. 4.3.8 Sperm less transparent fraction

RESEARCH ACHIEVEMENTS



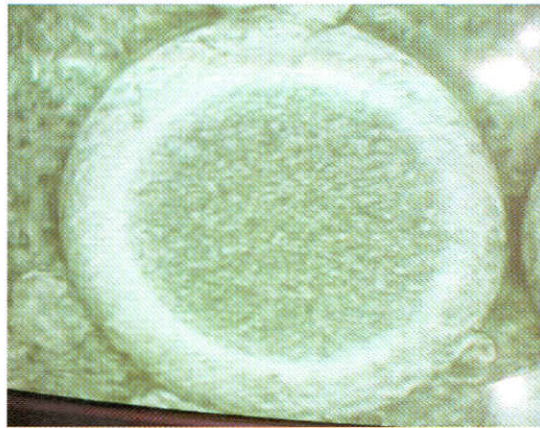


Fig. 4.3.9 : Entrapped Camel semen

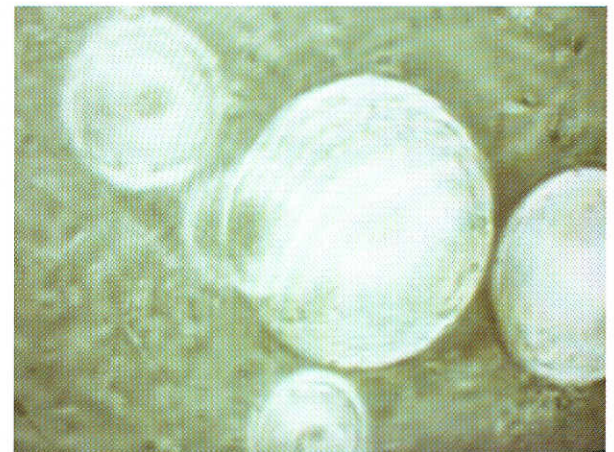
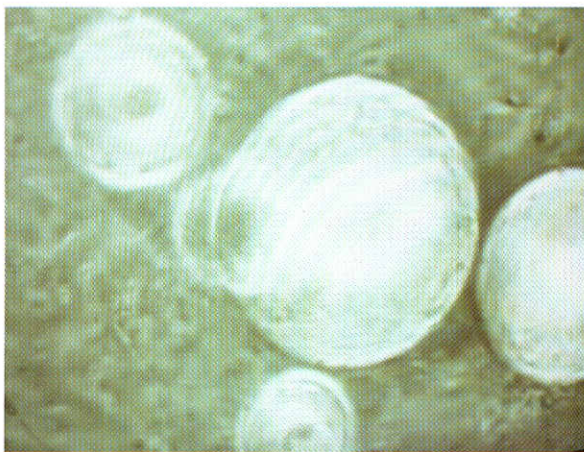


Fig.4.3.10 : Empty vacuole like structure after spermatozoa release

Sub-project 5 : Assessment of sperm head membrane integrity with fluorescent microscope

Project Leader : Gorakh Mal

Associates : Aminudeen

The study was undertaken with fluorescent microscope (Olympus CX41). The purpose of using this technique was an added advantage being its sensitivity and easy detection of dead spermatozoa. Sperm head membrane integrity was measured by counting non-damaged spermatozoa, defined as non-stained by Hoechst 33258. Under ultraviolet (UV) light, membrane intact spermatozoa showed little or no blue fluorescence head. The head portions of dead spermatozoa get blue staining and give bright fluorescence under the microscope. At least 150 spermatozoa were counted from different fields to assess the sperm head membrane integrity. Figure 4.3.11 showed a clear view of live and dead spermatozoa. The live spermatozoa does not get stained with Hoechst dye because they have intact cell membrane where as dead spermatozoa



appears bright blue in color i.e. they get stained with Hoechst dye as they do not have intact cell membrane. Figures 4.3.12 (fused head and tail) and 4.3.13 (clumps) showed abnormality found in the sperms. Further study based on large number is in process.

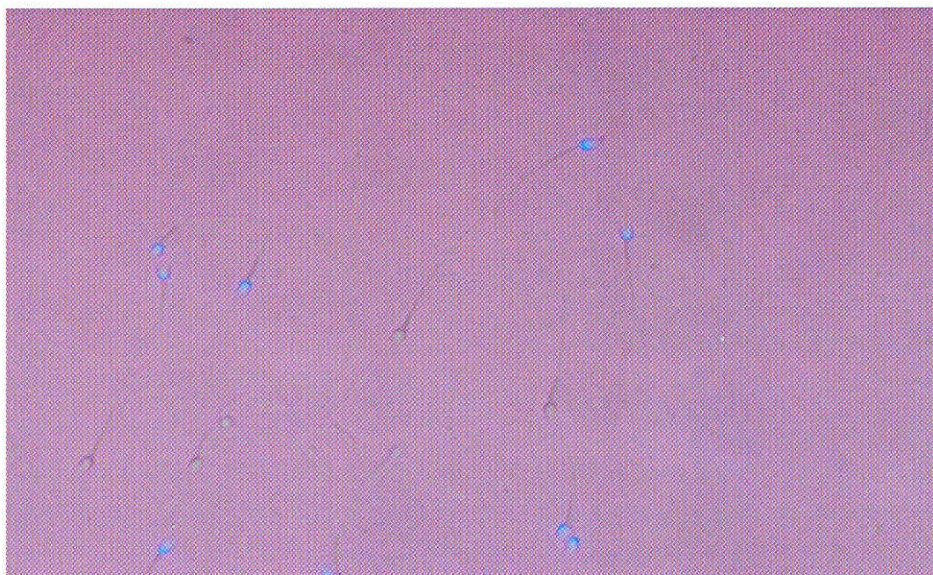


Figure 4.3.11: Live (unfluoresced) and dead (fluoresced) spermatozoa (60X)

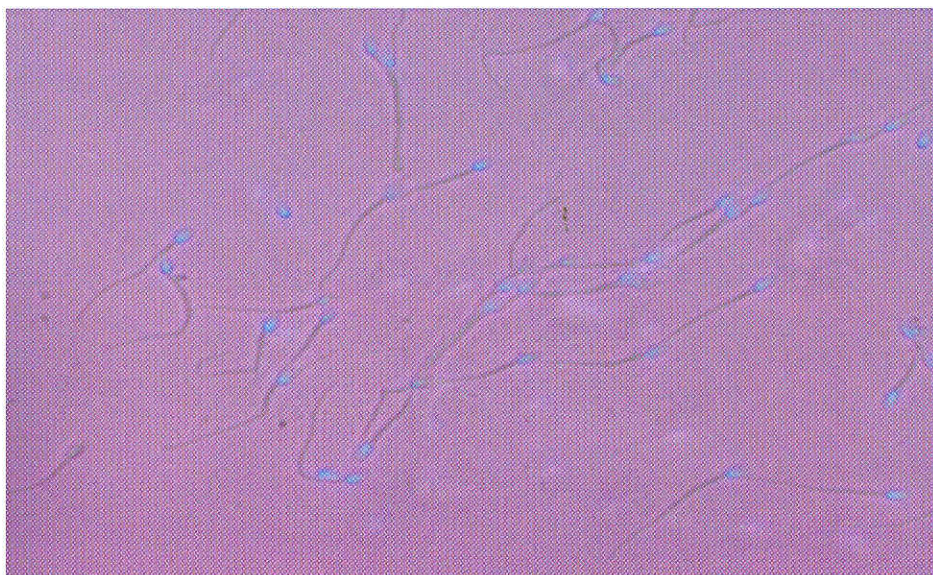


Figure 4.3.12: Abnormal spermatozoa with fused head and tails (60X)



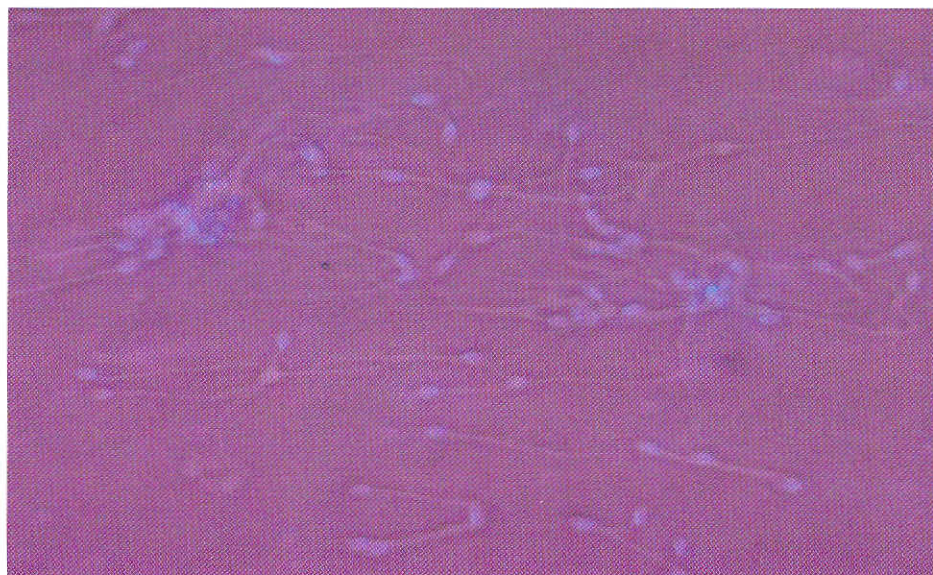


Figure 4.3.13: Clumping of spermatozoa (60X)

Sub-project 6 : Application of sonography and other diagnostic techniques in fertility and infertility management

Project leader : Sumant Vyas

Associates : Aminu Deen

Ultrasound monitoring of non-pregnant females for follicular growth during non-breeding season (May 2005)

Thirteen adult female camels of the centre's herd which did not conceive in the preceding breeding season (2004-05) were examined for follicular growth by ultrasound during the non-breeding season (May). A follicle was observed in 12 she camels. No follicle was observed in one camel. A follicle of < 1.0 cm diameter was observed in two she camels. One camel was observed to possess a follicle between 1.0-2.0 cm diameter. Follicles of 2.0 to 2.5 cm diameter were observed in four she camels. Follicle of 2.5-3.0 cm diameter was observed in one she camel. Follicle of 3.0 to 3.5 cm diameter was observed in two she camels and follicle of >3.5 cm diameter was found in two she camels. Mating was explored upon finding of ovulatory follicle. Only two Bikaneri and three Jaisalmeri studs were in mild to fair rut. Two she camels (B 387 and J 117) became pregnant. A reduction in calving interval by 150 days approx was achieved in each of these two she camels.

Ultrasound monitoring of females for follicular growth during early breeding season (October)

The conventional period of camel breeding starts from December. In order to extend the breeding period it was envisaged in the present study to examine the ovarian activity by ultrasound in the month of October.



A total of 123 ultrasound examinations were held on 52 non-pregnant female camels (dry non-lactating-16; lactating-21 and heifers-15). Follicle of ovulating size was observed in 15 out of 16 dry, non-lactating; 9 out of 15 heifers and only 1 out of 21 lactating females. The repeated examinations of male camels of centre's herd for the reproductive behaviour during early morning revealed that only four camels were in mild to strong rut. The rut was more pronounced in Bikaneri followed by Jaisalmeri and Kachchhi camels. Twenty-two females were mated with virile studs (three heifers were left). Eight females were diagnosed as pregnant by ultrasound examination at 60 days post mating. This may help in reduction of calving interval by 60 days particularly in dry females. Moreover early calving will facilitate availability of more span of breeding season for these females to conceive by mating during early post-parturient period.

Ultrasound monitoring of females during early post-parturient period

About 40 ultrasound examinations were performed on twenty female camels which had calved in the breeding season (2005-06). In addition to it 10 post-parturient female camels belonging to nutrition experiment were also considered for rebreeding during early post-parturient period on the basis of the behaviour and post-parturient period. Till March 2006 eighteen females were identified and selected for mating by virile studs and eight out of them have been diagnosed as pregnant. Thus the inter-calving period can be reduced by 270-300 days. This improvement was observed over the last year results (Five she camels became pregnant from early post-parturient breeding last year).

4.4. Project Title: To Study the economics of different camel management practices under arid and semiarid Eco-system

Sub project 1 : Studies on camel calf rearing in different system of management

Project Leader : Champak Bhakat

Associates : N Saini, N Sharma and M. S Sahani

A trial is conducted by selecting 10 camel calves (7-10 months aged) and it is divided into two comparable groups containing 5 calves in each. Each group contains 3 Jaisalmeri, 1 Bikaneri and 1 Kachchhi camel. First group is reared under intensive system of management with saras gold pasu ahar (@ 1 Kg/animal/ day). The second group is reared under semi-intensive system of management. Manger feeding of moth chara (*Phaseolus aconitifolius*) is also carried out for both management system. After 120 days, average total body weight gain was found to be higher in intensive management (65.20 kg) than semi-intensive management (35.60 kg). The average growth rate varied significantly ($P < 0.01$) between both the groups. The average daily fodder intake and water intake was slightly higher in intensive management than semi-intensive management group. The total feeding cost for 120 days (per calf) is Rs. 2274/- and Rs. 1484/- in I and II groups, respectively. Comparatively, feeding cost per day per calf was higher in intensive management than semi-intensive management group. But total cost per kg body weight gain was less and economical



in intensive management (Rs 34.87 per calf per day) than semi-intensive management (Rs. 41.68 per calf per day). Table 4.4.1 represents the comparative biometrics of camel calves in different system of Management. Biometrical parameters comparatively higher in I group than II group during 30, 60, 90, and 120 days. Other biometrical parameters viz: neck length, leg length (fore & hind), distance between eye, tail length, distance between ear, footpad length (fore & hind), footpad width (fore & hind), etc are also carried out.

The feed intake schedule and behavioral pattern of camel calves in intensive management system reveals that concentrate intake is maximum (82%) during 0-2 hr where as fodder intake was highest (57%) during 6-8 hr of supply. The time involvement under standing posture of calves is highest (93%) during first two hours and during evening, it is reduced and time involvement of lying posture gradually increased during evening.

