Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Animal Production & Health Newsletter

No. 58 July 2013

http://www-naweb.iaea.org/nafa/index.html
http://www.fao.org/ag/portal/index_en.html

ISSN 1011-2529

Contents

Sheep herd drinking water at the National Agricultural Research Institute facilities in Eritrea.

To Our Readers

Dear Colleagues,

The first phase of this year has been a busy time for all personnel in the Subprogramme. Apart from our regular Coordinated Research Project (CRP) activities and our technical support given to national and regional Technical Cooperation (TC) projects, we were involved in the technical planning of project concepts for new TC projects by Member States for the 2014/2015 biennial project cycle. We were also occupied with preparing the IAEA's 2014/2015 Work and Budget Programme, and the FAO's 2014/2015 Programme of Work and Budget. It is hoped that our inputs will serve the best interests of our Member States (MS). Please look at our web site and our Animal Production and Health Newsletter to familiarize yourselves with all the activities of the Subprogramme.

A bone of contention is the current avian influenza H7N9 situation. On 1 April 2013, a human case of infection with the avian influenza H7N9 virus was reported in China. Since then this strain has been detected in four provinces of eastern China and has infected 132 people of which 37 have died (situation as of 3 June 2013). The number of cases dropped in May as compared to April, probably because of the control measures taken by Chinese health authorities, which includes closing live bird in markets, but this can also be due to the change climatic conditions or the international contribution.

IAEA International Atomic Energy Agency

It is known that these viruses have a seasonal pattern where there is a decline of infections in the summer. In this case, a new wave of cases can be expected when the weather turns cooler. Since the H7N9 influenza virus does not induce disease in poultry (but still pose a risk to in-contact humans), we are investigating early and rapid molecular diagnostic technologies suitable to identify infected birds/poultry carrying the H7N9 virus to assist MS in the control of the disease and to protect human lives. To this effect, technical support and guidance is being provided by our Animal Production and Health Laboratory (APHL) in Seibersdorf. In addition, the evaluation, validation and distribution of real time polymerase chain reaction (PCR) Standard Operating Procedures (SOPs) and guidelines is being conducted with the relevant OIE and FAO avian influenza reference laboratories, and distributed and disseminated to MS.

An important component for the prevention, control and eradication of any disease is capacity building for decision makers and for laboratory personnel needs to be considered. To address this two training courses will be held in the next few months at the Laboratories in Seibersdorf for participants from European and Asian countries at risk. These courses will focus on laboratory diagnosis and aim at enhancing technical knowledge on the epidemiology of avian influenza H7N9, differential diagnosis of the virus sub-types involved, and sampling and submission procedures (including the shipment of pathological samples to OIE/FAO reference centres). These courses will provide hands-on training on current rapid techniques for disease diagnosis, in particular the use of nuclear based or related techniques for the identification and characterization (genomic cartography) of the pathogen(s). In addition, they will include an introduction into the genome sequencing and molecular epidemiological analysis of H7N9 viruses.

The international laboratory network on avian influenza lead by the APHL can provide valuable technical support to other countries in order to control the disease by monitoring the presence of any avian influenza serotype in wild birds and local poultry, and submitting DNA samples to the Laboratories in Seibersdorf for sequencing and genomic cartography. The Joint FAO/IAEA Division will provide technical and expert 'on-site assistance and services' to MS if needed (please see our web site for more information).

In this newsletter I, however, want to draw your attention on the current status of animal health and which research is needed in the future. Please see the paper developed by the Friedrich-Loeffler-Institut, Germany Federal Research Institute for Animal Health, Riems, Germany, in the Expert Opinion section of this newsletter and on our web page.

The complex global developments mentioned there have highlighted a fragile and risky epidemiological environment throughout the world. Both the developing and developed countries will have to establish or improve their early detection systems (first line diagnostic technologies) in order to timely detect and properly react to the threatening disease challenges. This important 'first line defence' component of disease control plans should cover the whole process from proper sampling in the field, through submission to designated official laboratories and selection of appropriate tests, to the issuing of a result. As there is a big discrepancy in laboratory capacities among developing, and in some cases developed countries, a long term strategic approach will be required to achieve a technically satisfactory level of capabilities for the early and rapidly detection of animal and zoonotic diseases. As a first step, conventional serological and molecular techniques, such as various agglutination and immunodiffusion based techniques, immunofluorescence, ELISA, conventional and real time PCRs (RT-PCRs), isolation and cell culture techniques, etc., should be available in all official national and regional laboratories. Significant efforts should be directed towards proper harmonization of these methods among laboratories (i.e. an interactive laboratory network) in order to comply with existing international standards and to produce comparable and trustworthy results. Once this basic platform of technologies is in place, the implementation of advanced and upcoming diagnostic technologies, such as new generation sequencing, metagenomic analysis and multi-pathogen detection platforms, could be encouraged in carefully selected laboratories according to their technical and organizational competence, as well as their geographical distribution.

In order to improve and maintain national, regional and international collaborations within the network of diagnostic laboratories, other collaboration programmes should be encouraged, such as the OIE twinning programmes for education (http://www.oie.int/support-to-oie-members/veterinary-education/guide-to-veterinary-education-twinning-projects/) and for laboratories (http://www.oie.int/en/support-to-oie-members/ laboratory-twinning/) or third source collaboration project (e.g. the German GTZ programme). These programmes should be targeted to maintain and improve the laboratory competence among developing countries (but not only), as well as to encourage and facilitate regional and international knowledge and information sharing. Finally, sustainable collaboration with and between the competent animal health authorities in developing countries should be encouraged in order to achieve the most efficient incorporation of the diagnostic capacities in the national and regional disease control plans. The Animal Production and Health Subprogramme will certainly support such collaboration wherever possible and in line with Member State needs and requests.

