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REPORT ON CAMEL BREEDING, PROTECTION AND ENVIRONMENT CENTRE RESEARCH ACTIVITIES IN THE KINGDOM OF SAUDI ARABIA

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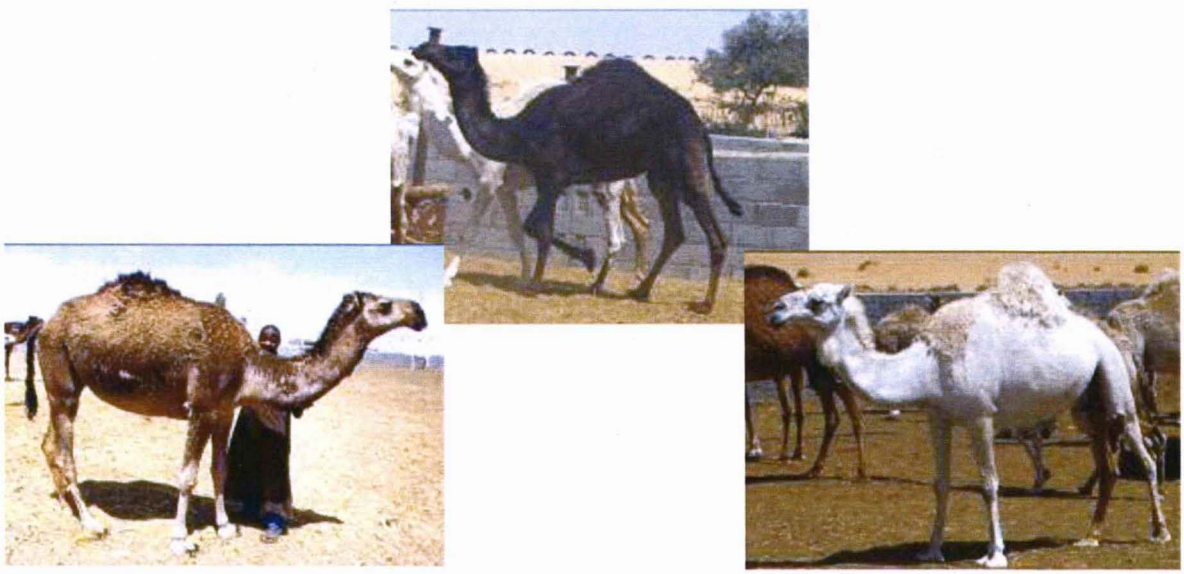
Dr Bernard FAYE



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SUMMARY :

The research centre of El-Jouf in the north of Saudi Arabia is primarily turned on the pastoralism, the breeding cameline and the culture of olive. My intervention was within the framework of the project entitled "Camel breeding, protection and improvement Centre in the Kingdom of Saudi Arabia" (UTFN/SAU/021/SAU), supported by the national office of FAO (A. Ohaidi). Following the preceding mission, it was decided that I will ensure the follow-up of the research activities of the center at a rate of a mission every two months. It was about in the mission in process:

(I) to establish the assessment of the work progress since my coming in May,
(II) to program the activities for 2010 (formation, experiments, investigations in breeding, human resources, equipment, training courses),
(III) to provide a program for the organization of an International Conference on the breeding cameline about the climate changes. In 2010, four months of mission (in six times) are programmed.

SOMMAIRE

ANNEXES

ACKNOWLEDGMENTS

Thanks to Dr. Abdellah Oihabi and the FAO office for giving me facilities in order to achieve this mission. The facilities provided by the "Camel & Range Research Center" at Al Jouf, through the courtesy of Mr. Sallal were greatly appreciated. Thanks also to all the staff of the camel center which have strong motivation for continuing the work and achieve the project.

ABSTRACT

The El-Jouf Camel and Range Research Center in the north of Saudi Arabia is focused on pastoralism, camel breeding and oleiculture. The present mission was achieved in the frame of « *Camel breeding, protection and improvement Centre in the Kingdom of Saudi Arabi*" project (UTFN/SAU/021/SAU).

The main purpose of the mission were:

(i) the establishment of the outcomes of the research activities started in may 2009,

(ii) the programme of the research, training and general workplan for 2010,

(iii) the proposition for training, equipment, capacity building and the content of the international camel conference in 2010. The workplan was discussed with all the staff and presented to FAO officer at El-Jouf.

INTRODUCTION

The Camel Breeding, Protection and Improvement Centre in the Kingdom of Saudi Arabia – Camel and Range Research Centre - Project – UTF/SAU/021/SAU – at Aljouf – Sakaka – Unilateral Trust Fund – Run jointly by FAO and the Saudi Ministry of Agriculture (MoA) - is conducting different researches in the field of camel diseases and production. After the training session achieved by CIRAD expert in may 2009[1] and under the supervision of the Chief RNER and the FAO Programme Coordinator in KSA, under the direct supervision of the CTA, under the technical supervision of the related technical division and in close collaboration with the National Project Director and project staff/counterparts, a list of research proposals with specific scientist as responsible were decided. The first part of the current mission was to follow up the implementation of the research proposals and analyze the constraints for their achievement both in term of equipment and human resources.

The diagnosis of the constraints may conduct to review the project document in close collaboration with the NPD and the FAO Programme Coordinator. The objective of this diagnosis will be the contribution to the preparation of the project workplan for 2010.