The behavioral pattern and choice of vegetation of camel calves in rangeland area reveals that among the bushes first order of preference was Phog and followed by Pala, Muralikakani, Ker, Bui, Kheemp, Sinio. Among the grasses first order of preference was Ganthia, followed by Dachab and Sewan. The grazing and resting cycle reveals that calf devote 70 % time for grazing and 30 % time for resting during 6 to 7 hours period in rangeland area. Among the trees order of preference was Khejri, followed by Babool, Jal, Ardu, and Neem. The nutritive evaluation of feed and fodder utilized by experimental animal in both management systems and some other relevant parameters are in progress.

Table 4.4.1. The comparative biometrics of camel calves in different system of Management

	Intensive System of Group I						Semi-intensive system of Group II				
	0 Days	30 D	60 D	90 D	120 D		0 Days	30 D	60 D	90 D	120 D
BL (cm)	82.4 ± 5.3	87.3 ± 3.6	95.7 ± 3.1	103.8 ± 4.1	108.9 ± 3.2	**	81.9 ± 4.8	85.1 ± 3.8	93.9 ± 3.5	97.7 ± 3.8	101.1 ± 2.1
HG (cm)	108.1 ± 6.7	117.2 ± 4.1	131.5 ± 4.2	141.9 ± 3.6	150.0 ± 3.2	**	105.6 ± 5.1	115.9 ± 4.8	122.1 ± 3.2	130.0 ± 4.5	139.8 ± 3.4
HW (cm)	127.1 ± 3.3	131.2 ± 3.4	139.1 ± 3.2	146.6 ± 3.1	153.3 ± 2.8	**	126.0 ± 3.5	129.5 ± 3.1	133.1 ± 3.4	136.4 ± 2.7	143.6 ± 2.4
FL (cm)	29.0 ± 3.5	31.1 ± 2.3	33.6 ± 2.1	36.5 ± 2.1	39.6 ± 3.1	NS	28.0 ± 3.3	29.5 ± 3.4	32.4 ± 3.2	34.5 ± 2.8	38.2 ± 2.6
HC (H) (cm)	31.6 ± 3.8	34.0 ± 4.1	38.3 ± 4.6	45.5 ± 3.7	52.8 ± 4.8	**	31.0 ± 3.6	33.0 ± 3.2	37.0 ± 3.1	43.5 ± 4.1	48.5 ± 3.2
HC (V) (cm)	12.0 ± 4.0	13.2 ± 4.1	17.5 ± 4.5	22.5 ± 4.1	32.5 ± 4.1	NS	10.0 ± 2.8	11.5 ± 3.5	16.5 ± 3.8	23.5 ± 3.9	28.4 ± 3.1

** significant at 1 %, NS: non-significant

BL: body length, HG: heart girth, HW: height at wither, FL: face length, HCH: hump circumference horizontal, HCV: hump circumference vertical.

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Sub project 2 : Studies on hair production of camel under farm Management conditions.

Project leader : C. Bhakat

Associates : S.C Mehta and M. S. Sahani.

Annual hair production data over the years from 1445 Indian dromedary camels belonging to 3 elite breeds (Bikaneri, Jaisalmeri, and Kachchhi) from different age groups were analysed by using mixed mode least squares and maximum likely hood computer programme to study the effect of breed, age, sex, year of production influencing hair yield attribute. The least square Mean \pm SE for hair production (kg) of Indian camel reared under farm condition. is presented in Table 4.4.2.

Table 4.4.2. Least square Mean \pm SE for hair production (kg) of camel reared under farm conditions

Sex	Highest production group				Lowest production group			
	3 Year aged.				> 6Year aged.			
	Bikaneri	Jaisalmeri	Kachchhi	Overall	Bikaneri	Jaisalmeri	Kachchhi	Overall
Male	1.61 \pm 0.1 (32)	\pm 0.1 (41)	0.86 \pm 0.1 (19)	1.20** \pm 0.0 (92)	0.71 \pm 0.0 (63)	0.58 \pm 0.0 (101)	0.54 \pm 0.1 (26)	0.61** \pm 0.0 (190)
Female	1.27 \pm 0.0 (42)	0.93 \pm 0.1 (30)	0.77 \pm 0.1 (22)	0.99** \pm 0.0 (94)	0.61 \pm 0.0 (223)	0.49 \pm 0.0 (180)	0.46 \pm 0.0 (63)	0.52** \pm 0.0 (466)
Production year								
1	1.49 \pm 0.1 (11)	0.96 \pm 0.1 (8)	0.69 \pm 0.1 (6)	1.04 \pm 0.1 (25)	0.64 \pm 0.1 (29)	0.50 \pm 0.1 (23)	0.45 \pm 0.1 (11)	0.55 \pm 0.0 (63)
2	1.12 \pm 0.1 (10)	0.85 \pm 0.1 (9)	0.62 \pm 0.2 (4)	0.85 \pm 0.1 (23)	0.65 \pm 0.0 (49)	0.48 \pm 0.0 (44)	0.45 \pm 0.1 (13)	0.55 \pm 0.0 (106)
3	1.41 \pm 0.1 (10)	1.06 \pm 0.1 (9)	0.84 \pm 0.1 (7)	1.10 \pm 0.1 (26)	0.63 \pm 0.0 (49)	0.52 \pm 0.0 (45)	0.51 \pm 0.1 (11)	0.58 \pm 0.0 (105)
4	1.45 \pm 0.1 (13)	1.10 \pm 0.1 (12)	0.87 \pm 0.1 (7)	1.14 \pm 0.1 (32)	0.62 \pm 0.0 (39)	0.53 \pm 0.0 (38)	0.47 \pm 0.1 (10)	0.57 \pm 0.0 (87)
5	1.43 \pm 0.1 (12)	1.09 \pm 0.1 (12)	0.86 \pm 0.1 (7)	1.13 \pm 0.1 (31)	0.62 \pm 0.0 (36)	0.51 \pm 0.0 (41)	0.47 \pm 0.8 (10)	0.56 \pm 0.0 (87)
6	1.50 \pm 0.1 (8)	1.06 \pm 0.1 (10)	0.86 \pm 0.2 (5)	1.14 \pm 0.1 (23)	0.64 \pm 0.0 (42)	0.54 \pm 0.0 (43)	0.49 \pm 0.1 (16)	0.58 \pm 0.0 (101)
7	1.53 \pm 0.1 (10)	1.08 \pm 0.1 (11)	0.88 \pm 0.1 (5)	1.16 \pm 0.1 (26)	0.60 \pm 0.0 (42)	0.57 \pm 0.0 (47)	0.50 \pm 0.1 (18)	0.57 \pm 0.0 (107)
Overall	1.42** \pm 0.0 (74)	1.03** \pm 0.0 (71)	0.80** \pm 0.1 (41)		0.63** \pm 0.0 (286)	0.53** \pm 0.0 (281)	0.50** \pm 0.0 (89)	

** Significant at 1 % level.



The highest mean annual hair production is at 3 year age group in Bikaneri breed (1.42 ± 0.03 kg) where as the lowest mean annual hair production is in >6 year age group in Kachchhi breed (0.50 ± 0.03 kg). The Bikaneri breed of camel produced maximum annual hair yield followed by Jaisalmeri and Kachchhi breed. The least square analysis indicated significant ($P < 0.01$) effect as breed and sex on annual hair production. The male camel produced significantly ($P < 0.01$) heavier annual hair clip than female in all breeds.

Sub project 3 : Service project on Extension, communication and human resource development

Project leader : C Bhakat.

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

Kissan Divas :

Kissan divas was organized at the centre on 3rd March 2006 with a major objective to provide exposure to camel keepers/ farmers about advanced technologies of camel management, improved feeding, camel reproduction, important diseases, their prophylaxis, breed characterization and importance of camel products viz., milk, hair etc for better utilization in village cottage industry for higher economic gains. Camel keepers were shown the feed block machine, electrified traditional two wheel camel cart. At this occasion a film show was conducted on the scientific way of camel management, progressing research on camel and the way of subsidiary income by using camel hair, milk, skin etc.

Exhibitions:

During the year five exhibitions were organized in and out campus. These were depicting advance techniques of camel rearing, reproduction, management and new technologies developed by the centre viz.,



A view of Kissan Divas at NRCC



Fig. 4.4.2 A view of field exhibition of Pushkar Camel Fair (9/11/05 to 11/11/05)

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- Mega Trade Fair Bikaner (10.9.05 to 20.9.05),
- Pushkar camel fair, Ajmer (9.11.05 to 11.11.05),
- Camel Festival (14.1.06 to 15.1.06), Katriasar, Bikaner,
- Subap, Jodhpur (9.12.05 to 10.12.05),
- CSWRI, Bikaner (17.12.05 to 18.12.05).

Transfer Technology :

Efforts were made to transfer / popularize the technology of light arrangement in camel cart and technology of preparation of camel milk products to field level through various approaches. Flavoured milk, soft cheese, paneer tea/coffee and camel milk have been provided to various national and international visitors as well as scientists and feed back was collected regarding all these aspects. Electrified traditional two wheel camel cart was demonstrated how it can be beneficial in avoiding risk of accidents during night and as a source of electricity in areas / dhanies which are not electrified.

Kissan gosthies:

Seven Kissan Gosthies were organized and participated viz.,

- At Subap, Jodhpur on 10.12.05,
- Three at NRCC on 3.3.06, 10.1.06, 1.7.05,
- Two at Gadwala on 21.2.06 & 6.5.05
- Pushkar, Ajmer on 11.11.05.

The farmers were appraised about recent management practices through discussion and newly published handouts. The scientists of centre gathered feedback from farmers about the traditional camel husbandry practices.



Fig. 4.4.3 Popularisation of camel milk, hair and other products in Mega Trade Fair Bikaner (10/9/05 to 20/9/05)



Fig. 4.4.4 A view of farmers participated in a Gosthi of NRCC (3.3.06)



Demonstration of centre's research activity :

Trainees, visitors (National/ International) scientists, students, (from veterinary colleges, Medical Colleges, SAUs, schools, Universities), livestock owners, administrators, Defence Officers, N.G.Os, Indian and foreign educationists, Journalists, Youth, farmers and farm women etc were demonstrated about on going research activities, camel husbandry practices, and latest technology know- how of the centre during the reporting period.

Collaboration : Collaboration :

Collaborations were continued with NGO's

- LPPS, Sadri Pali,
- URMUL dairy and Trust, Bikaner,
- KVK, Beechwal, Bikaner,
- CSWRI, Avikanagar
- RAU, Bikaner.

An effort was made for popularization of camel hair, milk, skin utility aspects of camel etc. An investigation was carried out on product making possibilities using camel hair, skin etc

An effort was made for popularization of camel hair, milk, skin utility aspects of camel etc. An investigation was carried out on product making possibilities using camel hair, skin etc.



Fig. 4.4.5 Farmers and Farm women observing Camel research museum (3/3/06)

Revenue generation programme :

All efforts were made to strengthen the revenue / resource generation through various ways. viz : Entry of tourists, Still photography, Camel riding and also through sale of camel milk and milk products etc. Achieved more than the target fixed for the centre.

4.5. Project Title: Surveillance, Monitoring and Control of Camel diseases. .

Sub project 1: Sero prevalence of cameline surra, production and validation of anti cameline Ig conjugate (HRPO)

Trypanosoma evansi isolated from camel were maintained in albino rats upon intraperitoneal inoculation of 1×10^4 live parasites. Parasitaemia in these animals were monitored by wet smear examination of blood.

The parasites were also maintained in liquid nitrogen at -196°C as well as at -80°C under 12% (v/v) glycerol as cryoprotectant. The viability and pathogenicity of the parasites were checked from time to time in rats.



Out of 413 blood samples examined, 215 samples were collected from organized farm (NRCC). All these 215 samples were parasitologically negative for Trypanosome infection. Rest 198 samples were collected from different field areas/ villages around Bikaner. While examining the wet smear, two samples were found positive for the presence of trypanosome infection with its active movements. A few samples suspected (depilated) were inoculated in rats, were found positive even after 15 days of monitoring and observation thus, 5 more samples were found positive after rat inoculation.

Sero prevalence of cameline surra and validation of anti cameline Ig conjugate (HRPO)

During the period 88 camel sera are analysed in triplicate for the presence of antibodies against typanosomes.

Appropriate controls, like antigen control, antibody control, conjugate control were included in the present study. New born camel calf serum and trypanosome positive camel serum were considered as negative and positive control, respectively.

In this regard the mean ELISA value for negative control was 0.133 at the dilution of 1:200 and positive control the value was 0.304 at the same dilution, thus the conjugate developed was found working satisfactory, and all seven sera samples showed the ELISA value at the level of known positive samples, other samples showed ELISA value far below the positive control samples. (Table 4.5.1)

Table: 4.5.1. Mean ELISA value at 492 nm of 88 sera samples

0.076	0.202	0.168	0.149	0.179	0.107	0.142	0.263	0.195	0.122	0.410	0.430
0.141	0.206	0.163	0.143	0.188	0.070	0.150	0.192	0.231	0.099	0.383	0.433
0.130	0.162	0.122	0.093	0.113	0.071	0.164	0.210	0.073	0.203	0.288	0.139
0.135	0.140	0.123	0.106	0.138	0.078	0.158	0.213	0.234	0.211	0.219	0.130
0.134	0.148	0.123	0.104	0.128	0.081	0.163	0.167	0.112	0.196	0.250	0.402
0.187	0.163	0.116	0.149	0.132	0.080	0.146	0.116	0.177	0.124	0.184	0.194
0.304	0.193	0.169	0.139	0.175	0.082	0.158	0.010	0.177	0.283	0.038	0.247
0.314	0.181	0.246	0.114	0.103	0.111	0.136	0.215	0.085	0.193	0.224	0.362



Sub Project 2 : Molecular characterization of Trypanosomes

Proteases have been shown to be key factor in the pathogenicity of many parasitic diseases, either by inducing tissue damage and facilitating invasion or by empowering the parasites to salvage metabolites from host proteins.

In the present study a pair of primers deduced from the sequence of the cysteine protease gene of related genus was used. By the amplification of *Trypanosoma evansi* with this primer pair, multiple copies of tandem-repeat of the particular gene was revealed.

Further studies on this particular gene in terms of isolation, cloning and sequencing etc are to be carried out.