Looking back at the activities of the past six months, we had several workshops, training courses, and research coordination meetings (RCMs). Activities scheduled for the

next half-year include project review meetings, national, regional and interregional training courses, regional workshops and consultants meetings. Both past and future activities are discussed in further detail in this newsletter and are also accessible at our website. Let us know if you have any ideas, comments, concerns or questions. We thank all those who have responded to our request to update their contact and mailing address details, and urge those who haven't to please do so by replying to R.Reiter@iaea.org. This will ensure that the next copy of our newsletter will be received. By also sending us the addresses of unsubscribed colleagues we will be able to further widen our network. As discussed in previous newsletters, the Animal Production and Health Subprogramme will continue to move progressively forward and in pace with developments within the livestock field so as to optimally serve our Member States. We will therefore continue to encourage project teams to keep abreast of current technological developments and to promote their implementation where feasible. This will allow a better positioning of our Member States with respect to international trade and other livestock related issues, promote improved quality assurance of animal husbandry and health practices, and lead to a greater autonomy for Member States.

Gerrit Viljoen,
Head, Animal Production and Health Section

Staff

Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Headquarters: Vienna International Centre, P.O. Box 100, A-1400 Vienna, Austria; Telephone: (+43 1) 2600+Extension; Fax (+43 1) 26007; Email: Official.Mail@iaea.org

Name	Title	Email	Extension
Qu LIANG	Director, NAFA	Q.Liang@iaea.org	21610

Animal Production and Health (APH) Section

Name	Title	Email	Extension
Gerrit J. VILJOEN	Section Head, APH	G.J.Viljoen@iaea.org	26053
E. Nicholas ODONGO	Livestock Nutritionist	E.Odongo@iaea.org	26845
Ivancho NALETOSKI	Veterinarian, Serologist	I.Naletoski@iaea.org	26054
Mohammed SHAMSUDDIN	Livestock Reproductionist/Breeder	M.Shamsuddin@iaea.org	21619
Hermann UNGER	Veterinarian, Virologist	H.Unger@iaea.org	21644
Mario GARCIA P.	Veterinarian, Theriogenologist	M.Garcia-Podesta@iaea.org	26048
Svetlana PIEDRA-CORDERO	Project Assistant	S.Piedra-Cordero@iaea.org	26051
Roswitha REITER	Senior Project Assistant	R.Reiter@iaea.org	26052

Animal Production and Health Laboratory (APHL), A-2444 Seibersdorf, Austria

Name	Title	Email	Extension
Adama DIALLO	Laboratory Head, APHL	Adama.Diallo@iaea.org	28355
Kathiravan PERIASAMY	Livestock Geneticist / Breeder	K.Periasamy@iaea.org	28358
Charles Euloge LAMIEN	Biochemist	C.Lamien@iaea.org	28314
Francisco BERGUIDO	Immunologist	F.Berguido@iaea.org	28356
William DUNDON	Molecular Microbiologist	W. Dundon@iaea.org	28379
Richard KANGETHE	Molecular Parasitologist	R.Kangethe@iaea.org	28385
Esayas Gelaye LEYKUN	Biotechnologist	E.Leykun@iaea.org	28254
Bharani SETTYPALLI	Molecular Biologist	T.B.K.Settypalli@iaea.org	28252
Eva-Maria WINGER	Senior Laboratory Technician	E.M.Winger@iaea.org	28303
Rudolf PICHLER	Laboratory Technician	R.Pichler@iaea.org	28378
Mamadou LELENTA	Laboratory Technician	M.Lelenta@iaea.org	28321
Joanna MLETZKO	Project Assistant	J.Mletzko@iaea.org	28362

The Animal Production and Health Laboratory, Seibersdorf, is a collaborating Centre for ELISA and molecular technologies in animal disease diagnosis for the OIE.

Animal Production and Health Subprogramme


G. VILJOEN


A. DIALLO


H. UNGER


N. ODONGO


I. NALETOSKI


K. PERIASAMY


C. LAMIEN


M. SHAMSUDDIN


M. GARCIA


F. BERGUIDO


E. LEYKUN


B. SETTYPALLI


W. DUNDON


R. KANGETHE


E. WINGER


R. PICHLER


M. LELENTA


S. PIEDRA-CORDERO


R. REITER


J. MLETZKO

Expert Opinion

Major Animal Diseases and Zoonoses: Current Status and Future Considerations

By the Friedrich-Loeffler-Institut, Federal Research Institute for Animal Health, Riems, Germany

The Friedrich-Loeffler-Institut (FLI) is an independent higher federal authority affiliated with the Federal Ministry for Food, Agriculture and Consumer Protection of Germany. The FLI publishes research results, cooperates with scientists and scientific institutions in Germany and worldwide, and fulfils the tasks assigned to it by the OIE as 'Collaborative Centre for Zoonosis in Europe' as well as by the WHO as 'World Reference Centre for Rabies'. In addition to research in the field of animal diseases, FLI carries out epidemiological outbreak investigations and acts as National or Community Reference Laboratory for notifiable animal diseases. The FLI maintains reference laboratories designated by the OIE (6), FAO (3) and WHO (1). Research work is performed in the field of notifiable animal and zoonotic diseases.