1. FOLLOW-UP OF THE RESEARCH PROPOSALS

1-1. In the field of milk production and udder health

- **Detection of subclinical mastitis in dromedary Camel (*Camelus dromedarius*) using Somatic cell count, California mastitis test and udder pathogen.**

The camel milk has a different behavior than other milk in case of infections and the analysis of Somatic Cell Count is an important aspect of the standardization. In a previous study, Merin et al., (2004)[2] have shown the specificity of camel milk in case of clinical mastitis (Table 1).

Table 1. Compared values in Somatic Cell count concentration (SCC) and activity of *NAGase* in different dairy species (from after Merin et al., 2004)

	SCC		*NAGase*	
	Non infecté	**Infecté**	**Non infecté**	**Infecté**
Chamelle	118,000	308,000*	96	89
Vache	100,000	>1,000,000	18	60
Brebis	374,000	3,272,000	38	77
Chèvre	485,000	2,203,000	-	-

[1] Faye B., 2009. *Training and documentation on camel sciences. International consultation FAO. Al-Jouf (Saudi Arabia)- 4th to 17th May 2009*. Rapport de mission CIRAD-ES, Montpellier, 20 p.

[2] Merin U., Sela S, Rosen B., Pinto R. , Leitner G. 2004. Standards for camel milk. Proc. of . Intern. Workshop, « Desertification combat and food safety : the added value of camel producers". Ashkabad (Turkménistan), 19-22 april 2004. In "Vol. 362 NATO Sciences Series, Life and Behavioural Sciences". B. Faye and P. Esenov (Eds), IOS press Publ., Amsterdam (The Netherlands), 152-158

This feature has to be confirmed and the relationship with CMT (Californian mastitis Test) is quite practically useful. However, the protocol presented must be changed by the increasing of the number of animals involved, the introduction of animals with clinical mastitis, and the automatic detection of the intramammary infections (IMI).

The main constraint to the achievement of this study is **the acquisition of a cell counter** which is urgent to get as the calving season will begin soon. Contact with Dubai Dairy farm (Dr Peter Nagy) is encouraged.

- **Milk Composition of camels**

A priori, a protocol focusing on camel milk composition will be of low interest because the camel milk composition is well-known. A recent meta-analysis has been published (Konuspayeva et al., 2008)[3] treating data published in 82 references. The question must be: "what the new protocol will add in the knowledge of camel milk composition?" It is clear that there is a lack of recording data on camel milk production and variability, and little information was published on some variation factors as lactation stage, parity, sire effect, breed variability. These factors are included in the present proposals. So, it could be considered that the main interest of this proposal, is (i) to have a systematic analyse of milk from the camel farm in order to give the information to the buyers, (ii) to have the tools for assessing the variability in milk technological quality by taking in account the main variation factors. Unfortunately, neither the present equipment (in fact **there is no equipment at all,** no Gerber centrifuges for fat analysis, no Kehjdahl analyser for nitrogen, no atomic absorption spectrophotometer for minerals, only a lactoscan is available), nor **the ability to process the milk** (except pasteurization) allow for the moment the emergence of a true milk unit research in the camel centre. The priority for implementing these studies, both for routine analysis and scientific research is **the urgent equipment of the dairy lab** and of the biochemistry lab in order to engage more deep research on fine milk composition and bio-activity of some milk components.

- **Effect of heat treatment on camel milk composition and some bacteriological parameters**

For this protocol, similar remarks could be done that for the previous one. It was suggested anyway to change the protocol. The effect of heat treatment must be measured in the same sample of milk. Indeed, it is proposed to make the microbial examination successively in raw milk, in pasteurized milk at 63°C for 30 min., in pasteurized milk at 75°C for 15 sec, and after 6 days at 5°C. The comparison will be convenient if only the same sample of milk (analysis on aliquot of the raw milk) is analyzed. The change in gross chemical composition is not interesting because the change is probably without interest. However, it could be more interesting to analyse the change in vitamin concentrations and in the protein composition (by electrophoresis). However, for those last parameters, specific equipment is needed. Vitamins could be measured with different kits and specific training in biochemical lab (see training proposals in 2010) could be proposed.

Another point to be analyzed could be the research of good pasteurization indicators. Usually, the alkaline phosphatase which is used for pasteurized cow milk is not available for camel milk because this enzyme is heat resistant. Several enzymes were tested (Loiseau et al., 2001)[4], but further studies must be achieved. Eventually, training session could be organised at the UMR "qualisud" at CIRAD in biotechnology lab after the implementation of biochemistry lab.

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[3] Konuspayeva G., Faye B., Loiseau G., 2008. *The composition of camel milk : A meta-analysis of the literature data.* J. Food Compos. Anal., 22, 95-101.

[4] Loiseau G., Faye B., Serikbaeva A., Montet D., 2001. *Enzymes ability to serve as markers of pasteurized camel milk.* Int. Conf. On new horizons in biotechnology, 18-21 avril 2001, Trivandrum, Inde.

1.2. In the field of meat sciences

- **Fattening performance and carcass characteristics of camels**

This proposal is linked also to the full equipment of the meat unit research in the camel farm. Indeed, the objective is not only to assess the growth performance according to the breed, but to have also data on meat quality. It was suggested to change also the protocol and the main propositions were:

(i) to abandon the measurement of the growth of the suckling camel calves which is under the dependence of the milk potential of the mother,

(ii) to make the measurement on weaned young camel from 6 to 12 months as 6 months is the time of weaning and one year the time of slaughtering,

(iii) to achieve some measurement in the meat and carcasses after slaughtering (protein, moisture and fat content). A contact with one Sudanese doctorate under the supervision of the expert is encouraged, in order to share the methodology used. In 2011, a training could be already envisaged at meat lab research at INRA-Theix in France where similar collaborative research was performed with CIRAD and El-Obeid University in Sudan.