Sub-project 3 : Indigenous system of medicines against skin affections in camel mange

Project leader : S.K. Dixit

Associates : F.C.Tuteja, D.Suchitra Sena

Aiming at the mission of the project, two formulations developed against mange earlier were continuously evaluated on more number of animals both at the center and as well as with users for their clinical and therapeutic properties in phased manner. Initial studies conducted at Institutional level were further confirmed for promising results which led to go for further therapeutic trial in the field in association with farmers, veterinary clinic and camel owners so as to observe the effectiveness of the drugs and get feed back in real terms before subjecting them for further refinement and pharmacological studies. Formulation FI was a matter of curiosity for current year so as to arrive at some final conclusion and was found to possess effective mangicidal action. F II seems to have equal coverage but need more trial as yet. Both formulations relieved the animals from symptoms viz., intense itching, thickening and wrinkling of skin, excoriation etc. apart from conditioning, nourishing and toning of skin Addition or withdrawal of one or more components remain a focal research area and processing of the formulation through lyophilization or other means may open new ways in the propagation, extension and marketing of the drug though some attempts were made to expedite it but still more research trial are required.

Sub-project 4: Therapeutic spectrum & immunomodulatory role of selected herbs against dermatophytes / bacteria *in vitro* studies

55 skin scrapings from farm and field animals were collected from different body sites of affected animals using standard procedure and 32 were processed for bacterial/ fungal culture on nutrient broth/agar. The initial growth of the organism preliminarily revealed presence of both agents (bacterial/fungal) in abundance (Table 4.5.2). Isolation and characterization of the organism is in progress.



Table 4.5.2 : Culture of skin scraping samples from different sites

Sample Number	Site of lesion	Type of collection	Fungus	Bacteria
1	Neck	Skinscrap	<i>Aspergillus niger</i>	<i>Pseudomonas</i>
2	Neck	Skinscrap	-	<i>Proteus</i>
3	Abdomen	Pus	-	<i>Corynebacterium</i>
4	Thigh	Skinscrap	<i>Trichophyton verrusosum</i>	<i>Pseudomonas</i>
5	Abdomen	Pus	<i>Trichophyton</i>	<i>Streptococci</i>
6	Abdomen	Skinscrap	-	<i>Micrococci</i>
7	Abdomen	Skinscrap	-	<i>Bacilli</i>
8	Hump	Skinscrap	<i>Aspergillus fumigatus</i>	<i>Proteus</i>
9	Hump	Skinscrap	<i>Scopulariopsis</i>	<i>Micrococci</i>
10	Neck	Pus	<i>Nigrospora</i>	<i>Streptococci</i>
11	Back	Skinscrap	<i>Fusarium</i>	<i>Unidentified</i>
12	Abdomen	Skinscrap	<i>Aspergillus niger</i>	<i>Staphylococci</i>
13	Abdomen	Skinscrap	-	<i>Staphylococci</i>
14	Abdomen	Skinscrap	<i>Trichophyton</i>	<i>Micrococci</i>
15	Head	Pus	-	<i>Klebsiella</i>
16	Tail	Skinscrap	<i>Fusarium, A. niger</i>	<i>Pseudomonas</i>
17	Neck	Skinscrap	<i>Trichophyton</i>	<i>Klebsiella</i>
18	Abdomen	Skinscrap	<i>Aspergillus niger</i>	<i>Staphylococci</i>
19	Chest	Skinscrap	<i>Trichophyton</i>	<i>Pseudomonas</i>
20	Hump	Skinscrap	-	<i>Streptococci</i>
21	Neck	Skinscrap	-	<i>Staphylococci</i>
22	Nostril	Skinscrap	<i>Microsporium</i>	<i>Bacilli</i>
23	Nostril	Skinscrap	-	<i>Proteus</i>
24	Chest	Pus	<i>Aspergillus niger</i>	<i>Corynebacterium</i>
25	Tail	Skinscrap	<i>Secdosporium</i>	<i>Staphylococci</i>
26	Tail	Skinscrap	<i>Microsporium gypseum</i>	<i>Staphylococci</i>
27	Tail	Skinscrap	<i>Microsporium</i>	<i>Staphylococci</i>
28	Tail	Skinscrap	<i>Sporothrix schenckii</i>	<i>Proteus</i>
29	Limb	Skinscrap	-	<i>Micrococci</i>
30	Head	Skinscrap	<i>Fusarium, Cladosporium</i>	<i>Micrococci</i>
31	Tail	Skinscrap	<i>Fusarium</i>	<i>Staphylococci</i>
32	Thigh	Skinscrap	<i>Trichophyton verrusosum</i>	<i>Pseudomonas</i>



Table: 4.5.3. .Relative frequency of various fungi in 24 fungal isolates.

S.No.	Fungus identified	No. of isolates	Percentage
1	<i>Fusarium spp.</i>	4	16.7
2	<i>Cladosporium spp.</i>	1	4.2
3	<i>Aspergillus niger</i>	6	25
4	<i>Aspergillus fumigatus</i>	1	4.2
5	<i>Trichophyton spp.</i>	5	20.8
6	<i>Scopulariopsis spp.</i>	1	4.2
7	<i>Nigrospora spp.</i>	1	4.2
8	<i>Microsporium spp.</i>	2	8.3
9	<i>Scedosporium spp.</i>	1	4.2
4	<i>Sporothrix schenckii</i>	1	4.2
11	<i>Aspergillus flavous</i>	1	4.2

Evaluation of spectrum of activity

A survey of the NRCC campus and of adjoining area was carried out to record availability of medicinal plants and to explore the possibility of their medicinal use considering antibacterial/antifungal properties. Twenty nine plants were selected, their bark, roots, leaves etc were collected and processed to get their extracts. *In vitro* evaluation, their spectrum of activity is in progress. The extract from all parts was watery.

Table 4.5.4. Evaluation of various plant materials for medicinal utility

Botanical name	Common name
<i>Salvadora oleoides</i>	Jal
<i>Boganviellia spectabilis</i>	Boganbillia
<i>Tecoma stans</i>	Tikam
<i>Pongamia pinnata</i>	Karanj
<i>Punica granatum</i>	Anar
<i>Ziziphus nummularia</i>	Beri pala
<i>Morus alba</i>	Sahtoot



Botanical name	Common name
<i>Jatropha unguistifolia</i>	Ratanjot
<i>Azadirachta indica</i>	Neem
<i>Dalbergia sissoo</i>	Shisham
<i>Prosopis sineraria</i>	Khejari
<i>Allium sativum</i>	Garlic
<i>Albizia lebbek</i>	Siris
<i>Prosopis juliflora</i>	Pardesi kikar
<i>Lowsonia innermis</i>	Mehandi
<i>Prosopis nilotica</i>	Desi kikar
<i>Ficus religiosa</i>	Peepal
<i>Ailanthus excelsa</i>	Ardu
<i>Leucaena leucocephala</i>	Subabool
<i>Caligonum polygnoides</i>	Fog
<i>Maholia indica</i>	Mahua
<i>Vinecer porea</i>	Sadabahar
<i>Maholia indica</i>	Bajri
<i>Vinecer porea</i>	Amrood
<i>Leptadaenia pyrotechnica</i>	Kheenp

Studies on antibacterial and antifungal properties of commonly available medicinal plants.

15 fungal isolates of skin infections in camels which comprised of *Aspergillus niger* (7), *Microsporium spp.* (3), *Trichophyton spp.* (3), *Cladosporium spp.* (1), and *Aspergillus fumigatus* (1), were examined for *in vitro* antifungal properties of onion, garlic, aloe vera, bitter gourd and lemon. Sabouraud's Dextrose Agar plates were used for determining the antifungal activity. In each



plate agar was punched in the center using gel punch and fixed volume (20µl) of juices were added accordingly into the wells with the help of micropipette. Then cultures were stab inoculated surrounding the well. Plates were kept at room temperature for one hour to facilitate diffusion and later were transferred to an incubator. Results were interpreted as +, ++, and +++ according to their zone size of inhibition.

Fungi	No of Isolates tested	No. of isolates found sensitive				
		Garlic (<i>Allium sativum</i>)	Alovera (<i>Aloe barbadensis</i>)	Lemon (<i>Citrus limon</i>)	Karela (<i>Momordica charantia</i>)	Onion (<i>Allium cepa</i>).
<i>Aspergillus niger</i>	7	6	5	2	3	5
<i>Microsporium spp.</i>	3	2	0	1	1	0
<i>Trichophyton spp.</i>	3	3	3	2	2	1
<i>Cladosporium spp.</i>	1	1	0	1	0	0
<i>Aspergillus fumigatus</i>	1	1	1	1	1	0
Overall sensitive	15	13	9	7	7	6
Percent sensitive		86.6	60	46.6	46.6	40

Overall sensitivity and maximum antifungal sensitivity were exhibited by garlic followed by alovera, lemon, bitter gourd and onion.

Sub-project 4 : Studies on mastitis in camels

Project leader : F.C. Tuteja

Associates : S.K. Dixit, D.S. Sena and U.K. Bissa

Effect of mineral feeding on intramammary infections in camel

Thirty-six infected quarters of 14 camels as detected by cultural examination were divided into two groups.

Group I : Eight camels with 18 infected quarters including 4 quarters with mixed infections were fed with CuSO₄ (2gm), ZnSO₄ (2gm) and SeS (Se~2mg) daily for 30days.

Group II: Six camels with 18 infected quarters including 2 quarters with mixed infections were kept as untreated control.

Milk samples from these quarters were screened for bacteriological examination on 0, 15 and 30 days of mineral feeding.



Table 4.5.5. Efficacy of mineral feeding against intramammary infections in camels

Organism	Mineral feeding			Untreated control		
	Quarters infected			Quarters infected		
	0 day	15 day	30 day	0 day	15 day	30 day
<i>Staph. aureus</i>	3	3	2	3	3	3
<i>Staph. epidermidis</i>	12	10	8	12	11	10
<i>Streptococcus spp.</i>	6	-	-	5	4	4
<i>Corynebacterium spp.</i>	1	-	-	-	-	-
Overall	22	13	10	20	18	17

At the end of 30 days mineral feeding could clear overall 54.4 percent (12/22) of the infections where as in control group a selfcure for 15 percent (3/20) of the infections was observed.

Sub-project 6 : Studies on immunity aspects in neonatal camel calves

Project leader: D. Suchitra Sena

Associates : M.S. Sahani

Immunoglobulin content in camel colostrum/milk whey:

The results of the immunoglobulin concentration in colostrum/milk collected from 18 she camels at 0, 24, 48 and 72 hour followed by weekly intervals till one month were done by ZSTT (zinc sulphate turbidity test). The Ig content was highest in the colostrum immediately after parturition (15.852±1.20 mg/ml) and decreased gradually by 4th week (2.330±0.13 mg/ml), which is shown in Table 4.5.6

Table 4.5.6. Mean Immunoglobulin concentration in camel colostrum/milk whey (Mean ± SE)

Time	Immunoglobulin concentration (mg/ml) in Colostrum/milk whey
0 hr	15.852±1.20
24 hr	13.764±1.37
48 hr	11.024±0.76
72 hr	9.076±0.37
1 wk	6.560±0.41
2 wk	4.700±0.22
3 wk	3.024±0.17
4 wk	2.330±0.13



Experimental trial in camel calves under 3 different feeding practices:

The present study was conducted in 18 she camels in the last month of pregnancy and divided into three groups of 6 each. All the pregnant camels were healthy with no clinical signs of illness. The newly born calves of them were maintained under colostrum feeding for first 3-4 days and later on milk from their respective dams ad lib upto 3 months of age. The Group I (control group) calves were fed with colostrum and milk as mentioned above with out any immunomodulator. The Group II calves were given access to milk on one lateral side of udder by natural suckling method. The Group III (treated group) received a herbal immunomodulator (trade name:RESTOBAL) @ 20ml per os daily for 5 days at 45 days of age. The passive immune status (using modified Zinc Sulphate Turbidity Test) was measured in the dams as well as their neonatal camel calves immediately after birth, 12 hr, 24 hr, 48 hr, 72 hr, 1 wk and at weekly intervals till 4 week and fortnightly interval upto 3 months. The body weight in the camel calves were recorded immediately after birth, 3 days and at weekly intervals upto 4 week and fortnightly interval till 3 months on the periods mentioned above. The results were presented in Figures 4.5.1 to 4.5.4 and Tables 4.5.7 to 4.5.9. In all the dams the Ig concentration ranged from 18 to 22 mg/ml and the neonatal camel calves immediately after birth have less than 0.6 mg/ml of Ig which later increased after consumption of colostrum to around 10 mg/ml at 72 hrs and later to around 14-15 mg/ml by 3 months of age. The results indicated improvement in passive immune status and average growth rate (based on improvement in body weight) in treated calves from 2 to 3 months of age compared to control group and group II. This suggests that apart from feeding milk alone to camel calves upto 3 months of age some supplements/immunomodulators can be given so that better growth rate can be seen. In group II calves 2 animals suffered from enteritis after one month and were cured within 2 days.