Friedrich-Loeffler-Institute, Riems, Germany.

Current developments in the spread of animal and zoonotic diseases

Challenges are plentiful in the field of animal health today. Consumption patterns are changing; the worldwide demand for meat products, especially from pigs and poultry, is rising. Thus, the current trend in livestock production is directed towards more intensive systems with always growing unit sizes to decrease production costs and towards locations closer to or even within urban centres where lucrative markets exist. Global trade and travel routes take products from distant corners of the world into developed countries and vice versa. Migration within countries and internationally is increasing, heading for economic centres in search of better living conditions. Tourism discovers new targets in remote areas of Africa, Asia and South America. The human population is growing rapidly and with it the number of domestic animals. More space is needed for agriculture and urban extensions, untouched areas are encroached upon and wildlife habitats are converted into farmland.

Despite the great success in the global eradication of rinderpest virus infection, infectious animal diseases, some with zoonotic potential, some endemic for a long time and some expanding into new regions, continue to pose challenges. Control of parasitic and bacterial infections imposes a huge financial burden on farmers and is constantly challenged by the development of resistant variants. Endemic infectious diseases of livestock such as avian influenza, foot and mouth disease and African and classical swine fever threaten farmers' livelihoods. Zoonoses have always spread from wildlife to domestic animals and on to humans, but in recent years a marked acceleration became evident; even more significant zoonotic outbreaks have to be expected in the future. The 13 most important zoonoses annually account for 2.2 million human deaths and 2.4 billion illnesses. Among them, gastrointestinal infections rank first followed by leptospirosis, (animal) tuberculosis and rabies. Also included are brucellosis, echinococcosis, Q-fever and anthrax. Rabies still causes tens of thousands of human deaths every year, 95% of them in Asia and Africa and roughly 97% resulting from dog bites. Bird flu H5N1, though so far causing only a limited number of human casualties, has lately shown its ability for worldwide dissemination sparking fears of a new pandemic.

Among vector-borne diseases, infections transmitted by arthropods play a central role. Global trade, travel and climate change help pathogens and their vectors to invade regions they could not inhabit before, causing new dangers for residents. West Nile virus (WNV) has made a spectacular incursion into the western hemisphere in

1999, starting in New York and reaching the pacific coast in 2002, causing fatalities in birds, horses and humans. Increasing numbers of WNV infections have also been observed in humans and horses in the larger Mediterranean region. Japanese encephalitis virus (JEV) left Southeast Asia and Australasia and Crimean-Congo hemorrhagic fever virus is invading Europe. Rift Valley fever (RVF) has spread out of Africa into the Arabian Peninsula threatening further expansion.

Pure livestock diseases, which have no direct impact on human health but may cause substantial economic losses, have also moved into new areas in recent years. In 2007, African swine fever (ASF) was brought to Georgia by contaminated animal products. The disease established itself in the Caucasian region, in southern and western parts of the Russian Federation and spread recently into Ukraine. So far, there is neither a vaccine nor an effective treatment against ASF. In many African countries ASF is a constant menace, with reservoirs in wildlife animals and in a soft tick vectors. Classical swine fever (CSF) is considered one of the most important swine diseases on a global scale, with a significant effect on both the profitability of commercial pig farming as well as on the livelihoods of farmers engaged in small scale pig production. Vaccination represents a key pillar of CSF control programmes.

The appearance of bluetongue virus (BTV), serotype 8, and Schmallenberg virus (SBV) in Central Europe, both apparently transmitted by the same indigenous Culicoides vectors, highlights the ongoing expansion of infectious diseases. Both, BTV and SBV infect mainly domestic and wild ruminants. While the BTV-8 epidemic could be contained through vaccination and the development of immunity after natural infection in less than three years, Schmallenberg virus is still on the move, spreading over an area that extends from Southern France to Norway and from Ireland to Poland in little more than one year. In the Mediterranean basin, in the whole of Africa and the Middle East, a large variety of different serotypes of BTV are part of everyday life, some of which are controlled by vaccination in a few countries.

African horse sickness (AHS) is transmitted by the same vectors as BTV. It is endemic in Africa and has spread to the Middle East, Pakistan and India. An introduction of AHS into countries that are free from the disease has devastating consequences. Foot and mouth disease (FMD) is endemic in most parts of the developing world, including Africa, Asia, the Middle and Far East despite efforts to control the disease and the extensive use of vaccines. The United Kingdom suffered a devastating FMD epidemic, and in January 2011, FMD occurred in wild boars in Bulgaria close to the Turkish border. Questions arose regarding the role of wild boar in the epidemiology of FMD and the risk of wild boar populations transmitting the disease to domestic livestock. Peste des petits ruminants is endemic throughout sub-Saharan Africa, the Middle East to India, but has for the first time crossed the Sahara desert and appeared in northern Morocco.

Problem areas to look at and necessary corrective measures to implement

A large part of the human population will never visit a supermarket but will procure food from local, open-air vendors. However, veterinary inspections of these markets are often weak. In many developing countries, there is only one vet per one million livestock units. Urbanization and intensified livestock keeping create an environment prone to new infections, especially in South-East Asia and around urban centres in Africa. Airline hubs and international harbours with their gigantic container ports in North America, Western Europe and East Asia represent a major risk for the spread of diseases. It is there where cargo and passenger planes and ships from all over the world are unloaded, where microorganisms from everywhere are able to enter and to change hosts, vectors or vehicles. It is there where we can discover what is invading and where we should monitor and fight diseases as soon as we are aware of their arrival. But what happens in those 'cold spots' nobody looks at, where we find plenty of neglected diseases, like in the remote pastoral areas, the poor rural zones, the surroundings of game parks and sparsely inhabited margins of the great forests?