1.3. In the field of veterinary sciences

- **Studies of some viral diseases that cause diarrhea death in camel calf**

Camel calf diarrhea is a main cause of camel calf mortality in most of the countries in the world. The causes of those diarrheas are well-known, even in camel (see for example, BENGOUMI et al., 1998[5]). Bovine Viral Diseases virus (BVD), coronavirus, rotavirus, Herpes virus type I are the most encountered pathogen agents. The over-infection with *E. coli* is common. However the discussion of the protocol turned around the objective of the study which might be more detailed. Formerly, it was proposed a prevalence study at the S.A Kingdom level which is quite impossible to achieve without knowing the exhaustive camel farms population randomly selected. If the objective would be the identification and repartition of etiologic agents among the cases of mortality, it would be necessary to implement a monitoring of the farms.

Neither of these proposals was realistic and a new protocol will be proposed. In fact, the main reason of the proposal was to control diagnostic methods using PCR, ELISA test and **Rapid test. This last must be quickly acquired in order to implement diagnostic ability of viral diseases** (see below). Another way could be the analysis of risk factors of camel calf mortality due to diarrhea. This approach (ecopathological study) needs to prepare a retrospective questionnaire coupled with blood and feces samples of sick animals.

- **Elisa in comparison with conventional method for detection of trypanosomosis in camel**

This proposal is limited to a comparison of diagnostic methods and was mainly motivated by the control of the techniques. Contrary to the previous protocols, the equipment is available but the researcher is not trained to use it. The objective was to make diagnostic of trypanosome in 3 batches of camels (apparently healthy, infected camel with clinical signs of surra, infected camels confirmed by parasitological examination. It is suggested to add infected, then treated animals with trypanocid (melarsomin). At any case, **a training is necessary** both to learn the diagnostic techniques using the acquired material and to adapt a

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[5] Bengoumi M., Berrada J., Rochdi M., Hidane K., De Lafarge F., Faye B., 1998. *Physiopathologie des diarrhées du chamelon au Maroc. Signes cliniques et perturbations métaboliques.* Rev. Elev. Med. Vét. Pays Trop., 51, 277-281

convenient protocol according to the known situation of the diseases in the Kingdom. It is suggested that the scientist (Ihad ABDEL KARIM) spend time in a reference lab. A preliminary contact was achieved with the UMR177-Trypanosomes at Montpellier (France) in order to organize a training session in January 2010 and to discuss innovative protocol.

- **ELISA and PCR tests in the diagnosis of *Pasteurella* infection in camels in North region of KSA**

Similar remarks have been done for this proposal. It is not clear that the demand is a specific training to control the tests (that could be achieved in Morocco–Biopharma Lab, contact: Dr EL-HARRAK), or if it is a true research programme. At any case, the first step would be the control of the tests by the technician. In a second steps, it would be more interesting to achieve an epidemiological survey by monitoring some farms having respiratory disorders. **A new protocol in that way has to be proposed**. A convenient methodology has to be achieved for assuming a reliable detection of sick or death animals in camel farms.

- **Study of selenium deficiency in Arabian camel**

This study included two protocols:

(i) a cross-survey on selenium deficiency which is presented as widely present in El-Jouf area,

(ii) an experiment on different types of selenium supplementation in pregnant and lactating camels. The cross-survey achieved in the region at risk will involve 7 farms in which 3 pregnant females, 3 lactating females and 3 camel calves will be sampled for blood and milk (lactating) as well as the components of the diet. The experiment can be easily achieved in the camel farm of the Centre.

Contact must be taken with lab able to make the selenium determination in blood and milk (formal contacts were taken with IDAC at Riyad). Also the measurement of Glutathione-peroxidase must be set up in the lab of the camel Centre. However, in spite of the name on the door, there is no **operational biochemistry lab**.

This project being supported by D O. ALHAMMA, the expert has sent to him recent publications on the subject (see [6]) and notably a synthesis of studies achieved since 1998 by the expert with different partners.

- **Camel genetic**

This point was widely tackled by the genetic expert (Dr BOUJENANE, IAV Hassan II, Morocco) and all the data concerning the filiations of camel in the farm (since 1993) were stored in a data base

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[6] Seboussi R., Faye B., Alhadrami G., Askar M., Ibrahim W., Hassan K., Mahjoub B., 2008. *Effect of different selenium supplementation levels on selenium status in camel.* Biol. Trace Elem. Res., 123, 124-138.

Seboussi R., Faye B., Askar M., Hassan K., Alhadrami G., 2009. *Effect of selenium supplementation on blood status and milk, urine and fecal excretion in pregnant and lactating camel.* Biol. Trace Elem. Res., 128, 45- 57.

Seboussi R., Faye B., Alhadrami G., Askar M., Ibrahim W., Mahjoub B., Hassan K., Moustafa T., Elkhouly A., 2009. *Selenium distribution in camel blood and organs after different level of dietary selenium supplementation.* Biol Trace Elem. Res., DOI 10.1007/s12011-009-8410-1

Seboussi R., Faye B., Alhadrami G., Askar M., Bengoumi M., Elkhouly A., 2009. *Chronic selenosis in camels.* J. Camel Pract. Res., 16(1), 1-14.