RESEARCH ACHIEVEMENTS

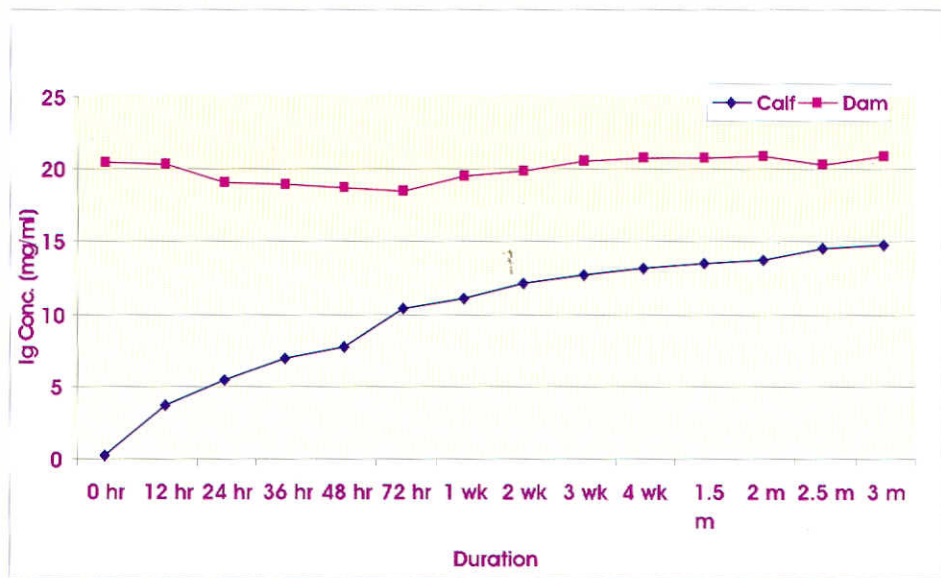


Fig 4.5.1 : Mean Serum Ig content of dams and neonatal camel calves of Group I



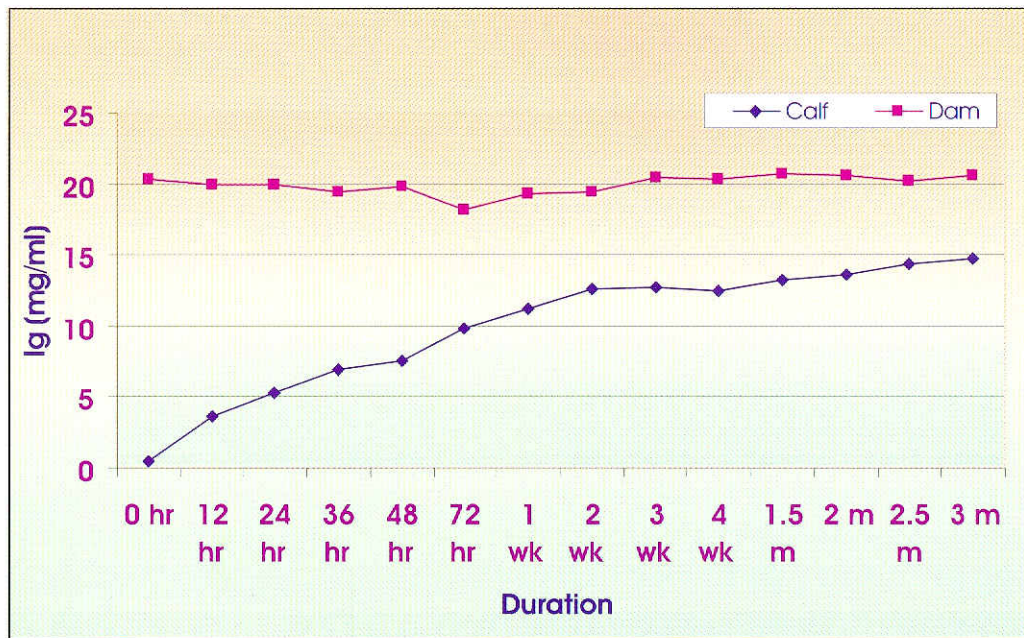


Fig 4.5.2 : Mean Serum Ig content of dams and neonatal camel calves of Group II

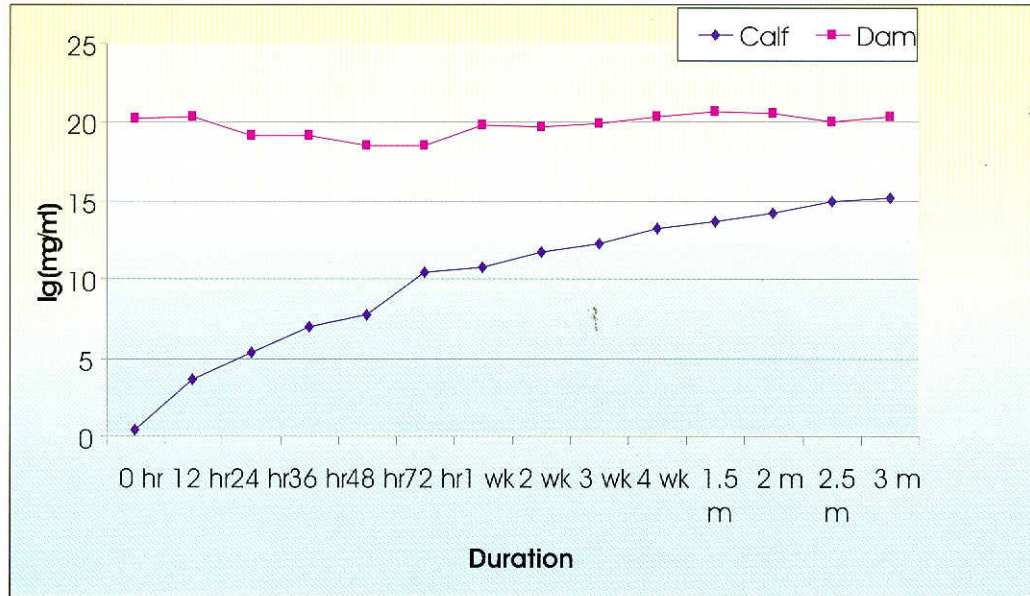


Fig 4.5.3 : Mean Serum Ig content of dams and neonatal camel calves of Group III



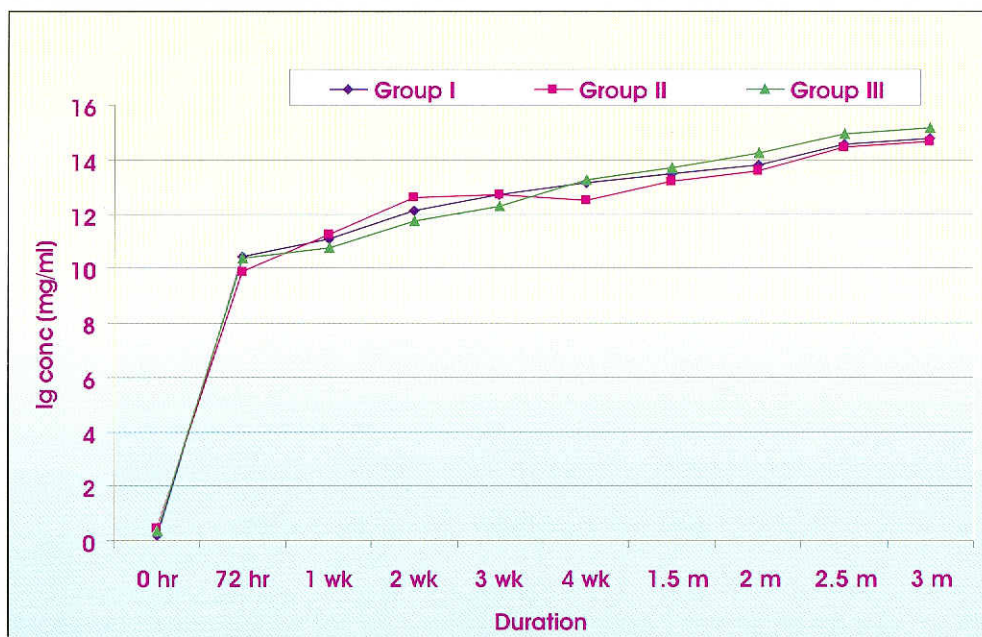


Fig: 4.5.4: Comparison of mean passive immune status in neonatal camel calves of Group I, II and III

Table 4.5.7: Group and age wise mean body weight (kg) of camel calves (Mean±SEM)

Period	Group I*	Group II*	Group III*
0 hr	38.50±2.10	43.16±2.15	38.33±0.95
72 hr	39.60±2.07	44.66±2.23	40.16±0.87
1 wk	41.30±2.51	50.50±1.76	42.66±1.22
2 wk	48.16±3.70	55.66±1.54	47.83±1.13
3 wk	53.83±4.76	61.66±2.45	53.66±1.02
4 wk	59.33±4.79	70.66±4.47	60.66±1.33
1.5 m	69.33±6.15	82.50±4.16	71.00±2.55
2 m	82.33±7.16	95.33±3.48	82.66±1.97
2.5 m	94.66±8.09	103.50±2.70	95.66±1.66
3 m	100.83±9.89	115.00±2.32	110.16±2.38

(P<0.01) Between different days there was significant improvement in body weight in each group



Table 4.5.8. Group wise average growth rate (kg) of camel calves

Duration	Group I*	Group II*	Group III*
72 hr	1.2±0.74	1.5±0.76	1.8±0.87
1 wk	1.2±0.76	3.3±1.05	2.5±0.42
2 wk	6.8±1.62	7.6±0.88	5.1±0.79
3 wk	5.6±1.64	6.0±1.39	5.8±1.07
4 wk	5.5±0.56	9.0±2.65	7.0±1.39
1.5 m	10±1.93	11.8±1.37	10.3±2.36
2 m	13±3.96	12.8±0.87	11.6±2.04
2.5 m	12.3±2.53	8.1±1.32	13.0±1.61
3 m	6.1±3.19	11.5±1.23	14.5±2.02

Table 4.5.9. Mean Ig content (mg/ml) of camel calves of group II and III (Mean±SEM)

Duration	Group I*	Group II*	Group III*
0 hr	0.23±0.18	0.48±0.18	0.40±0.24
12 hr	3.71±0.22	3.63±0.15	3.71±0.22
24 hr	5.44±0.15	5.27±0.14	5.44±0.15
36 hr	6.97±0.19	6.93±0.09	6.97±0.19
48 hr	7.74±0.19	7.60±0.14	7.74±0.19
72 hr	10.46±0.27	9.88±0.17	10.42±0.53
1 wk	11.10±0.43	11.25±0.38	10.80±0.54
2 wk	12.12±0.22	12.61±0.29	11.78±0.46
3 wk	12.72±0.34	12.74±0.33	12.30±0.30
4 wk	13.15±0.20	12.52±0.49	13.28±0.74
1.5 m	13.50±0.28	13.24±0.46	13.73±0.23
2 m	13.82±0.26	13.63±0.46	14.26±0.29
2.5 m	14.56±0.50	14.45±0.38	14.97±0.23
3 m	14.78±0.50	14.71±0.36	15.21±0.25



4.6. Project Title: Studies on feed requirements and feed resources evaluation in camel for optimum production

Project leader : A.K. Nagpal

Sub-project 1: Influence of different levels of energy and protein on the performance of pregnant camels and birth weight of new born calves.

Twelve advance pregnant camels of 9-12 years of age with an average body weight of 564.67 kg and in their 2-3 parity were randomly distributed into three groups of four each. The camels were kept on diet of Guar straw, groundnut haulms and concentrate mixture containing 9% CP and 50 TDN (Gp. 1), 10.5 %CP and 55% TDN (Gp. 2) and 12 % CP and 60% TDN (Gp. 3). The camels were housed in well-ventilated shed having sandy floor, asbestos roofing and provision for manger for individual stall-feeding. The animals were given a morning walking exercise of one-hour daily. Clean fresh water was offered once a day at 2.00 PM. After maintaining these animals on the respective rations for 60 days, a digestibility trial of 5 days was conducted. During the trial, weighed quantity of feed was given in the morning and feed residue was recorded next day morning. The representative samples of feed and faeces were pooled and estimation of the proximate principles was done (AOAC, 1990). The feeding trial was continued till calving. Body weights of animals were recorded monthly for two consecutive days on Avery electronic balance prior to feeding and watering. The data were analyzed statistically

The chemical composition of guar straw, groundnut haulms and concentrate mixture in terms of proximate principles is given in Table 4.6.1.

Table 4.6.1. Chemical composition of experimental ration % DM basis

Parameters	Guar straw	Groundnut haulms	Concentrate
CP	9	11	20
EE	0.81	1.97	5.35
CF	29.55	26.80	9.20
TA	10.27	9.17	14.26
NFE	50.37	51.06	51.19

The voluntary DM intake/ 100 kg body weight was observed to be at par in all the 3 groups (Table 4.6.2). The less feed intake in Gp1 may be attributed to low CP and high CF intake. Water intake per unit DM intake also did not differ among 3 groups. The digestibility coefficients of DM and other proximate principles except EE were almost similar in the different groups showing thereby that the level of protein and energy in the rations did not significantly influence the digestibility of nutrients. The digestibility coefficients of CP, EE and NFE parameters tended to be



lower in Gp1 and increased with higher plane of nutrition while that of CF tended to be higher in the first group and decreased in Gp2 and Gp3 which might be due to the different quantity and nature of roughages in the mixed rations. The CP intakes were 951, 1095, and 1265 g respectively in groups Gp1, Gp2 and Gp3 when the body weights of the pregnant camels averaged 650 kg. This trend continued and the DCP intakes were 463, 571 and 679 g respectively in the 3 groups. The average ME intakes ranged between 74 and 80 MJ in different groups indicating clearly that the energy intakes through the different rations were similar. Statistical analysis of the data indicated a highly significant ($P < 0.01$) difference among groups with regards to intake of DCP per kg metabolic body weight but non-significant difference in DM and TDN intake. Nutrient intake in term of DCP $g / kg W^{0.75}$ was higher ($P < 0.05$) in Gp3 than Gp1 and Gp2 groups. This indicated that a higher CP content in the ration enabled the camels to consume more amount of feed. The present study indicated that the CP requirements for pregnant camels were similar and ME requirements were 9.64% lower to that indicated in the NRC standards.

Comparing nutrient intakes observed in Gp1 of the present experiment with those of other feeding standards (Table 4.6.3), it was observed that the CP and ME intake were 85% than those recommended by NRC(1989). The CP intake of Gp2 was almost similar and ME intake was 90% than NRC (1989) recommendations. While in case of Gp 3 CP intake was 113% and 95% compared to NRC (1989) recommendations. It can be safely stated that NRC (1989) recommendations for CP and ME hold true in Gp1.

Weight gain in pregnant camels was statistically significant ($P < 0.01$) among 3 groups, minimum in Gp1 and maximum in Gp3 (Table 4.6.4). The pregnant camels exhibited average weight gain of 124.0, 150.0 and 177.0 kg during 123 days study in the respective groups. The gain in the body weights were 1.01, 1.22 and 1.44 kg/d in Gp1, Gp2 and Gp3 indicating thereby that the significant role of dietary CP and ME.