In many countries legislation is not yet adapted to modern disease control measures. Increased awareness and capacity building is needed and policies should be adapted. Strengthening of Veterinary Services is urgent in many countries to protect people from disease and economic losses. The OIE has developed the PVS tool (http://www.oie.int / support-to-oie-members / pvs-evaluations / oie-pvs-tool /) which evaluates their capacity and helps to enhance compliance with sanitary and phytosanitary measures (SPS) standards. Activities of the Veterinary Services are a global public good and consequently eligible for national, regional or international funding. SPS measures play a role of high priority in international trade. The effectiveness of inspections, especially for export shipments, is not sufficient in many countries, notably in the developing world. Therefore the bush meat trade and illegal shipments of live animals are often only noticed on arrival, if detected at all. Measures that prevent the spread of diseases are generally more effective than the most sophisticated diagnostic techniques that help to detect an emerging disease after it has spread to a new area.

The presence of most of the epizootic diseases can only be verified by diagnostics. In industrialized countries, veterinary diagnostic capacities are available, well organized and use modern state of the art methods. A network of regional private or state laboratories or large centralized laboratory systems provides capacities for mass diagnostics of endemic diseases and during outbreaks. Re-

gional laboratories are supported by national and international (OIE, FAO, WHO, EU) reference laboratories for confirmation of results, evaluation of diagnostic methods, organization of ring trials, and further support like the collection and distribution of reference materials. However, in many developing countries diagnostic capacities are limited, local diagnostic networks small and modern techniques or trained personnel missing.

In recent years, novel state of the art detection methods have been developed. Real time polymerase chain reaction (real time PCR) allows highly sensitive detection of pathogens within hours. For most zoonotic and transboundary diseases, validated protocols are available and used. Antibody detection is mainly done by enzyme linked immunosorbent assays (ELISA). In some cases, differentiation of infected from vaccinated animals (DIVA) is possible, thus supporting control concepts by the use of marker vaccines. In order to enable diagnostics at the point of interest, so-called 'pen-side' or 'point-of-care' tests become increasingly available. Although most pen-side tests are less sensitive than laboratory based assays, such systems can be very helpful, in particular in developing countries. At present, new pen-side tests using amplification methods are under development and will in the future allow sensitive rapid diagnosis directly on farms.

For the rapid transmission of disease information from field veterinarians, even in remote areas, to epidemiology units in national or regional centres, the digital pen technology has been successfully used. Digital pens and cell phones are used to transmit disease information on special electronic forms in real time (http://www.fao-ectad-gaborone.org/en/spip.php?article173). Community Animals Health Workers, who have proven effective not only in controlling Rinderpest, are worth to be supported as agents close to animals, their keepers and the veterinary services.

With their help and the tool of Participatory Epidemiology (http://www.participatoryepidemiology.info), disease intelligence in remote areas of the globe can be successfully accomplished.

Forthcoming Events

Regional (AFRA) training course on Transboundary Animal Diseases Surveillance Applying Molecular Techniques (RAF/5/057)

Technical Officers: Hermann Unger, Adama Diallo

The training course is part of the activities of TC Project RAF/5/057. The training course is planned from 1 to 5 July 2013 in Ghana.

The purpose of the training course is to provide a comprehensive and up to date, theoretical and practical training on molecular diagnostic and epidemiological techniques applying qPCR and LAMP technology. Basic principles of sequencing, alignment and interpretation of sequence data and molecular mapping will be demonstrated during the course; reporting including spatial distribution patterns and phylogenetics will help in data presentation and practical sessions will provide hands-on participation and experience in all techniques.

Regional training course on the Serological and Molecular Detection of the Avian Influenza Strain H7N9 RER/5/016

Technical Officers: Ivancho Naletoski, Adama Diallo

During February 2013 an outbreak of the influenza-like disease has affected human population in several provinces of China. Due to the rapid response of the Chinese authorities in March 2013 the virus was classified as avian influenza H7N9 strain, which was not detected by conventional diagnostic tests and has previously not been reported to infect people. By 29 May 2013, 132 human cases were diagnosed with 37 deaths.

Intensive investigations, primarily at the Chinese Centre of Disease Control, CDC have shown that the avian strain has mutated at several positions, resulting in better adaptability to mammalian host, primarily the human population. Knowing the panzootic potential of the avian influenza viruses, the international community has immediately developed response plans on the eventual spread of the Chinese H7N9 strain and called for emergency preparedness.

The Animal Production and Health Section of the Joint FAO/IAEA Division and the Technical Cooperation Department of IAEA immediately reacted to these calls by organizing two unplanned training courses under the existing technical cooperation projects RER/5/016 (regional European) and RAS/5/060 (regional Asian; for further details please see next item in this newsletter).

The training course will be held from 10 to 30 August 2013 in Seibersdorf, Austria.