Faye B., Seboussi R., 2009. *Selenium in camel – A review.* Nutrients. 1, 30-49. DOI: 10.3390/nu1010030

Faye B., Seboussi R., Al-Hadrami G., 2009. *Selenium in camel*

and treated. Three papers were written (reproductive traits, milk yield at 305 days, growth traits)[7] and it is expected that they were sent as soon as possible in an international journal. So, in that field a significant advance has been done and has to be pursued by the national survey. However, to go ahead, molecular genetic capacity has to be undertaken. For this, specific competence is needed (recruitment or expert ?).

N°	Leader	Topic	Type of study	Achievement
1	Osama MAHMOUD ALHAMNA	Selenium/copper	Experiment on the effect of organic trace-elements on status of lactating camel	Protocol written Contacts with lab analysis Survey not started
2	Hussein RIDAA ABDALLAH	Survey	Organization of the large-scale survey on camel farming system, farming practices and breed description	No proposal Mr Abdallah was out of the centre
3	Dr Saied Kamal SALIH	Mastitis	Assessment of the interaction between subclinical mastitis (CMT, SCC) and pathogen germs in the camel milk	Protocol written Waiting Cell counter equipment
4	Ihab Abdel KARIM	Trypanosoma	Survey on the incidence of clinical trypanosome in Al-Jouf region	Need training. Contact taken for training
5	Mustafa Ibrahim ZEIDAN	Camel diarrhoea	Survey on the risk factors of the newborn diarrhoea and identification of the main causal agents	Protocol to be rewritten
6	Gamri Hashim AL RAMADA	Brucellosis	Incidence survey on brucellosis in camel farms of El-Jouf area	No proposal Another proposal on pasteurellosis was done
7	Abdel Gadir MUSAAD	Pasteurization and quality	Determination of the milk composition and heat resistance of some enzymes after pasteurization of the camel milk.	Genetic data treated and first publications proposed. Waiting equipment of dairy and meat unit in the farm

[7] Sallal E., Boujenane I., Musaad A., Awad-Acharari F., 2009. Genetic and non-genetic effects for growth in Saudi camels
Sallal E., Boujenane I., Musaad A., Awad-Acharari F., 2009. Reproductive traits and calving weight in Saudi camels
Sallal E., Boujenane I., Musaad A., Awad-Acharari F., 2009. Genetic and non-genetic effects for milk yield at 305 days and test milk yield in Saudi camels.

2. OUTCOME OF THE RESEARCH PROPOSALS

According to the former proposals reported in the previous international consultation FAO in May 2009, the following outcomes could be given:

Since my coming in last May, some progress could be observed and the motivation is quite present but all the team needs to be regularly pushed. The late arrival of equipment is obviously a handicap for starting the protocols but in many cases, **the activities of sampling, surveys in the field could start even without equipments**. I share the point of view of Dr BOUJENANNE when he wrote in his report[8]: "*To be honest, I found that important efforts were made for building new offices, labs, and a pharmacy. Thus, there is a milk unit which is supposed to hire all researches that deal with milk, composition, quality, processing... But, it hasn't functioned. Also, there is a meat unit, with a small slaughterhouse, that is meant to hire all researches on carcasses, meat composition, processing... But, it hasn't functioned. There are some other labs for nutrition, reproduction, bacteriology... But, they are not used. With regard to laboratory conception, the centre is well equipped. However, there is no equipment at all. The only equipment available is an old pasteurization unit for milk and a lactoscan that can be used for milk composition. Therefore, there is a real need for purchasing research equipment.* ***Nevertheless, it is not necessary to buy lab equipment if the researcher to use it is not present.*** *In my opinion, the first objective for the centre is to hire some qualified researchers, because the team working on camels is very weak. Once researchers are in place, they will order the equipment they need for their research.* ***In other words, if the equipment is purchased before hiring researchers, it will not be used, and it will become old-fashioned after few years***"

As it will be mentioned in the workplan 2010, the scientific staff of the Camel centre must go out of the vicious circle considering the following situation: I cannot work because I don't have the adequate equipment. When I have the equipment, I don't know how to use it. So, I need training to use it. When I got training to use it, I don't know how I can write a protocol. As I don't know how to write a convenient protocol, I don't achieve it, and so on...

At reverse, I feel a strong motivation of the staff and I think they need to have a pro-active scientific leader to push them strongly for achieving the work, starting different training and for contributing to find partners. The junior scientific staff appeared too young for understanding how to implement research, or when they are senior, without enough background to be motor for the young ones. I believe that the training, especially abroad, must be encouraged for the youngest scientist and technicians in order to maintain their motivation.

The training locally must be proposed to the senior scientists. This strategy will allow:

(i) for the junior scientists and technicians, to discover other manner for doing research;
(ii) for the senior scientists, to build a network at the national level for further partnership.

3. WORKPLAN 2010.

The global coherence of the project will be proposed below (chapter 5). The conceptual model of the project implementation is the representation of the links between the elements of the current workplan. This workplan could be reported by underlining 4 aspects, namely, (i) the achievement of discussed protocols, (ii) the achievement of non-discussed activities (iii) the improvement of human resources, (iv) the list of equipment needed. The 4 items are reported successively.