Fig. 4.6.1 : Pregnant camels on metabolic trial

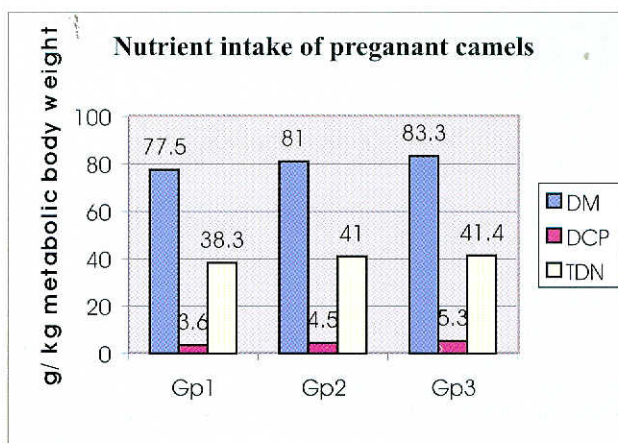


Table 4.6.2. Nutrient intake, digestibility and water intake of camel of different groups

Parameter	Gp 1	Gp 2	Gp 3
Body wt. kg	653.75 ± 25.78	646.00 ± 25.95	650.00 ± 32.38
DMI kg/d*	10.01± 0.18	10.36±0.39	10.74±0.64
DMI kg/100 kg B.Wt.	1.53 ± 0.04	1.61±0.07	1.65 ± 0.03
Water intake l/d	22.23 ± 1.58	21.20 ± 1.18	20.85 ± 2.06
Water intake l/ kg DMI	2.23± 0.14	2.04 ± 0.04	1.93± 0.09
Digestibility %			
DM	53.28 ± 1.11	55.58 ± 1.27	54.83 ± 0.48
OM	57.99±0.78	58.40± 1.59	56.93± 0.68
CP	48.84± 0.66	52.06± 1.91	53.66± 1.16
EE**	-8.56± 4.36	42.82± 5.62	60.44± 4.57
CF	36.82± 0.90	36.53± 5.26	30.86± 1.42
NFE	68.12± 1.18	66.36± 1.07	64.58± 0.64
Nutritive value			
CP %	9.48	10.57	11.78
DCP %	4.63	5.51	6.32
TDN %	49.40	50.56	49.64
ME MJ /kg	7.44	7.62	7.48
Plane of Nutrition			
DMI kg/d	10.01±0.18	10.36±0.39	10.74±0.64
CPI g/d	948.80± 18.92	1094.63± 38.12	1264.83± 81.66
DCPI g/d	463.08±5.17	570.60±33.82	678.51±45.79
TDNI kg/d	4.945±0.15	5.238±0.27	5.331±0.35
MEI MJ/d	74.48±2.26	78.90±4.04	80.30±5.21
DMI g/kg W ^{0.75}	77.52±1.40	81.00±2.96	83.29±2.35
DCPI** g/kg W ^{0.75}	3.59±0.07	4.46±0.27	5.26±0.22
TDNI g/kg W ^{0.75}	38.27±0.45	40.98±2.26	41.35±1.57
MEI MJ / kg W ^{0.75}	0.58±0.01	0.62±0.03	0.62±0.02

Different superscripts in a row differ significantly ** = P<0.01



Table 4.6.3. Comparison of nutrient intake with various feeding standards

Group	BW kg	DM kg	CP g	DCP g	ME MJ
Gp 1	654	10.01	949 (85%)	722	78.38(85%)
Gp 2	646	10.36	1095 (98%)	857	83.21 (90%)
Gp 3	650	10.74	1265 (113%)	995	85.06 (95%)
NRC (1989)	650	--	1120	--	91.88
Wardeh (1997)	650	9.50	--	522	77.92
ICAR (1987 & 1998)	650	18.75	-	750	105.44

Table 4.6.4. Weight gain during pregnancy, decline in body weight of pregnant camels on calving and birth weight of new born calves

Parameter	Gp 1	Gp 2	Gp 3
Pregnant camels			
Initial B.Wt. (kg)	596.50 _± 29.59	554.00 _± 21.89	548.67 _± 13.42
Final B. Wt. (kg)	720.50 _± 30.32	704.00 _± 23.31	725.67 _± 15.01
Total Gain (kg)	124.00 _± 3.58	150.00 _± 2.04	177.00 _± 4.62
ADG** kg/d	1.01 _± 0.03	1.22 _± 0.02	1.44 _± 0.01
Loss in B.Wt. on calving			
B. Wt. before calving (kg)	720.50 _± 30.32	704.00 _± 23.31	725.67 _± 15.01
B. Wt. after calving (kg)	614.50 _± 30.61	605.75 _± 18.09	623.33 _± 14.26
Decline in weight (kg)	106.00 _± 5.92	98.25 _± 7.40	102.33 _± 15.98
Per cent loss	14.79 _± 1.08	13.92 _± 0.77	14.06 _± 2.09
New born calves			
Birth weight (kg)	43.25 _± 1.44	42.33 _± 4.06	44.25 _± 1.65

Different superscripts in a row differ significantly ** = P<0.01



The decline in body weight of pregnant camels was not significantly different among 3 groups and it was to the tune of 14.79, 13.92 and 14.06 % in groups Gp1, Gp2 and Gp3 respectively. The birth weight of new born camel calves of 3 groups also did not differ among 3 groups and was 43.25, 42.33 and 44.25 kg respectively.

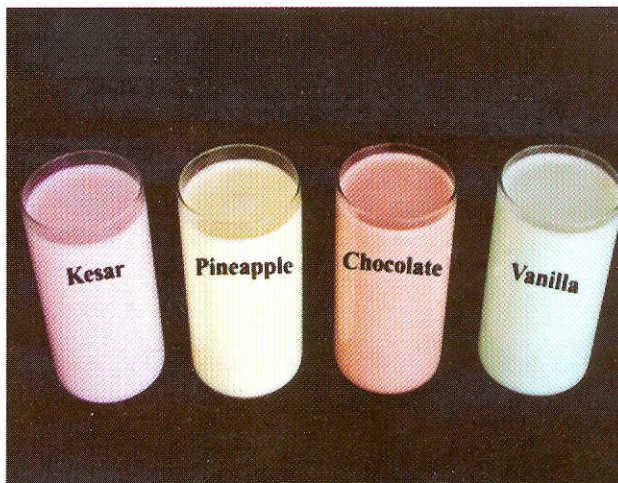
Results indicated that all the three rations were almost similar in nutrient utilization and were able to meet the nutrient requirements of camel calves for reasonable body weight gains also. However the cost factor may be considered as inclusion of higher quantity of tree leaves also involves higher cost.



5. TECHNOLOGY ASSESSED AND TRANSFERRED

I. Camel milk products

Various camel milk products (Kulfee, flavoured milk, lassie, coffee and tea etc.) developed at the centre were evaluated and further improved in light of comments of dairy experts. Now these milk products are on regular sale since more than last six months at the centre milk parlour with very encouraging response from foreign and Indian tourists and others. Poly packaging of some of the milk products is in process for wider publicity and marketing.



Camel milk products

II. Camel milk skin cream:

Fresh raw camel milk is centrifuged at 4000 rpm for 10 minutes and the upper cream layer was separated. The cream was analyzed for moisture content, fatty acid profile to standardize the formulation and accordingly the percent of other ingredients glycerol, preservative (methyl and propylparaben and BHA), sandal wood powder, perfume, deionized water and ethanol were added followed by homogenous mixing. The preparation was kept overnight for its settlement for its saturation level and finally packed in suitable packaging material for further use in skin. Results of 3 months trial of karabh skin cream were very encouraging in imparting fairness and smoothness to the skin and with reduction in roughness. The spread per unit area was very high.



Camel milk skin cream

III. Electrification of traditional camel cart

The traditional two wheel camel cart was electrified and it was further improved and modified to be more cost effective, without causing any hindrance in the movement of cart with full load on different terrains. One fixed circular strip is having 39 coils and inside circular strip having 39 small magnets this strip moves with the movement of wheel of cart. It charges the 12 volts battery and once charged it provides current for 8-10 hrs. This is sufficient for 2 front lights, rear indicator lights. It will be helpful in not only reducing the camel cart accidents during night but also provide a source of light in village / chain houses which are not electrified yet. One can play music system also for entertainment.



6. EDUCATION AND TRAINING

SCIENTISTS			
Name and designation	Education/Training	Place	Date
Dr. Gorakh Mal Sci.,(Sr.scale)	Summer School on Advances in Agricultural Research Project Management	NAARM, Hyderabad	5 th - 25 th May, 2005
Dr. G. Nagarajan Scientist	New insights in parasite disease epidemiology and control	KVAFSU, Bangalore	6 th - 26 th Feb., 2006



7. AWARDS AND RECOGNITION

- Nagar Raj Bhasa shield of Bikaner for the year 2005-06 and Raj Bhasa award at Solan (Himachal Pradesh) was awarded to the Centre for promotion of Research work in Hindi and communication of research results to its users.
- Dr. Raghvendar Singh, Senior Scientist of the centre was awarded by Chairman Nagar Rajbhasha Karyanvayan Samiti, Bikaner for his significant contribution in promotion of Rajbhasha karyanvayan in June 2005.
- Dr. Raghvendar Singh, Senior scientist of the centre is recipient of Best research poster paper award on "value added camel milk Products" in National Seminar on value Added Dairy Products : Organized by National Dairy Research Institute, Karnal and Dairy Technology Society of India, 22-25th December 2005.



8. LINKAGES AND COLLABORATIONS

I. National Level

Rajasthan Agricultural University, Bikaner	:	Research work of M.V.Sc and Ph.D students
National Dairy Research Institute, Karnal	:	Camel milk analysis especially on protective proteins
Centre for Sheep and Wool Research Institute, Avikanagar	:	Camel hair utilization in the form of blends
Central Institute of Agricultural Engineering, Bhopal (M.P.)	:	Camel drawn implements & their performance
Lokhit Pashupalan Sansthan	:	NGO at Sadri, Pali

II. International Level

- CIRAD-EMVT, France : Research and training

8.1. RFLP based genotyping of major histocompatibility complex class II genes in Marwari horses

Project Leader : R.C.Sharma

Associate : S.C.Mehta and R.S.Bansal

The RFLP analysis of the MHC-DRB3 gene in Marwari horses was successfully carried out with three restriction enzymes. Digestion with restriction enzyme Hinf I revealed existence of heterozygosity in the Marwari horses screened (Table 1).

Table 1: Hinf I polymorphism at MHC-DRB 3 locus in Marwari and Kathiawari horses.

S. No.	Restriction Enzyme	Breed	MHC	Sample Size	Homozygous	Heterozygous
1	Hinf I	Marwari	ELA	24	10	14
2	Hinf I	Kathiawari	ELA	4	0	4



8.2. Molecular and biochemical studies of acute intermittent porphyria in Indian patients and their families

Project Leader : Molecular genetics Component : S.C.Mehta

Clinical and Biochemical Component : D.Kochar

Associates : S.K.Bhure, Mahendra Pal, S.Kochar, M.S.Sahani

Twenty five blood samples from the patients of porphyria were collected along with a few control samples. The DNA was isolated and the PCR amplification of four different fragments of the gene was successfully carried out. The fragments covered about 80 to 85 % of the gene sequence of the entire 10 kb gene. Three fragments of 0.5 kb, 2.1 kb and 3.1 kb were successfully cloned and the inserts were released and characterized. These clones were sent for sequencing. The results are awaited.



9. AICRP/COORDINATION UNIT/NATIONAL CENTRES

AICRP on Improvement of feed resources and nutrient utilization in raising animal production

Project Leader : M.S.Sahani

Associates : N.Saini, Ramkumar

Research Fellows : B.D.Kiradoo, A. Bhardwaj, N.Singh

On the basis of preliminary data collected on rainfall, topography and cropping pattern (Table 9.1), eight northwest districts of the state comes under five- agro eco zones i.e., Arid western plain (Bikaner, Jaisalmer), Irrigated northwestern region (Hanumangarh, Ganganagar), Transitional plain of inland drainage (Churu, Nagaur) and Transitional plain of Luni basin (Pali, Jodhpur) were selected for survey study. Two tehsils from each district have been selected from the list of camel population. From each tehsils, two villages and twenty farmers were interacted individually for collection of primary data on various different management practices through open questionnaire.

Table: 9.1 Land type, Location, rainfall, soil and vegetation cover of surveyed areas.

Zones/ Topography	Districts	Annual rainfall (cm)	Area (ha)	Land capability	Soil Type	Vegetation cover
Arid western plain	Bikaner, Jaisalmer	10-40 cm	65645	IV	Loamy sand	<i>Prosopis cineraria</i> , <i>Acacia tortolis</i> , <i>Zizyphus</i> <i>spp.</i> <i>Lasirus</i> based silvi- pastoral system.
Irrigated north western plain	Sriganganagar, Hanumangarh	40 cm	20634	II, III, IV	Sandy loam- silty- clay loam	<i>Salvadora oleoides</i> , <i>Azadirachta indica</i> , <i>Dalbergia sissoo</i> , <i>Prosopis cineraria</i> , <i>Acacia tortolis</i> , <i>Zizyphus</i> <i>nummularia</i>
Transitional plain of inland drainage	Nagaur, Churu	15-40 cm	34548	III, IV	Sandy soil	<i>Salvadora oleoides</i> , <i>Azadirachth indica</i> , <i>Dalbergia sissoo</i> , <i>Prosopis cineraria</i> , <i>Acacia nilotica</i> , <i>Zizyphus</i> <i>numularia</i>
Transitional plain of luni basin	Jodhpur, Pali	30-50 cm	35237	III, IV	Shallow sandy loam	<i>Salvadora oleoides</i> , <i>Azadirachth indica</i> , <i>Dalbergia sissoo</i> , <i>Prosopis cineraria</i> , <i>Acacia tortolis</i> , <i>Zizyphus</i> <i>nummularia</i>

Out of total 320 respondent interviewed, about 41.25 % belong to medium land holding followed by large (34.69%) and small (24.06%). Majority of farmers (44.69%) having medium



family and about 46.88 % respondent reared camel for self-use and 23.44% for breeding while 29.69% reared it for selling purposes. About 67.2 %-surveyed area was rain fed and 32.8 % irrigated.