The course aims at enhancing the early and rapid diagnosis and control of high pathogenic avian influenza (HPAI) and low pathogenic avian influenza (LPAI). In particular, at enhancing technical risk assessment and epidemiological knowledge on avian influenza H7N9 through specific lectures on epidemiology, risk assessment, differential diagnosis of the virus sub-types involved, sampling and submission procedures (including shipment of pathological samples to the FAO/OIE reference laboratories) and at providing practical training on current rapid techniques for disease diagnosis, in particular, the use of nuclear-based or related techniques for the identification and characterization of the pathogen(s). In addition, the course will include genome sequencing, molecular epidemiological and bioinformatical analysis of HPAI and LPAI viruses with special emphasis on H7N9 viruses. Specifically, the on-site computer teaching facilities will be used for the bioinformatics analysis of avian influenza genomes using web-based and freeware analysis software, including analysis and interpretation of the cleavage site, according to the currently recognized procedures. The ultimate goal is to contribute to the early detection and early reaction capabilities in Member States to prepare them for the current H7N9 avian influenza threat and for similar influenza threats of the future.

Regional training course on the Rapid and Confirmatory Diagnosis of Avian Influenza H7N9 (RAS/5/060)

Technical Officers: Hermann Unger, Adama Diallo

The training course is part of the activities of TC Project RAS/5/060. The training course is planned from 9 to 20 September 2013 in Seibersdorf, Austria.

The course aims at enhancing technical, risk assessment and epidemiological knowledge on avian influenza H7N9 through specific lectures on epidemiology, risk assessment, differential diagnosis of the virus sub-types involved, sampling and submission procedures (including shipment of pathological samples to the FAO/OIE reference laboratories) and at providing practical training on current rapid techniques for disease diagnosis, in particular, the use of nuclear based or related techniques for the identification and characterization of the pathogen(s). In addition, the course will include an introduction into genome sequencing, molecular epidemiological and bioinformatical analysis of H7N9 viruses. The ultimate goal is to contribute to the early detection and early reaction capabilities in Member States.

Joint IAEA/FAO/OIE regional stakeholder workshop on Awareness Raising for Veterinarians Involved in the Control of Transboundary Animal Diseases (RER/5/016)

Technical Officer: Ivancho Naletoski

The workshop is provisionally scheduled from 16 to 18 October 2013 at the VIC, Austria.

The project RER/5/016 is targeted to improve overall preparedness of Member States to early detect transboundary animal disease (including those with zoonotic impact). Among others, vector borne diseases (such as African swine fever and West Nile fever) were in the focus of interest of the project, due to their gaining importance in the last years. In order to achieve maximal input from the project outcomes, transfer of diagnostic technologies in official laboratories were the primary target of the project activities. However, representatives of the competent authorities and related stakeholders (representatives of farmer societies, agricultural organizations etc.) are included in the relevant project components in order to facilitate the response to unexpected disease outbreaks. Major focus of the project was the early detection platforms for infectious diseases of animals, including those with zoonotic impact.

The regional stakeholder workshop will aim to integrate and harmonize the activities among different stakeholders involved in animal disease control. This includes early diagnosis and reporting, rapid enforcement of appropriate control measures and raising awareness of farmers on the importance of animal health in overall animal production and food safety.

Consultants meeting on the Development of More Accurate Methods of Quantifying What and How Much the Animals are Consuming and the Partitioning of Nutrients thereof for Better Understanding and Managing Nutrient Use Efficiency

Scientific Officer: Nicholas Odongo

The consultants meeting will be held at IAEA Headquarters, Vienna, Austria.

The meeting is scheduled to take place in July 2013 at IAEA Headquarters, Vienna, Austria.

Consultants meeting to Develop and Validate Biotechnologies for the Control of Transboundary Animal Diseases

Scientific Officers: Ivancho Naletoski, Charles Lamien

The consultants meeting is provisionally planned to take place from 21 to 23 October 2013 at IAEA Headquarters, Vienna, Austria. The meeting will cover the newest high-tech diagnostic platforms as a response tool to combat the increased spread of infectious animal diseases, including those with zoonotic impact. International experts in the field of development of diagnostic platforms and disease surveillance at the wildlife/domestic animal interface will be invited in order to present and discuss the current development of the diagnostic and pathogen screening platforms and their feasibility for application in Member States.

Regional (ARASIA) training course on Radioimmunoassay Procedures and Data Interpretation (RAS/5/063)

Technical Officer: Mario Garcia Podesta

The training course is part of the activities of TC Project RAS/5/063, Improving the Reproductive and Productive Performance of Local Small Ruminants by Implementing Reliable Artificial Insemination Programmes. The training course is planned to be held from 7 to 11 October 2013 in Tunisia.

The objectives of the training course are to transfer knowledge and to develop skills in milk and plasma progesterone RIA and ELISA as a tool to improve reproductive management in relation to artificial insemination in small ruminants to enhance livestock production in Member States. The participants will be able to understand the oestrous cycle of the ovine and caprine, the role of the reproductive hormones and method of measuring progesterone in milk or plama. The participants will learn about the progesterone RIA/ELISA, the applicability of the techniques on the understanding of the reproductive physiology, on the identification of reproductive and productive constraints and on the monitoring of remedial measures for improving livestock productivity. Participants will improve their skills on the use of these techniques and on the use of progesterone data for the management and improvement of reproductive efficiency in small ruminants, especially when artificial insemination is practiced.

Candidates should have an academic background equivalent to a degree in veterinary or animal science. The candidates must have good knowledge of livestock production and of basic concepts of reproduction, genetics and breeding. Working experience is required in animal trials, measuring the response in biological and production pa-

rameters to treatments involving feeding, breeding, reproductive intervention or veterinary care. The course is open for 15 participants from ARASIA Member States and the deadline for nominations is 12 July 2013.