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[8] Boujenanne I., 2009. Camel Genetics and Breeding Consultation. CTA/Project: UTF/SAU/021/SAU. Camel Breeding, Protection and Improvement Centre in the Kingdom of Saudi Arabia, 93 p.

3.1. Achievement of discussed protocols

According to the discussion with all the scientists and technicians of the centre, it is proposed to start as soon as possible all the activities presented to the expert during the time at El-Jouf. I have separated the activities into 3 topics:

(i) the production including health disorders linked to the production as mastitis;
(ii) the camel health, mainly focused on infectious and hémoparasitoses diseases,
(iii) the genetic which appeared as the most advanced topic thanks to the recent expertise. The workplan for 2010 could be summarized in the following table, including the comments for the achievement of each discussed activity.

Type of study	Responsible	Comments
Production		
Detection of subclinical mastitis	Saied Kamal Salih	Starting the milk sampling. Getting urgently the cell counter. To be achieved in 2010. First publication at the end of 2010
Camel milk composition	Abdel Gadir Musaad	Must be achieved in 2010. Starting the sampling before the arrival of the equipment. Some biochemical analysis could be started (vitamin C). Need support of a biochemist
Effect of heat treatment	Abdel Gadir Musaad	Can start now with the old pasteurization equipment, and according to the changes in the protocol. Publication in 2010 available.
Fattening performance and carcass characteristics	Abdel Gadir Musaad	Starting weighing young camel (6 months old) now before to get lab equipment for meat analysis. Must be achieved in 2010 with first publication at the end of the year.
Health		
Etiology of camel calf diarrhea	Mustafa Ibrahim Zeidan	Starting a new realistic protocol with a first cross-survey on camel calf mortality. Submitting new protocol to the expert. The training on PCR, ELISA techniques will be achieved by Dr Ehab after his training in France. Need rapid test technique.
ELISA in comparison with conventional method for detection of camel tryp.	De Ehab Abdel Karim	Training at CIRAD-France in January on PCR and ELISA techniques. Agrrement obtained Starting the training for other users in the centre. Starting experiment on trip. First publication in 2010.
ELISA and PCR tests in the diagnosis of *Pasteurella* infection	Gamri Hashim Al Ramada	Training on Pasteurellosis and viral diseases diagnosis techniques in Biopharma- Morocco (El-Harrak)- Agreement obtained Starting diagnosis. Resubmitt a protocol to the expert as soon as possible.
Selenium deficiency	Osama Mahmmoud Alhamma	The survey has to start now as well as the experiment. The analysis can be done later. One publication at least in 2010.
Camel genetic		
Camel Genetics and Breeding Consultation	E. Sallal, A. Musaad, F. Awad-Acharari	Valorisation of the results on genetic to be achieved (expert mission of Dr Boujennane). Select convenient journal for publication

3.2. The achievement of former activities

At least, the previous activities have to be achieved and completely finished before the end of the year 2010. However some other activities were not presented and must start in 2010 if we want to expect results in 2011. They are the followings:

Type of study	Responsible	Comments
Typology of the camel farming systems	Falah	The survey can start in 2010. The formalization of a questionnaire with an expert could be achieved quickly. Support possible by a master student from France
Characterization and classification of the main breeds using molecular techniques	??	Need a specialist in this field. Stage master CIRAD possible?
Use of x-ray and ultrasonography in the diagnosis of pregnancy and disease	Osama Mahmmoud ALHAMMA	Training needed in Saudi Arabia (Hospital or medicine faculty)

Other activities, as the current diagnosis lab activities, are linked to the performances of the whole lab activities within the scientific research including acquisition of convenient equipment and training of the scientists. The researches as the establishment of nutrient requirements, characterization of the main diseases, identification of risk factors linked to farming practices are too wide to be approach significantly with the current human resources. The discussed activities represent a fist step for their accomplishment.

3.3. The improvement of human resources

It's the main question to improve the activities within the centre as the scientific level of the current scientists appeared weak in spite an apparent high motivation. The improvement of the human resources must include the training in and out of the Kingdom, and the recruitment of some new competencies. Other demands were submitted by the technical staff as a training in vet lab of histopathological interpretation that could be achieved in one-month training in histology lab from Vet faculty in SA.

The two main training is concerning diagnostic techniques for trypanosome and viral or bacterial diseases. It is suggested to organize one 3-wk training in France at CIRAD-UMR177 on trypanosome diagnostic techniques (already agree) for one scientist, and a 3-wk training in Morocco at BIOPHARMA (already agree) for one technician.

TRAINING 2010		
Type of knowledge	**Beneficiary**	**Proposals**
PCR, ELISA for diseases diagnosis	Ehad Abdel Karim	Training at CIRAD-Montpellier, UMR trypanosomose. Contact taken. Official invitation accepted for January 2010
	Ghamri Al-Ramadan	Training at Morocco. Contact taken. Agreement from Biopharma
X-Ray, ultrasonography	Osama Mahmoud Alama	Training in hospital or vet faculty in SA University. Contact to be taken quickly
Data treatment	All scientists	Two weeks training at the end of 2010 when data will be collected in enough quantity training by external expert.
Milk biochemistry	Abdel Gadir Musaad	Training to be achieved when the equipment of milk unit will be operational. External expert
Documentation and literature research on internet	All scientists	Local one week training after Training in CIRAD for documentalist
Histopathology	Technician staff	Looking for external place (Al-Ain vet lab???)