Feeding resources

The major fodder resources obtained from forest area, barren, uncultivated lands and pasture are presented in Table 9.2. Regarding other resources, crop residues such as clusterbean, moth bean, cowpea, mung bean, horse bean and finger millet, sorghum, pearl millet constituted the major feed resources for the camels in this region. Out of these, guar phalgati is the major feed given by 51.25 % respondent followed by moth chara 15.63%, groundnut chara (13.7), chana (8.75%) and others (Table 9.3). In zone I comprising (Bikaner, Jaisalmer) and zone III comprising of (Churu, Nagaur) districts, camel owners mostly fed moth chara, guar chara and groundnut chara according to availability. The farmers of zone II comprising (Hanumangarh, Ganganagar) and Rajgarh thesil of zone III having irrigation facilities mostly fed chana, as fresh or dry (channa ki khar) in addition to guar phalgati and groundnut chara. The major feeds of zone IV (Pali, Jodhpur) were guar phalgati and groundnut chara.

Table 9.2 Feeding resources in arid zone of Rajasthan

Trees		Straw/Crops	
Israli Babool	<i>(Acacia tortolis)</i>	Guar	<i>(Cyamopsis tetragonoloba)</i>
Desi Babool	<i>(Acacia nilotica)</i>	Moth	<i>(Vigna aconitifolia)</i>
Neem	<i>(Azadirachta indica)</i>	Mungphali	<i>(Arachis hypogaea)</i>
Sesum	<i>(Dalbergia sissoo)</i>	Chana	<i>(Cicer arietinum)</i>
Khejri	<i>(Prosopis cineraria)</i>	Bajra	<i>(Pennisitum typhoides)</i>
Vilati Babool	<i>(Prosopis juliflora)</i>	Wheat	<i>(Triticum aestivum)</i>
Jal	<i>(Salvadora oleiodes)</i>		
Ardu	<i>(Ailanthus excelsa.)</i>		
Ber	<i>(Zizyphus moritiana)</i>		
Grasses		Bushes\Shrubs	
Grammna	<i>(Panicum antidotale)</i>	Sinia	<i>(Crotolaria burhia)</i>
Sewan	<i>(Lasirus indicus)</i>	Kheemp	<i>(Leptadaenia pyrotechnica)</i>
Dhaman	<i>(Cenchrus spp.)</i>	Murali	<i>(Lycium barbarum)</i>
Motha	<i>(Cyprus rotundus)</i>	Bui	<i>(Aerva tomentosa)</i>
Sati	<i>(Boerhavia diffusa)</i>	Phog	<i>(Calligonium polygonoides)</i>
Kanti	<i>(Tribulus terrestris)</i>	Ker	<i>(Capparis decidua)</i>
Bakeriya	<i>(Indigofera cordifolia)</i>		

Feeding Practices

Farmers of zone I & IV used to follow grazing practices, whereas in zone II only stall-feeding was the common feeding method followed by 62.5 % of the respondents. Likewise, in zone III grazing plus providing additional fodder was common practices (50%). The pooled data (Table



9.3) however reflects that grazing was the common practices (76.50%) followed by a majority of the farmers in the entire region whereas stall-feeding was favored only by a 23.44% of the farmers. Majority of the farmers (60 %) offers single type of fodder and 39.0 % farmers prefers mix fodder i.e., combination of two or more fodders. In general, camels are not fed green forage except zone II and Rajgarh tehsil of Churu. The practice of feeding of mixed fodder was more common in zone III in comparison to others. None of the respondent was providing concentrates daily to their camel at any age. Camels in advanced pregnancy are fed concentrate i.e., methi + gur /til oil + gur (1:1) oil and bajari flour whereas, newly calved lactating mother just after calving are fed Methi, oil, Ajwain about 2 kg daily along with 5 kg gur 10-15 days regularly after calving for few days by 62.5% of camel keepers. Concentrates are also offered to breeding camel only during breeding season by 59.3 % once a month against the scientific requirement of 2-3 kg/days. Debilitated camels are being offered bajara / barley flour (5kg) and gur (1kg) and oil 1kg for few days. Majority (87.50%) of camel keepers give 20-25 gm of salt to the camel in a practice particularly to their working camel against the requirement of 125 g/d. The camels are fed approximately 10.0-15.5 kg roughage daily in winter and 10.0-16.2 kg in summer, which is as per scientific recommendation.

Management practices

Most of the farmers (43.13%) having 2-5 camels usually prefer semi intensive system of production (Grazing in nearby plus supplementation of some straw). In summer or lean period they are sent outside the villages or even more beyond the regular grazing areas to other nearby districts for access of forage or they feed some supplementary roughage about 15 kg in a week at home to each of their breeding, pregnant, lactating and camel calves.

The farmers who maintain one camel (which is utilized for carting/agriculture in villages/cities/towns as a source of livelihood) follow intensive system of management (36.88%) and these camels do not go for browsing in the field Extensive system of management i.e., zero input still follows by most camel breeders (20.0%) belonging to Raika & Rabari community. Under this system camel herds are allowed to graze about 30 km with some herdsman. These reproduce in the natural rangelands without any input. Majority of camel keepers use well and tube well as source of water whereas 34.38% farmers use tank constructed at centre place in village or rangeland locally known as khalli /pond followed by canal (25%) as a major source of watering to their camel. Most of the camel herders (60.9%) provide water to their camel once a day while, 23.4 % were offering on twice a day and 15.63 % on alternate days. According to farmers camel consumed average 50-lit/d and 37.5 lit/day during summer and winter respectively. Similarly quantity of water offered during winter and summer were significantly higher for zone IV in comparison to others.

Housing management

Camels are generally kept in open places irrespective of season. None of family (67.19%) constructed any type of shed for their camel. However, in rainy season and extreme summer, 32.81% respondents keep their animals under the trees during afternoon or along the side of protected areas.



Health care practices

The most of ailments were tackled either by home made medicine (59.38 %) or through veterinary hospital (40.63%). According to survey, mange was most prevalent 38.13% followed by pneumonia 20.9%, pica 12.1%, colic infection 7.31% and surra 5.31%. Shrinking of grazing (45.3%) due to urbanization and restriction by the State Forest Department and mechanization (32.8%) was conceived main problem of camel rearers. Camel keepers feel that like cattle etc. during draught/scarcity provision of subsidized feed and medicine should be made available from government side.

Table 9.3 Different feeding practices followed by camel keepers in arid zone of Rajasthan

Attributes Feeding Practices	Zone I		Zone II		Zone III		Zone IV		Pooled	
	N=80	%	N=80	%	N=80	%	N=80	%	N=320	%
Management of Feeding										
Grazing	40	(50)	10	(12.5)	30	(37.5)	40	(50)	120	(37.5)
Grazing + fodder	30	(37.5)	20	(25)	40	(50)	35	(43.75)	125	(39.0)
Stall feeding	10	(12.5)	50	(62.5)	10	(12.5)	5	(6.25)	75	(23.44)
Feeding										
Single fodder	50	(62.5)	50	(62.5)	45	(56.2)	50	(62.5)	195	(60.94)
Mixed fodder	30	(37.5)	30	(37.5)	35	(43.7)	30	(37.5)	125	(39.06)
Green fodder	10	(12.5)	30	(37.5)	15	(18.75)	20	(25)	75	(23.44)
Salt feeding	75	(93.7)	70	(87.5)	70	(87.5)	65	(81.2)	280	(87.5)
Type of fodder given										
Guar phalgati	46	(57.5)	30	(37.5)	52	(65)	36	45	164	(51.25)
Moth chara	15	(18.7)	10	(12.5)	10	(12.5)	156	18.75	50	(15.63)
Chana chara	5	(6.2)	10	(12.5)	3	(3.75)	10	12.5	28	(8.75)
Ground nut chara	10	(12.5)	20	(25)	10	(12.5)	4	5	44	(13.7)
Tree leaves	4	(5)	5	(6.25)	3	(3.75)	15	18.75	27	(8.4)
Water source										
Canal	20	(25)	60	75	0	0	0	0	80	(20.0)
Well +T.W.	30	(37.5)	10	12.5	40	50	30	62.5	130	(4.38)
Khalli	30	(37.5)	10	12.5	40	50	30	37.5	110	(34.3)
Frequency of watering										
Once a day	50	(62.5)	60	(75)	40	(50)	45	(56.2)	195	(60.9)
Twice a day	20	(25)	0	0	30	(37.5)	25	(31.5)	75	(23.4)
Alternate	10	(12.5)	20	(25)	10	(12.5)	10	(12.5)	50	(15.6)

Values in the parentheses show the percentage



Table 9.4. Existing management practices in different zones of Rajasthan

Attributes Rearing Practices	Zone I		Zone II		Zone III		Zone IV		Pooled	
	N=80	%	N=80	%	N=80	%	N=80	%	N=320	%
Method of management										
Extensive system	26	(32.5)	5	(6.25)	15	(18.7)	18	(22.5)	64	(20)
Semi intensive	38	(47.5)	25	(31.2)	40	(50)	35	(43.7)	138	(43.1)
Intensive	16	(20)	50	(62.5)	25	(31.2)	27	(33.7)	118	(36.8)
Housing										
Open	60	(75)	40	(50)	55	(68.7)	60	(75)	215	(67.1)
Protected area	20	(25)	40	(50)	25	(31.2)	20	(25)	105.0	(32.8)
Disease pattern										
Mange	40	(50)	35	(43.7)	45	(56.2)	52	(65.0)	172	(53.7)
Pneumonia	20	(25)	22	(27.5)	15	(18.7)	10	(12.5)	67	(20.9)
Pica	10	(12.5)	10	(12.5)	12	(15.0)	7	(8.75)	39	(12.1)
Colic infection	5	(6.25)	8	(10.0)	6	(7.50)	6	(7.50)	25	(7.78)
Surra	5	(6.25)	5	(6.25)	2	(2.5)	5	(6.25)	17	(5.31)
Treatment										
Traditional	50	(62.5)	30	(37.5)	60	(75)	50	(62.5)	190	(59.3)
Hospital	30	(37.5)	50	(62.5)	28	(35)	30	(37.5)	130	(40.6)
Constraints										
Shrinking of grazing land	40	(50)	20	(25)	40	(50)	45	(56.2)	145	(45.3)
Mechanization	20	(25)	35	(50)	30	(37.5)	20	(25)	105	(32.8)
Feeding cost	15	(18.7)	10	(12.5)	5	(6.25)	10	(12.5)	40	(12.5)
No constraints	5	(6.25)	10	(0)	5	(6.25)	5	(6.25)	30	(9.73)

N= Number of camel keepers

Values in the parentheses show the percentage

Breeding practices and behavior

Camel keepers follow the common traditional practices. Natural service is preferred. Only 7.81 % camel owners show interest in requirement of A.I. in camel. According to respondent, time involved in mating is 5-12 min. and generally no manpower is required during mating except zone II. Among the zone, mating efficiency of male camel per day varied from 1 to 3 (Table 9.5). Mating efficiency of male camel per day for the zone II was 2 ± 1.95 and different significantly ($p < 0.01$). Number of service required per conception varied between 1 to 3 for different zones of Rajasthan and may be biased estimate because, camels are let loose in herd and no record of observations on services were maintained by the breeders. Age of puberty is 5 years and was significantly different



($p < 0.01$) for zone III, which could be due to better nutrition. whereas, mating age of male and she camel were reported to be 5-6 and 4-5 years respectively in four zones.

Table: 9.5 Breeding behavior and practices in different zones of Rajasthan

Attributes	Zone I		Zone II		Zone III		Zone IV		Pooled	
	N=80	%	N=80	%	N=80	%	N=80	%	N=320	%
Breeding Practices										
Breeding bull										
Own	20	(25)	5	(6.25)	20	(25)	25	(31.25)	70.00	(21.88)
From other tola	37	(46.2)	30	(37.5)	20	(25)	15	(18.7)	117.00	(36.56)
Panchayat	18	(22.5)	25	(31.2)	20	(25)	25	(31.2)	93.00	(29.06)
Remote village	0	(0)	10	(12.5)	15	(18.7)	10	(12.5)	40.00	(12.50)
A.I.practices	5	(6.25)	10	(12.5)	5	(6.25)	5	(6.25)	25.00	(7.81)
Ration given										
During rutting	50	(62.5)	50	(62.5)	40	(50)	50	(62.5)	190.00	(59.38)
Late pregnancy /after calving	50	(62.5)	50	(62.5)	40	(50)	60	(75)	200	(62.5)
Calving done										
In house	50	(62.5)	70	(87.5)	60	(75)	55	(68.75)	235.00	(73.4)
In tola	30	(37.5)	10	(12.5)	20	(25)	25	(31.25)	85.00	(26.56)
Problem during calving										
Retention of placenta	8	(10)	5	(6.25)	7	(8.75)	6	(7.5)	26	(8.12)
Dystocia	5	(6.25)	3	(3.75)	0	(0)	2	(2.5)	10	(3.12)
Other	7	(8.75)	5	(6.25)	3	(3.75)	5	(6.25)	20	(6.25)
No problem	60	(75)	67	(83.75)	70	(87.5)	67	(83.75)	264	(82.50)

Values in the parentheses show the percentage

Inter calving period was kept 2 year by majority of camel owners and average lactation length recorded was reported to be varying from 10- 14 month. Number of calves delivered by she camel in life was 6 for the different zone. Male camels used for breeding are chosen by the experience, on the basis of reproductive traits of pedigrees and milk performance. Identification of heat in female camel was confirmed on the basis of slimy discharge from vulva, refuse to eat, frequent micturition and seeking of male camel etc. Camel keeper generally takes no work from their pregnant camel.

The breeding period in the camel ranges from November to March with peak in month of December and January. About 36.56% owners use breeding bull from different tola or Panchayat



29.06% while 21.88% uses their own breeding bull. Majority of camel keeper (73.44%) preferred to complete calving at home and 26.56 % preferred it in tola. No man assistance is generally required during delivery except dystocia. Main problem during calving was retention of placenta (8.1%) and dystocia (3.1%). According to respondent or hospital record prevalence of other reproductive diseases in camel was not much common.

Macro/micro nutrient content available in soil & blood serum

The macronutrient content of the soil in different zones (Table 9.6) show that the calcium content was high in zone I in comparison to other zones. Similarly a high pattern in case of Mg was seen in the zone III followed by zone I. Phosphorus content in zone III was found maximum compared to other zones.