Second regional TC coordination meeting on Improving the Reproductive and Productive Performance of Local Small Ruminants by Implementing Reliable Artificial Insemination Programmes (RAS/5/063)

Technical Officer: Mario Garcia Podesta

The coordination meeting will take place from 25 to 27 November 2013 in Muscat, Oman, with the participation of national project coordinators of ARASIA TC Project 5/5/0/63 (Iraq, Jordan, Oman, Syria and Yemen).

The purpose of this coordination meeting is to present the current status of sheep and goat production systems, including improvements in Artificial Insemination (AI) programmes in small ruminants, to discuss the results of completed project activities and the benefit for participating ARASIA Member States, and to review and update the project work plan for 2014-2015.

Past Events

2nd RCM of the CRP entitled Genetic Variation on the Control of Resistance to Infectious Diseases in Small Ruminants for Improving Animal Productivity (D31026)

Technical Officers: Mohammed Shamsuddin, Kathiravan Periasamy

The IAEA coordinated research project (CRP) entitled Genetic Variation on the Control of Resistance to Infectious Diseases in Small Ruminants for Improving Animal Productivity has been running since 2010. The overall objective of this CRP is to improve productivity in smallholder livestock production systems by phenotypic characterization and identification of genes responsible for resistance to gastrointestinal (GI) parasites of sheep and goat.

The second research coordination meeting (RCM) took place from 11 to 15 February 2013 at Institute Pertaninan Bogor, Bogor, Indonesia. Kathiravan Periasamy from the Animal Production and Health Laboratory (APHL), IAEA, acted as the Scientific Secretary (SS) of the meeting. The objectives of the RCM were: (1) to review the progress of work done and the achievement of milestones during the first phase of the CRP, (2) to revise the workplan and set new milestones for the second phase of the project (2013–2015), (3) to finalize the strategy for analysis of phenotypic data generated in artificial challenge trials, (4) to update tools and methods for genotyping and analysing genomic data from samples collected or to be collected during the field trial, and (5) to address any constraints/bottlenecks in conducting the experiments, sampling the animals and recording, analysis and interpretation of phenotypic data hitherto obtained.

The RCM was attended by nine research contract holders (RCHs) and three agreement holders (AHs). Mustafa Imir, FAO Representative in Indonesia, Luki Abdullah, Dean, Faculty of Animal Sciences, Bogor Agricultural University, Totti Tjiptosumirat, National Liasion Officer of Indonesia to the IAEA attended the inaugural session of the RCM and delivered welcome addresses to the participants.

All RCHs presented the progress of their works, which was followed by detailed discussions. All RCHs made good progress and generated valuable data on resistance of indigenous sheep and or goats to *Haemonchus contortus*, a gastrointestinal (GI) parasite. Every RCH has generated enough data for preparing at least one manuscript ready for publication in a peer reviewed journal.

As part of the RCM, the host institute organized a day-long international seminar (12 February 2013) on Applying Genetic Variation on the Control of Resistance to Infectious Diseases in Ruminants to Support Meat Self-Sufficiency in Indonesia. Presentations made by AHs and the SS covered recent advances in livestock genomics, especially with respect to ruminant production in tropics, animal genome mapping, genomic control of resistance to parasites in sheep, and single nucleotide polymorphic (SNP) markers developed and validated at the IAEA Animal Production and Health Laboratory in Seibersdorf.

A special workshop was conducted on statistical analysis of phenotypic data generated from artificial challenge trials. The statistical model to be followed for analysis of data from individual contracts was discussed and agreed in the workshop.

The group discussed and finalized the timeline for completion of data analysis and preparation of manuscripts with results from individual artificial challenge trials. Also the timeline and milestones related to ongoing field trials were discussed and finalized. Strategies were formulated for genomic analysis of samples from artificial challenge and field trials. Different approaches for genotyping the DNA samples from artificial challenge and field trials including candidate gene approach and SNP chip based whole genome approach were discussed. Candidate gene approach, selection signatures and genome wide association (GWAS) were finalized as tools for genomic analysis and timelines were decided. Overall, the meeting achieved its objectives and ended up with final conclusions and recommendations for the second phase of the CRP.

Conclusions and recommendations:

- The objectives of the meeting were accomplished and the presentations of research contract holders showed good progress in artificial challenge trials.
- Distinct genetic differences were observed on resistance or susceptibility characteristics of different sheep/goat breeds, which indicate a potential outcome to be achieved on genotype-phenotype association for parasite resistance also during the second phase of the project.
- The work plans were revised for field trials taking into account the specific situations of each counterpart with timelines for different activities.
- Strategy for genetic analysis of samples collected from artificial challenges and field trials of the project was finalized with specific timelines for each of three different approaches to be followed.
- DNA samples from both artificial challenges and field trials will be sent by RCHs to the IAEA Seibersdorf laboratory for genotyping new SNPs identified within different candidate genes, as well as

for SNP chip genotyping. All RCHs agreed to establish a trust fund for the development of SNP assays and to genotyping the samples sent by them.
- The genetic analysis of different variants of *Haemonchus spp.* would help evaluate differences in the relative resistance of host against different variants of the parasite depending on the availability of fund.
- Data so far available strongly indicate that national sheep/goats breeding programmes can be initiated with sires selected for parasite resistance based on faecal egg count and body weight.

National workshop on Control of Brucellosis in Bosnia and Herzegovina (BOH/5/001)

Technical Officer: Ivancho Naletoski

The national workshop took place from 13 to 16 March 2013 in Sarajevo, Bosnia and Herzegovina.