RECRUITMENT		
Type of competence	**Degree level expected**	**Comments**
Molecular genetic	PhD	For genetic characterization of the camel breeds. For the moment, only population genetic is available. Must be linked with specific equipment
Nutrition	MSci or PhD	For camel nutrition and management especially the dairy animals
Milk biochemistry	PhD	For milk analysis and support for blood analysis. Must encourage the implementation of biochemistry lab.

3.4. The list of equipment needed.

The centre is already well equipped for many researches and the temptation is to say that "*I don't have the equipment to achieve such works*" or "*I have the equipment but I don't know how to use it, so I cannot achieve the work*" or "*I'm not trained, so I cannot start the work*". But, it is always possible to take contact with other labs in the country to arrange some analysis (for example for selenium analysis). Of course, as the Centre is very far from the most of universities, it is quite difficult to transfer the samples, but not impossible. However, a certain type of equipment is needed. Below is reported the main equipment needed quickly to engage some studies.

The milk and meat unit has to involve all equipment of a biochemistry lab.

Equipment needed	Type of studies or activities
Cell counter	Milk quality control in the farm and the field
List of equipment for biochemistry lab Gerber centrifugation Kjeldhal apparatus Electrophoresis Laboratory scale 0.001 Spectrophotometer Stoves Lactodensimeter Refractometer Centrifugeuse Soxhlet Fiber analyse equipment PCR and DGGE	Milk biochemistry Meat composition
Deep freezer -70°C	Storage blood and milk samples
Pasteurization unit	Milk factory Unit Small scale milk processing
Molecular biology equipment List to be completed by expert	Molecular genetic

The small equipment for the current activities in the laboratory is not reported here, but the expenses in consumables and small equipment are depending of the true analytical activities.

4. PROPOSAL FOR IMPLEMENTING THE NEW PHASE OF THE PROJECT

According to the current human resources and to the available facilities, **it is better to achieve fewer activities than previously but do them correctly.** The project could be re-oriented up to 5 main research and development objectives:

- **To characterize the camel farming system and the camel population** both in term of genotype, phenotype and production performances including growth and milk production by experiment in the camel farm of the centre and by survey in private camel farms in the area of El-Jouf.

- **To identify some health disorders of high epidemiological interest** mainly focused on the main diseases as trypanosomose, calf diarrhoea, or on emerging diseases as respiratory disorders (pasteurellosis, PPR like viral disease,...) in order to suggest new ways for disease prevention, and based on the reinforcement of the lab activities for diagnosis.

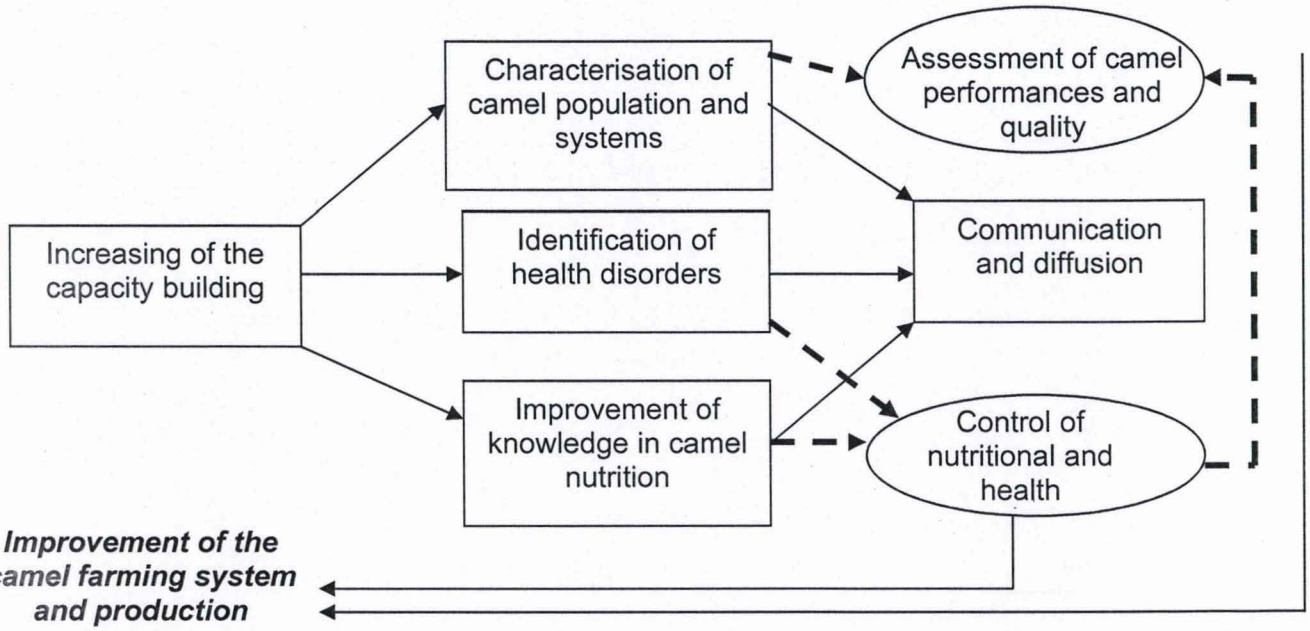
- **To improve the knowledge in camel nutrition** by considering the adequacy between milk production level and quality/quantity of the diet (the over-energetic diets seem to conduct to high body condition score of the camel rather to increase the milk production) and by studying the nutritional constraints (selenium deficiency, mineral and vitamin supplementation)

- **To increase the capacity building of the scientific and technical staff** by specific technique learning, training in data management and treatment, in communication, training course organization within the centre for farmers...