Table: 9.6 Macro mineral status of soil in arid zone of Rajasthan

Zone	Ca	Mg	P
Critical limit	<2 meq/100gm soil	<8ppm	<3 Kg/ha
Zone I	1.4	14.8	10.3
Zone II	1.2	12.4	10.3
Zone III	1.2	15.6	11.1
Zone IV	1.2	13.3	10.2
Overall Mean±SEM	1.3±0.08	14.0±1.30	10.5±0.11

Phosphorous: Low-3-4 kg/ha, Med-4-7 kg/ha, High-8-11kg/ha

The concentration of Cu in the soil was found deficient in all the zones under investigation Tables 9.7-9.8. Zinc content in the soils of zone III and I are at marginal level whereas in other zones it was reported deficient. Iron and Manganese inclusive of selenium content in these soils are sufficient in all the zones whereas cobalt content in zone I and zone III was reported marginal while zone II and IV were fortunate.

Table: 9.7 Micro mineral status (ppm) of soil in arid zones of Rajasthan

Zone	Cu	Zn	Fe	Mn	Se	Co
Critical value	<0.5	<0.5	<2	<1.8	<2	<0.2
Zone I	0.20	0.50	3.15	3.72	4.29	0.42
Zone II	0.24	0.32	3.41	6.61	3.65	0.21
Zone III	0.19	0.67	3.99	4.16	2.87	0.48
Zone IV	0.25	0.32	3.83	7.48	3.20	0.20
Overall Mean±SEM	0.22±0.13	0.46±0.06	3.59±1.06	5.49±1.36	3.50±0.91	0.33±0.62

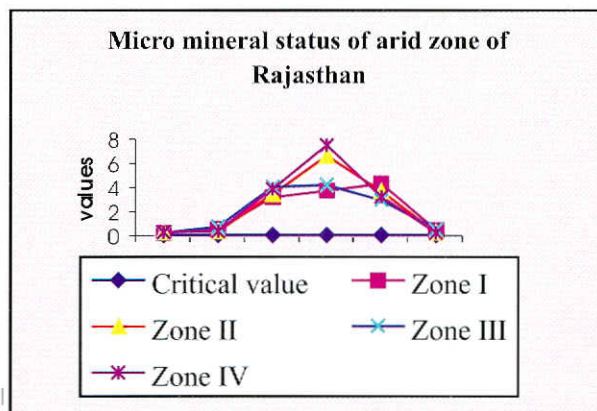
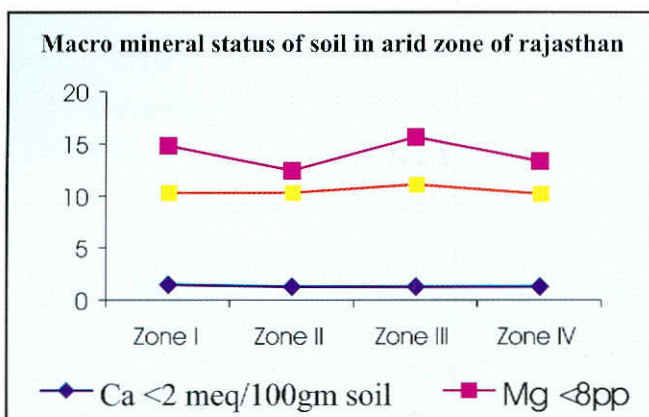


Table: 9.8 Mineral profile of camel blood serum ($\mu\text{g/ml}$) in arid zones of Rajasthan

Tehsils	Cu	Zn	Fe	Co
Critical Value*	0.65	0.80	1.00	0.40
Zone I	0.41	0.13	3.64	0.14
Zone II	0.67	0.84	4.32	0.48
Zone III	0.27	0.27	4.19	0.32
Zone IV	0.24	0.25	2.94	0.47
Overall Mean \pm SEM	0.40 \pm 0.02	0.62 \pm 0.09	3.7 \pm 0.07	0.35 \pm 0.01

*Source: Mc Dowell (1985)

The mineral profile of the blood serum of camel replicates the same trend as the feed and fodder analysis. Cu content in zone II show a marginal level and the other zones are in deficient mode, a similar trend in zinc had been observed. However, iron show a affirmative trend and the nutrient is found in sufficient amount, cobalt in zone II and IV show a optimum level but in zone I and III the nutrient is highly varied but zone I revealed a high down inclination in content.



10. LIST OF PUBLICATIONS

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- A. Bhardwaj B. D. Kiradoo, N. Saini, and M.S. Sahani (2006) Fate of organic farming in contrast to conventional farming systems-A thrust to organic Food. *Emirates journal of Agriculture Sciences* (Accepted).
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D. Popular articles

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केन्द्र, बीकानेर

नागपाल ऐ. के. 2005 Ek safal oont dairy farm mein gyabhin oontniyon ka vegayanic poshan parbandh।
करम (3) 21-25.

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E. Technical bulletin

नागपाल ऐ.के., अरोड़ा मंजु, जब्बार अब्दुल और साहनी एम.एस 2005- Improve camel productivity through feeding of complete rations- the only alternative to malnutrition (a Hindi and English bilingual bulletin- राष्ट्रीय उष्ट्र अनुसंधान केन्द्र बीकानेर।

Nagpal, A.K. and Sahani, M.S. 2005. Camel, their relevance in developing farming systems in arid regions of India. Chapter 26 in Book: Livestock Feeding for Dry Regions. (editors) Pathak, P.S. and Kundu, S.S. Pp.529-549. International Book Distributing Co. Lucknow.



11. LIST OF APPROVED ONGOING PROJECTS (X 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 and control of camel diseases.

12. MANAGEMENT COMMITTEE, RAC, SRC MEETING

I. Management Committee

The management committee was held on 23.02.2006 at National Research Centre on Camel. 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, Deptt. of Animal Husbandry, Govt. of Rajasthan, Bikaner	Member
2.	Dr. A.K. Gahlot, Dean, CVAS, Bikaner	Member
3.	Sh. Pratap Singh, Village Bhiyali Dist. Pali	Member
4.	Dr. S. K. Kaushish, PS & head, Div. Of AS & Forage Production, CAZRI, Jodhpur (Raj.)	Member
5.	Dr. S. K. Chopra, PS (Phy), IARI, New Delhi	Member
6.	Dr. S. K. Ghorui, Sr. Scientist, NRC on Camel, Bikaner	Member
7.	Sh. Satyapal, AF&AO, NRC on Camel, Bikaner	Member
8.	Dr. B. L. Chirania, T-7/8 & I/C Asstt. Admin. Officer, NRC on Camel, Bikaner	Member Secretary

II. RAC

New RAC Committee comprising of following was constituted w.e.f. 10th May, 2005.

- 1. Dr. Nagendra Sharma : Chairman
- 2. Dr. B. C. Patnayak : Member



- | | |
|---------------------|--------------------|
| 3. Dr. N. D. Khanna | : Member |
| 4. Dr. J. S. Bhatia | : Member |
| 5. Dr. A.K. Gahlot | : Member |
| 6. Dr. Aminu Deen | : Member Secretary |

First RAC meeting was held on 17-18th December, 2005. The presentations of progress were made by incharge unit scientists. RAC committee in its proceeding desired to provide the research achievements, gaps and future prospects of each project in all the ongoing projects of the Centre, which was duly submitted to chairman and all the members of RAC committee.

III. SRC

Annual SRC meeting was held on 20th August, 2005 at 11.30 A.M. in the Conference hall of the center under the Chairmanship of Dr. M. S. Sahani, Director, NRC on Camel, Bikaner & the following experts participated.

- Dr. K.M.L. Pathak, Director Research (Vet.) CVAS, Bikaner.
- Dr. Tribhuvan Sharma, Assistant Prof. & incharge, Dept. of Ani. Nutrition, CVAS, Bikaner.
- Brig. N.M. Singhvi, Jodhpur
- Dr. P.R. Jhatkar, Ex Dean CVAS, Bikaner and Principal, Tanweer Malawat College of Bio Sciences, Bikaner.



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

SCIENTIFIC STAFF			
Name and designation	Education/Training	Place	Date
M.S. Sahani Director	National Symposium of IAAP	New Delhi	17 th -19 th Feb., 2006
	Range Management Society of India	IGFRI at Jaipur (Raj.)	19 th Nov., 2005
G.P. Singh Pr. Scientist	Workshop' National Technological Interpenetration for the Promotion of India	Meghalaya	3 rd - 4 th May, 2005
	XXXIV Dairy Industry Conference	Bangalore	23 rd - 25 th Nov., 2005
	National Seminar of Indian Society for Sheep, Goat Production	CSWRI, Arid Region Campus Bikaner	17 th -18 th Dec., 2005
	National Nutrition Society of India	Gujarat Agrl.Univ., Anand	7 th - 9 th Jan., 2006
Aminudeen Pr. Scientist	National Symposium of IAAP	New Delhi	17 th -19 th Feb., 2006
	24 th Annual Convention of ISVM and National Symposium on "Current trends in diagnostic and therapeutic approach towards better health and production in livestock, poultry and companion animals"	KVAFSU, Bangalore	22 nd - 24 th Feb., 2006
A.K. Nagpal Sr. Scientist	National seminar on conservation , processing and utilization of monsoon herbage for augmenting animal production at arid campus	CSWRI, Bikaner	17 th -18 th Dec., 2005
	XII Animal Nutrition Conference on Technological Interventions in Animal Nutrition for Rural Prosperity	Gujarat Agrl. Univ., Anand	7 th - 9 th Jan., 2006

CONFERENCES



	Range Management Society of India	IGFRI, Jaipur (Raj.)	19 th Nov., 2005
S.K. Dixit Sr. Scientist	National seminar on conservation, processing and utilization of monsoon herbage for augmenting animal production at arid campus	CSWRI, Arid Region Campus Bikaner	17 th -18 th Dec., 2005
	National Symposium of IAAP	New Delhi	17 th -19 th Feb., 2006
	24 th Annual Convention of ISVM and National Symposium on "Current trends in diagnostic and therapeutic approach towards better health and production in livestock, poultry and companion animals"	KVAFSU, Bangalore	22 nd - 24 th Feb., 2006
F.C.Tuteja Sr. Scientist	24 th Annual Convention of ISVM and National Symposium on "Current trends in diagnostic and therapeutic approach towards better health and production in livestock, poultry and companion animals"	KVAFSU, Bangalore	22 nd - 24 th Feb., 2006
S. Vyas Sr. Scientist	Symposium on 'Frontiers in Reproduction: Concepts and Applications in Genomic Era' and 16 th Annual Meeting of the Indian Society for the Study of Production & Fertility	NDRI, Karnal	23 rd - 25 th Feb., 2006
Gorakh Mal Sci (Sr.Scale)	93 rd Indian Science Congress	ANGRAU, Hyderabad	3 rd - 7 th Jan., 2006
D. S.Sena Sci (Sr.Scale)	IV conference of IAVPHS and National Symposium on "Newer strategies for the diagnosis and control of zoonoses".	ICARNEH, Barapani,	11 th -12 th Nov., 2005.
	93 rd Indian Science Congress	ANGRAU, Hyderabad	3 rd - 7 th Jan., 2006
	National Symposium of IAAP	New Delhi	17 th -19 th Feb., 2006



	24 th Annual Convention of ISVM and National Symposium on "Current trends in diagnostic and therapeutic approach towards better health and production in livestock, poultry and companion animals"	KVAFSU, Bangalore	22 nd - 24 th Feb., 2006
N. Saini Sci (Sr.Scale)	National seminar on conservation , processing and utilization of monsoon herbage for augmenting animal production at arid campus	CSWRI, Arid Region Campus Bikaner	17 th -18 th Dec., 2005
	XII Animal Nutrition Conference on Technological Interventions in Animal Nutrition for Rural Prosperity	Gujarat Agrl.Univ., Anand	7 th - 9 th Jan., 2006
	Livelihood security and diversified farming system in arid region-Arid zone research association of India Jodhpur from January 2006 at (Raj)	CAZRI, Jodhpur	14 th - 16 th Jan., 2006
Raghvendar Singh Sr. Scientist	Workshop on current status and opportunities on value addition to goat and camel milk.	CAZRI, Jodhpur	29 th April, 2005
	National seminar on value added dairy products.	National Dairy Research Inst. Karnal	22-25 th Dec. 2005
S.C. Mehta Sr. Scientist	Food and nutritional security through environmentally sound micro-enterprises.	NRC for Women in Agriculture, Bhubaneswar	21 st - 24 th June, 2005
TECHNICAL STAFF			
Sh. Ram Kumar, FM	Range Management Society of India	IGFRI, Jhansi	19 th Nov., 2005
	Indian Society of Forage Research,	CCSHAU, Hisar	29 th to 30 th Aug., 2005



14. WORKSHOP, SEMINAR AND SUMMER INSTITUTE

Training organized at NRCC, Bikaner

- 48 students from various disciplines of B.Sc/M.Sc. Biotech and B.E. Biotech were given Biotechnology training for one month duration in May, 2005 and October, 2005.
- 29 post graduate students from various colleges of Rajasthan and other states undergone 2 months training in the field of Biotechnology and Microbiology.
- 8 post graduate students of Biotechnology/Microbiology undergone 4 months training during this year.