The activities of the project BOH/5/001 are oriented towards upgrading the capacities to control brucellosis at two levels: (1) competent authorities-Head Veterinary Office (HVO), (establishment of epidemiological team) and (2) designated laboratories (two national referent laboratories, one in each entity and eight regional screening laboratories). In order to systematically support Bosnia and Herzegovina, a comprehensive approach has been developed at both levels. Namely, a scientifically justified strategy, based on the modern methods of quantitative epidemiology has been developed for surveillance purposes. The samples collected under the established surveillance strategy are submitted to the regional (screening) laboratories. Samples from positive flocks are further processed in the two referent laboratories. The results of the surveillance are reported to the competent authority for further action (removal of diseased animals).

In order to maintain this complex chain of brucellosis control, comprehensive coordination between the strategic planning entities in the country (HVO), the designated veterinary practitioners (sample collection) and designated laboratories (testing) is required.

The workshop was aimed to support the between entity coordination and between laboratory harmonization, in order to achieve maximum output from the implementation of the brucellosis control measures. With support of the invited expert (Menachem Banai, Head of the OIE reference laboratory for brucellosis at the Kimron Veterinary Institute in Israel), gaps and lesions learned were discussed to help the counterpart in coordination and to harmonize all the activities related to the control of the brucellosis in the country.

Based on the discussions, following conclusions and recommendations have been drawn:
- Strengthening the disease control chain; especially the interaction HVO, designated veterinary practitioners and designated and referent laboratories, is necessary for the success of the brucellosis control campaign.
- Activities related to the harmonization have already started, laboratory trainings are partly finalized. In order to finalize this activity the counterparts will have to establish national (secondary) standards, calibrated against the recognized OIE standards, which will be purchased (waiting for counterpart submission).
- The current project achievements and the expected finalization are an excellent basis for successful implementation of the control measures. However, the responsibility HVO of BOH is significant, as they will have to: (i) plan, implement and review the impact of the control measures and (ii) ensure sustainability of the established achievements, such as funding, compact and synchronized team work, timely implementation of control measures and others.
- The counterparts should carefully review and implement the recommendations given by the international expert.

Menachem Banai, Head of the OIE Reference Laboratory for brucellosis at the Kimron Veterinary Institute in Israel (left), Nihad Fejzic, Dean of the Faculty of Veterinary Medicine in Israel (middle) and Sabina Seric Haradzic (veterinary epidemiologist), answering the questions of the auditorium.

National training course on Artificial Insemination under small dairy holdings (ZAM/5/028)

Technical Officer: Mario Garcia Podesta

The course was conducted on the shores of Lake Kariba in the Sinazongwe district of Zambia's Southern Province. The course ran from Thursday 14 March to Tuesday 26 March 2013, including weekends.

The aim of the course was to provide on-site training to

Participants came from various districts of Zambia where the government has earmarked establishment of livestock breeding centres.

local technicians and farmer representatives on the use and application of oestrus synchronization, artificial insemination (AI) and pregnancy diagnosis techniques in cattle. The training course was organized by the Ministry of Agriculture and Livestock in collaboration with the University of Zambia through the School of Agricultural Sciences and the National Institute for Scientific and Industrial Research as part of planned activities on the IAEA TC Project ZAM/5/028.

Paul Mollel from the National Artificial Insemination Centre in Arusha, Tanzania was the IAEA Expert and external lecturer. Local lecturers and organizers included Vincent Simoongwe and Victor Habeene from the Zambia National Artificial Insemination Services (NAIS – Mazabuka) and Joseph Simbaya from the University of Zambia. Linda Mwewa and Michelle Mwanza proved handy in providing practical demonstrations to participants. Travel and logistical support to participants and local resource persons were provided by the World Bank through the Zambia Livestock Development Project. Theory classes took place at World Vision Training Centre while practical lessons were conducted at ZAMBEEF plc Sinazongwe Abattoir.

The course was attended by 21 veterinary assistants and farmer representatives from different parts of the country where the Zambian government has earmarked the establishment of livestock breeding centres. In addition to the Sinazongwe ZAMBEEF plc abattoir, participants also made a field visit to the Livestock Development Centre of the Golden Valley Agricultural Research Trust in Batoka where they had the whole day to practice AI and pregnancy diagnosis.

During the first week, the theoretical part of the course was taught in the mornings while practical sessions were held in the afternoons. The second week was mostly devoted to practical training, which sometimes involved waking up very early in the morning or finishing late in the evening depending on the availability of cows at the abattoir.

Lectures and practicals included:

- Anatomy and physiology of the male and the female reproductive systems;
- The oestrus cycle, heat detection and oestrus synchronization;
- The insemination technique and time of insemination;
- Development of foetus, pregnancy diagnosis and parturition;
- Semen flasks and handling of liquid nitrogen;
- Semen processing and evaluation;
- Organization of artificial insemination services, extension work and AI record keeping;
- Infertility problems and reproductive disorders / diseases;
- Feeding and management of dairy animals.

At the end of the course all participants passed both practical and theory examinations, and thus qualified for the award of Artificial Insemination Certificates to enable them to practise as AI technicians in Zambia.

2nd RCM of the CRP entitled Development of Molecular and Nuclear Technologies for the Control of Foot and Mouth Disease (FMD) (D32028)

Scientific Officer: Gerrit Viljoen

The second RCM took place from 8 to 12 April 2013 at FAO Headquarters in Rome, Italy.