- **To establish a communication strategy** including participative survey in camel farms, return session of the results to the farmers, diffusion of the results to the professionals (brochures, website), scientific publications and transfer documents, continuous access to the library of the

Centre, contribution to ISOCARD activities (camelpedia, publications in Journal of camelid Sciences).

The following conceptual model could be suggested:



The reinforcement of the capacity building of the center must include some recruitment at national or international level. Three competencies are suggested: molecular genetic, nutrition and biochemistry.

CONCLUSION

The camel and range research Center has the tools to start convenient studies on the camel: good lab facilities even if it is necessary to complement some equipment, motivated staff even if the capacity building is necessary to be improved, wide matter of research for answering to camel farmers demand. The proposed workplan 2010 took in account the existing situation and proposed to achieve the following items:

- ⇒ Strengthening of the capacity for scientific and technical staff in order to control some tools
- ⇒ Recruiting new scientists in the field of nutrition, biochemistry and molecular genetic
- ⇒ Implementing studies and surveys without waiting the missing equipment
- ⇒ Acquiring the absolutely necessary equipment
- ⇒ Promoting communication and diffusion of the results

In the same time, the team of the Centre must learn how to work by taking in account the complementarities between the studies, to have volunteer for going ahead in their activities, to have access in continue at the scientific literature, and to be motivated by the valorization of their results.

ANNEXES

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ANNEXE 1

Calendar and encountered personalities

Calendar and encountered personalities

Thurday 15th October

- Departure from Montpellier at 10:20
- Arrival at Riyad at 21:15
- Transfer to Hotel

Friday 16th October

- Departure for El-Jouf at 8:50
- Arrival at El-Jouf at 10:15
  - First meeting with Dr Sallal

Saturday 17th October

- Visit of the bacteriology, virology, biochemistry labs
- Discussions with all the scientists of the camel center (Dr Saied Kamal Salih, Mr. Mustafa Ibrahim Zeidan, Mr. Falah Awad Alsharary, Hussein Ridaa Abdallah, Ihab Abdel Karim, Osama Mahmoud Alhamna, Abdel Gadir Musaad)
- Reading the research proposals

Sunday 18th October

- Visit camel dairy farm and milk laboratory
- Meeting with all the scientists: presentation of the research proposals and discussion

Monday 19th October

- Discussion with each scientists
- Visit of the camel farm
- First draft of the report

Tuesday 20th October

- Discussion with Mr Abdullah Oihadi (FAO officer)
- Writing report (continued)

Wednesday 21st October

- Return conclusion to all the scientists and final discussion
- Establishment of the working plan 2010 with Dr Oihabi

Thursday 22th October

- Return to Riyad
  - Return conclusion to FAO Office
  - Writing report

Friday 23th October

- Departure for Montpellier

ANNEXE 2

Term of references

Terms of Reference

International Consultant Camel Production

Duty station: Riyadh-Al Jouf
Duration: 1 week
EOD: 16-22 October, 2009

Description of duties:

Under the overall supervision of the FAO Programme Coordinator in KSA, under the technical supervision of the Regional Animal Production and Health Officer, and in close collaboration with the National Project Director and project staff/counterparts, the consultant will be responsible for:

1. Follow up of the research proposals implementation.
2. Review, in close collaboration with the NPD and the FAO Programme Coordinator, the project document in order to overcome the main constraints related to the lack of human resources in the centre.
3. Assist in the preparation of the project workplan for 2010
4. Write a report on the mission and give recommendations and conclusions.

ANNEXE 3

Training proposals

PROPOSAL FOR TRAINING OF Dr EHAB ABDEL KARIM

Objectives:

- to learn techniques on PCR and ELISA for trypanosome diagnostic
- to discuss the general protocol on camel trypanosomoses with international specialists
- to collect convenient scientific literature on the camel trypanosomoses

Place of training:

UMR tryanosoma, international lab reference for trypanosoma
Full adresse:
Dr Gérard CUNY
UMR 177 IRD-CIRAD -Laboratoire de Recherches et de Coordination sur les Trypanosomoses
TA A-17 / G
Campus international de Baillarguet
34 398 Montpellier cedex 5 (France)
Tél: 33.(0)4 67 59 38 35
Fax: 33.(0)4 67 59 38 94
Email: gérard.cuny@mpl.ird.fr

Date : from 15th January to 7th February 2010

Budget: the lab has accepted to achieve the training without lab fees

Cost:

- one flight Ticket El-Jouf –Riyad –Paris- Montpellier A/R
- 3weeks living expenses (approximately 900 €)

PROPOSAL FOR TRAINING OF Mr GHAMRI AL-RAMADAN

Objectives:

- to learn techniques on PCR and ELISA for viral and bacterial diseases
- to learn serological techniques
- to learn bases on molecular biology

Place of training:

Biopharma
Full adresse:
Dr Mehdi El-Harrak
Route de Casablanca. BP n° 4569.
Rabat Akkari
Tél: 212 037 69 16 92
Fax: 212 037 69 36 32
Email: biopharma_ma@yahoo.fr

Date : from January 2010

Budget: 1500 USD/wk to be negotiated

Cost:

- one flight Ticket El-Jouf –Riyad –Rabat A/R
- 3weeks living expenses

ANNEXE 4

International conference on camel in 2011

PROPOSAL FOR THE ORGANIZATION OF A CAMEL CONFERENCE IN SAUDI ARABIA IN 2011

Main topics

Three key conferences for 9 topics:

1. Mechanisms of adaptation in camels face to the climatic changes: its assets, its limits (lecturer from Saudi Arabia)
    a. The camel physiology (heat, drought, low-nutrition adaptation)
    b. The camel performances (impact of environmental conditions and farming practices on camel performances)
    c. The camel genetic (genetic variability of adaptation to harsh conditions)

2. The emerging diseases in camel population: the current situation (proposal: Dr EL-HARRAK)
    a. Parasitic diseases
    b. Bacterial and viral diseases
    c. Nutritional diseases

3. The role of camel in the preservation in arid lands and the desertification combat (Proposal: Dr B. FAYE)
    a. Camel farming systems
    b. Impact of camel breeding on the environment
    c. Impact of environmental failures on camel breeding and health

Possible dates:

March 2011

Duration: 3-4 days

Place: ?

ANNEXE 5

Proposals for ToR of Lamine DIA consultancy

Proposal for ToR Lamine Dia

International Consultant Camel trypanosoma

Duty station: Riyadh-Al Jouf
Duration: 4 weeks
EOD: March 2010

Description of duties:

Under the overall supervision of the FAO Programme Coordinator in KSA, under the technical supervision of the Regional Animal Production and Health Officer, and in close collaboration with the National Project Director and project staff/counterparts, the consultant will be responsible for:

1. Follow up of the research proposals implementation involving current research on trypanosomoses in camel within the project
2. Assess the training received by Dr Ehab Abdel Karim in France
3. Support the training of the local staff on the techniques and tool for diagnostic of trypanosomoses in camel
4. Propose a strategy for further research on trypanosome in camel with innovative approaches
5. Contribute to the implementation of new protocols

ANNEXE 6

Proposals for field master training

Master student field training proposals

Proposal 1: survey on camel farming systems in Saudi Arabia

Place of stage	El-Jouf Camel and range research Center
Subject of stage	Survey on camel farming system in Saudi Arabia
Problematic and context	The camel farming is the main livestock activity in the Saudi Arabia Kingdom. In the area of El-Jouf in the north of the country, camels are used for milk and meat production. Several breeds are described, but the farming system was never described in detail. In the frame of FAO project for the development of camel production in Saudi-Arabia, a survey has to be implemented, in order to identify the types of support to be achieved.
Proposed working programme	- writing questionnaire with the scientific staff of the centre - testing the questionnaire in 2 or 3 camel farms - establishing a farm sampling according local expected variability - implementation of the survey in approximatively 50 to 100 camel farms - Data base implementation and data treatment (typology analysis) - Writing summary report in english
Duration	From April 1st to august 31th 2010
Institutional frame	**Welcome structure:** El-Jouf camel and range research Center **Responsible for the stage** (name and function): Dr Sallal, head of the camel center **Signature of stage agreement** (name and function): Dr Abdullah OIHABI , FAO officer at Riyad (Abdallah.Oihabi@fao.org)
	Field contact (name and email): Dr Sallal, sallalessa@yahoo.com **French tutorial** (name and e-mail) : Bernard FAYE, UR18 faye@cirad.fr
Remarks and conditions (diploma, languages, particular competencies)	- Master level - Good knowledge in computer (MS Word & data base) - English speaking (or Arabic notion) - Field research - Knowledge in data treatment
Material conditions	**Air ticket:** Yes **Accommodation and facilities:** Yes **Field work**: Yes **Training per diem** : Yes

Proposal 2: Characterization of camel breeds in Saudi Arabia

Place of stage	El-Jouf Camel and range research Center
Subject of stage	Phenotypic characterization of camel breeds in Saudi Arabia
Problematic and context	The camel farming is the main livestock activity in the Saudi Arabia Kingdom. Several breeds are described in the country on the basis of their phenotype. In the frame of FAO project for the development of camel production in Saudi-Arabia, a survey has to be implemented, in order to characterize the different breeds in order to establish in a second step a classification with molecular tools..
Proposed working programme	- writing questionnaire with the scientific staff of the centre - testing the questionnaire in 2 or 3 camel farms - Establishing a farm sampling according to the expected different breeds and identification of the main prototype of each breed according to the farmer's opinion. - Measurement of phenotypic parameters and photos - Data base implementation and data treatment (discriminant analysis) - Writing summary report in English
Duration	From April 1st to august 31th 2010
Institutional frame	**Welcome structure**: El-Jouf camel and range research Center **Responsible for the stage** (name and function): Dr Sallal, head of the camel center **Signature of stage agreement** (name and function): Dr Abdullah Oihabi , FAO officer at Riyad (Abdallah.Oihabi@fao.org)
	Field contact (name and email): Dr Sallal, sallalessa@yahoo.com **French tutorial** (name and e-mail) : Bernard FAYE, UR18 faye@cirad.fr
Remarks and conditions (diploma, languages, particular competencies)	- Master level - Good knowledge in computer (MS Word & data base) - English speaking (or Arabic notion) - Field research - Knowledge in data treatment
Material conditions	**Air ticket:** Yes **Accommodation and facilities:** Yes **Field work**: Yes **Training per diem** : Yes