हिन्दी चेतना मास – 2005

केन्द्र में हिन्दी दिवस के शुभ अवसर पर परिषद् के अनुरूप ही दिनांक 14 सितम्बर-14 अक्टूबर, 05 तक हिन्दी चेतना मास का आयोजन रखा गया। केन्द्र में हिन्दी चेतना मास उत्साही व मनोरम वातावरण में मनाया गया।

केन्द्र निदेशक डॉ. मोहन सिंह साहनी द्वारा विधिवत् रूप से हिन्दी चेतना मास का शुभारम्भ किया गया। इस अवसर पर डॉ. साहनी ने कहा कि हिन्दी भाषा में काम करना कठिन नहीं है, जैसे-जैसे हम इसे कार्यप्रणाली में अपनायेंगे भाषा स्वतः स्वभाव में शामिल होगी। इस अवसर पर वैज्ञानिकों/अधिकारियों/कर्मचारियों से अधिकाधिक सरकारी कामकाज हिन्दी में करने के लिए संकल्प-पत्र भरवाया गया।

हिन्दी चेतना मास, 2005 के दौरान हिन्दी में सामान्य ज्ञान प्रश्नोत्तरी, श्रुति लेखन प्रतियोगिता तथा हास्य कवि सम्मेलन का आयोजन रखा गया। हास्य कवि सम्मेलन में स्थानीय नगर के जाने-माने कवियों – जनकवि श्री हरीश जी भादाणी, श्री भवानी शंकर व्यास 'विनोद', श्री विजय कुमार धमीजा, श्री गौरीशंकर 'मधुकर', श्री आनन्द जी आचार्य, श्री हनीफ शमीम बीकानेरी, डॉ. केशव शर्मा, डॉ. भगवान दास किराडू, श्री लीलाधर जी सोनी ने अपनी कविताओं के माध्यम से श्रोताओं का भरपूर मनोरंजन किया।

समापन समारोह के मुख्य अतिथि के रूप में पधारे श्री आर.के. अटोलिया, अपर मण्डल रेल प्रबन्धक, उत्तर पश्चिम रेलवे, बीकानेर ने इस अवसर पर कहा कि इस देश की मातृभाषा हिन्दी है। यह एक सुदृढ़ भाषा है, परन्तु हम अपनी ही भाषा को विस्मृत कर रहे हैं। श्री अटोलिया ने कहा कि यह चिन्ता का विषय है कि हमारी नई पीढ़ी निज भाषा को लेकर कतई जागरूक नहीं दिखती, उनमें यह सोच घर कर गई है कि व्यक्तित्व विकास के लिए अंग्रेजी का ज्ञान आवश्यक है न कि हिन्दी का, जो कि पूर्णतया गलत व निराधार है। अतः हमें नई पीढ़ी को हिन्दी में ज्ञान कराया जाना अति आवश्यक है।

विशिष्ट अतिथि के रूप में आमंत्रित डॉ. डी.डी. ओझा, सदस्य, संयुक्त हिन्दी सलाहकार समिति, पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय, भारत सरकार, जोधपुर ने कहा कि हमारी सोच हिन्दी में है न कि अंग्रेजी में, अतः वैज्ञानिक गण यह मानसिकता बना लें कि हिन्दी में लिखना ही उनकी उपादेयता है तो निश्चित रूप से अनुसंधान के सदुपयोग के साथ-साथ भाषा भी स्वतः प्रसार पायेगी।



समारोह के अध्यक्ष के रूप में केन्द्र निदेशक डा. मोहन सिंह साहनी ने कहा कि हमने जो भी तकनीकी विकसित की है, उसके यथोचित लाभ हेतु उसे प्रादेशिक भाषा (हिन्दी) के माध्यम से पहुँचाया जाने की महती आवश्यकता है। क्योंकि ऊँट पालकों/किसानों को अपनी भाषा में बात करने पर अपनत्व का बोध होता है तथा वे इससे किसी भी ज्ञान को अधिक सुगमता से ग्रहण करेंगे।

समापन समारोह के अवसर पर मुख्य अतिथि श्री आर.के. अटोलिया के कर-कमलों द्वारा केन्द्र की राजभाषा पत्रिका 'करम' के तृतीय अंक का लोकार्पण किया गया। वहीं केन्द्र की संतुलित आहार : बेहतर उष्ण उत्पादन व कुपोषण का एकमात्र विकल्प' विषयक लघु पुस्तिका का लोकार्पण, समारोह के विशिष्ट अतिथि डॉ. डी.डी. ओझा द्वारा किया गया। मंचस्थ अतिथिगणों द्वारा हिन्दी चेतना मास के दौरान आयोजित प्रतियोगिताओं के विजेताओं को पुरस्कृत किया गया।

1. राजभाषा कार्यशाला (02 जून, 2005)

केन्द्र में आयोजित राजभाषा कार्यशाला में अतिथि वक्ता के रूप में आमंत्रित डॉ. डी.डी. ओझा, सदस्य संयुक्त हिन्दी सलाहकार समिति, पैट्रोलियम एवं प्राकृतिक गैस मंत्रालय, भारत सरकार, जोधपुर ने अपने व्याख्यान 'राजभाषा में विज्ञान लेखन : दशा एवं दिशा' में कहा कि आज वैज्ञानिक साहित्य का महत्व बहुत अधिक है, इस हेतु हमें अथक प्रयास करने होंगे ताकि अनुसंधान की अर्जित उपलब्धियां का जन-जन तक प्रचार-प्रसार हो। उन्होंने कहा कि यदि विज्ञान की बात ज्यादा उपयोग में आयेगी तो उसका प्रभाव दीर्घकालीन होगा, वास्तव में विज्ञान की भाषा बड़ी अनुशासित भाषा है।

2. राजभाषा कार्यशाला (13 अक्टूबर, 2005)

चेतना मास के अन्तर्गत रखी गई हिन्दी कार्यशाला में अतिथि वक्ता के रूप में आमंत्रित डॉ. भगवान दास किराडू, प्राचार्य, नेहरु शारदा पीठ महाविद्यालय, बीकानेर द्वारा 'हिन्दी में लेखन : गुणात्मक अभिवृद्धि एवं 'क्या हिन्दी के प्रचार-प्रसार के लिए सामाजिक आंदोलन की आवश्यकता है?' विषयक व्याख्यान दिए गए। उन्होंने अपने व्याख्यानों में हिन्दी भाषा प्रयोग को अपनाने के लाभों के अलावा हिन्दी व्याकरण संबंधी अशुद्धियों को भी उजागर किया।

3. राजभाषा कार्यशाला (22 मार्च, 2006)

केन्द्र में आयोजित एक दिवसीय राजभाषा कार्यशाला के प्रथम सत्र में डॉ. चन्द्रशेखर श्रीमाली, व्याख्याता (कम्प्यूटर विभाग) रामपुरिया महाविद्यालय, बीकानेर द्वारा 'हिन्दी में कम्प्यूटर का व्यावहारिक प्रयोग' विषयक व्याख्यान दिया गया। डॉ. श्रीमाली ने कहा कि हिन्दी एक समृद्ध भाषा है, यदि इसे कम्प्यूटर से पूर्णतया जोड़ दिया जाए तो देश में सूचना प्रौद्योगिकी के क्षेत्र में बहुत बड़ा परिवर्तन आएगा। कार्यशाला के दूसरे सत्र के व्याख्यान 'सरकारी कार्यालयविधि में टिप्पणी व प्रारूप लेखन एक महत्वपूर्ण घटक' तथा 'नोटिंग व ड्राफ्टिंग के विविध प्रकार' विषयक हेतु श्री ओम मल्होत्रा, आकाशवाणी, बीकानेर को अतिथि वक्ता के रूप में आमंत्रित किया गया।

4. हिन्दी संगोष्ठी (05 अक्टूबर, 2005)

केन्द्र में आयोजित हिन्दी चेतना मास के अन्तर्गत 'हिन्दी का वर्तमान स्वरूप' विषयक संगोष्ठी में नगर के विषय-विशेषज्ञों को आमंत्रित किया गया। आमंत्रित वक्ता डॉ. शालिनी मूलचन्दानी, व्याख्याता (हि.सा.),



डूंगर महाविद्यालय, बीकानेर द्वारा संगोष्ठी की विषय-प्रस्तुति दी गई। विशिष्ट अतिथि के रूप में आमंत्रित डा. मदन केवलिया, पूर्व विभागाध्यक्ष (हिन्दी साहित्य) व उप प्राचार्य, डूंगर महाविद्यालय, बीकानेर ने अपने अभिभाषण में कहा कि आज हिन्दी दिवस न होकर राजभाषा दिवस होना चाहिए। हिन्दी में हमारी अस्मिता, जिसे भुला दिया गया है।

आमंत्रित वक्ता डॉ. उमाकान्त गुप्त, विभागाध्यक्ष, हिन्दी साहित्य, डूंगर महाविद्यालय, बीकानेर ने कहा कि हमें मात्र हिन्दी दिवस को औपचारिकता के रूप में न मनाकर इसे भारतीय भाषाओं का दिवस के रूप में मनाना चाहिए।

संगोष्ठी के अन्य अतिथि वक्ता श्रीमती संगीता सेठी, राजभाषा अधिकारी, भारतीय जीवन बीमा निगम, बीकानेर व जनकवि श्री हरीश जी भादाणी ने हिन्दी के वर्तमान स्वरूप के सम्बन्ध में अपने विचार रखे। अध्यक्ष के रूप में बोलते हुए केन्द्र निदेशक डॉ. मोहन सिंह साहनी ने संस्थान की राजभाषा स्थिति प्रकट करते हुए कहा कि हम अनुसंधान के द्वारा प्राप्त उपलब्धियों को किसानों व आमजन के समक्ष रख रहे हैं, उसके पीछे मुख्य ध्येय यह है कि अनुसंधान का यथोचित लाभ मिले, जिनके लिए अनुसंधान जारी है।

राजभाषा निरीक्षण दौरा (15 दिसम्बर, 2005)

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र, बीकानेर का श्रीमान् सुनील सरवाही, उप निदेशक (कार्यान्वयन) गृह मंत्रालय, राजभाषा विभाग, क्षेत्रीय कार्यान्वयन कार्यालय (मध्य), भोपाल द्वारा दिनांक 15.12.2005 को राजभाषा सम्बन्धी निरीक्षण किया गया। श्री सरवाही ने केन्द्र में राजभाषा कार्यान्वयन सम्बन्धी स्थिति के अन्तर्गत प्रोफार्मा, रजिस्ट्रों, फाइलों, हिन्दी पत्र-पत्रिकाओं, लघु पुस्तिकाओं, प्रचार-प्रसार सामग्री का अवलोकन किया तथा केन्द्र में राजभाषा स्थिति पर संतोष व्यक्त किया। इस अवसर पर केन्द्र में एक बैठक का भी आयोजन रखा गया जिसमें उन्होंने कहा कि हमें राजभाषा में लिखने के लिए शब्द प्रयोग को शुद्ध या परिष्कृत रूप में नहीं बल्कि सहज रूप में लेना चाहिए। इस दौरान केन्द्र निदेशक डॉ. मोहन सिंह साहनी ने कहा कि केन्द्र अधिकाधिक अनुसंधान सम्बन्धी जानकारी राजभाषा के माध्यम से दे रहा है।

केन्द्र के हिन्दी प्रकाशन (वर्ष 2005-06)

1. राजभाषा वार्षिक पत्रिका 'करभ' (तृतीय अंक)
2. संतुलित आहार : बेहतर उष्ट्र उत्पादन व कुपोषण का एकमात्र विकल्प



15. VISIT OF DIGNITARIES

- 8.5.2005 Former Prof. Ishwar Singh Chauhan, High Commissioner of India in Fiji & Vice Chancellor Barkutalla Univ. & M. P. Bhoj Open University, Bhopal.
Sh. Virender Singh, M.L.A. Lunkaransar (Bikaner) tasted various camel milk products.
- 8.9.2005 Prof. B. K. Nagla & Dr. (Miss) Madha Bagla, Reader, Dept. of Sociology, M.D. University, Rohtak
- 16.12.2005 Dr. V.K. Taneja, DDG (Animal Science) ICAR, Krishi Bhavan, New Delhi.



Dr.V.K. Taneja (DDG, Ani. Sci.) and Dr. O.P. Dhanda (ADG) showing keen interest on Camel Research achievements (16/12/05)



Dr. V.K. Taneja DDG (AG) & Dr.O.P. Dhanda ADG discussing farm activities at the centre.



Plantation of tree at NRCC



Visit of group of Agricultural Trainees from British College (27/3/06)



16. PERSONNEL

Name of staff members

Dr. M. S. Sahani	Director
Scientific	
Dr. G. P. Singh	Principal Scientist (Animal Nutrition)
Dr. Aminu Deen	Principal Scientist (Animal Physiology)
Dr. A. K. Nagpal	Sr. Scientist (Animal Nutrition)
Dr. S. K. Ghorui	Sr. Scientist (Veterinary Parasitology.)
Dr. S. K. Dixit	Sr. Scientist (Veterinary Medicine)
Dr. A. K. Roy	Sr. Scientist (Animal Physiology) joined back after deputation 12.02.06
Dr. Sumant Vyas	Sr. Scientist (Animal Reproduction)
Dr. R. Singh	Sr. Scientist (Animal Biochemistry)
Dr. S. C. Mehta	Sr. Scientist (Animal Genetics and Breeding)
Dr. F. C. Tuteja	Sr. Scientist (Veterinary Medicine)
Dr. C. Bhakat	Scientist Sr. Scale (Livestock Production Management)
Dr. Gorakh Mal	Scientist Sr. Scale (Animal Biochemistry)
Dr. D. Suchitra Sena	Scientist Sr. Scale (Veterinary Medicine)
Dr. Nirmala Saini	Scientist Sr. Scale (Animal Nutrition)
Dr. S. K. Bhure	Scientist (Biochemistry, Animal Science) up to 6.02.06
Dr. G. Nagarajan	Scientist (Biotechnology-Animal Sciences)
Technical	
Dr. U. K. Bissa	Sr. Veterinary Officer, T -9
Dr. N. Sharma	LFS, T-9
Sh. Ram Kumar	Farm Manager, T-9
Dr. B. L. Chirania	Veterinary Officer, T -8
Sh. Ram Dayal	Technical Officer, T -6
Sh. Dinesh Munjal	Technical Officer, T -5
Sh. M. K. Rao	Technical Officer, T -5
Administration	
Sh. Satyapal	Asstt. Fin. & Account Officer joined on 12.5.05
Sh. K. P. Sharma	Asstt. Admin. Officer



17. INFRASTRUCTURE DEVELOPMENT

The following infrastructure were completed during the year

- New Pathology Laboratory
- Community Hall completed except for wooden flooring and false ceiling.
- Extension of Camel Museum.
- New lobby at Guest House of Centre.
- Renovation of Molecular Genetics laboratory.
- New Administrative cum Library building. Shifted the office and Library.





Dignitaries are taking keen interest to observe camel farm on 16.12.05



Dr. V.K. Taneja (DDG, Ani. Sci.) visiting NRCC on 16.12.05



NATIONAL RESEARCH CENTRE ON CAMEL

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