Foot and mouth disease (FMD) is one of the most important livestock diseases known to man due to its high infection rate (ease of spread) and its effect on the limitation of livestock movement and trade. An outbreak of FMD can have a devastating effect on a country's food security, with direct impact on national and international trade. The confirmatory diagnosis of FMD and its effective control through prophylactic, quarantine or slaughter procedures are therefore of paramount importance as it has financial and trade implications. Vaccination with inactivated FMD virus is undertaken to control FMD in endemic countries or countries at risk. Vaccines, whilst widely available, should match (i.e. should be of homologous serotype and strain isolate) virulent FMD viruses circulating in the region of vaccine use, are instead of variable quality, not from the homologous outbreak serotype/strain isolate, and are often stored under inadequate temperature conditions and therefore might be not as effective in the field as determined in animal experiments. Due to insufficient knowledge of vaccine strength and antigenic match (antigenic cartography) between vaccine strain and outbreak virus, it is often not possible to pinpoint the weakness of the vaccination strategy and to take

action against this weakness. Vaccine effectiveness can be determined by animal challenge, but this is both costly and difficult. In vitro systems have been developed in different countries since the 1980s, but these are not standardized for international use. Many countries now produce FMD vaccines but often without effective consideration of their effectiveness. This CRP investigates methods and possibly provides internationally acceptable guidelines for procedures which test a vaccine's ability to induce the production of protective antibodies in cattle without the need for animal challenge experiments.

The CRP involves countries and laboratories both from endemic and regions free from FMD. The participating laboratories have different levels of expertise ranging from internationally acclaimed research facilities with numerous global collaborations to laboratories that presently cannot perform diagnostic assays due to various reasons. One aspect of the CRP is to make the expertise available to those laboratories that are in need, to set up the links and build capacity. Participants were strongly encouraged to contact the agreement and contract holders for research inputs and other needs.

It was clear from this RCM that vaccines and vaccination are not properly controlled in some countries. Therefore, the need to perform post vaccine monitoring is of high priority to provide feedback to producers and decision makers on the efficiency of the vaccines. Countries should be encouraged to ensure they use vaccines applicable to their epidemiological situation that antigenically match the viruses circulating in their region and in addition, if they produce their own vaccine, to perform the necessary quality tests prior to releasing the vaccine in the field. All vaccination campaigns should be monitored using serosurveys regardless of the product used as several aspects could impact on the level of seroconversion in the field.

RCM participants.

The project covers a number of aspects related to vaccines and post vaccination monitoring. One contract holder is developing an attenuated Asia-1 vaccine strain that can be used in the existing production facilities using the currently accepted technologies but which will not cause outbreaks should the virus accidentally escape from the facility. Since it is based on using the registered international techniques for FMD vaccine production, application and uptake should be rapid. This technology will be applicable to any other FMD strain, therefore potentially having important global impact. The project will continue with validation and testing the vaccine in animals in the next phase. The use of P1 amino acid sequences together with VNTs and r-values, structural data and mathematical modelling is being developed for SAT type viruses to predict antigenic matching. This is an important step to replace animal challenges, therefore addressing animal ethics standards and will also be applicable to other serotypes once proof of concept has been shown. The methodology relies on using only the sequence data once a new virus emerges and applies the sequence to the model being developed in this project to determine whether the current vaccine strains will provide protection. Since sequence data can be generated rapidly once a new virus is detected, this method could significantly shorten the period between detection and decision on vaccine strains. More validation for SAT2 is planned for the future. This compliments the approach in South America where they are optimizing the VNT results to predict protection against the vaccine strains used in the region. The predictions are based on previous challenge data where the antibody titres were correlated to protection against live virus challenge. Once this baseline is available, decisions regarding protection can be based on VNT titres only. However, it is important that the tests be validated to ensure that correct decisions are made.

An important outcome is the statistical evaluation of factors that impact on the variability observed with VNT data. Two laboratories that use VNTs for vaccine matching purposes are participating in this effort. Early reports indicate that most of the variability cannot be linked to any known factors, but increasing the data set used for evaluation across two different laboratories may provide more information that would be applicable to all laboratories performing these assays. One laboratory has established a multiplex PCR based diagnostic assay that both confirms disease and provides information on the serotype. The challenge is to ensure the test is rolled out to all laboratories in the country performing FMD diagnostics.

RCM participants.

2nd RCM of the CRP entitled The Use of Enzymes and Nuclear Technologies to Improve the Utilization of Fibrous Feeds and Reduce Greenhouse Gas Emission from Livestock (D31027)

Scientific Officer: Nicholas Odongo

The CRP entitled The Use of Enzymes and Nuclear Technologies to Improve the Utilization of Fibrous Feeds and Reduce Greenhouse Gas Emission from Livestock was initiated in September 2010 with the award of eleven research contracts, three research agreements and one technical contract. The overall objective of the CPR is to improve the efficiency of using locally available fibrous feed resources to improve livestock productivity while protecting the environment.

RCM participants.

The second RCM was held at the IAEA in Vienna, Austria from 13 to 16 May 2013. The objective of the meeting was to review the results from the studies conducted during the first 18 months of the CRP as the basis for revising and updating the programme of work and activities to be undertaken during the second 36 months of the CRP within the time schedule for each research contract. It was attended by nine research contract holders (RCH) and three research agreement holders (RAH), two IAEA staff members (Nicholas Odongo, the Scientific Secretary and Shamsuddin Mohammed) and Harinder Makkar from FAO, Rome, Italy. Gerrit Viljoen, the Head of Animal Production and Health Section formally opened the meeting and was followed by Mr Odongo's presentation of the objectives of the second RCM.

The meeting commenced with the RCH presenting a progress report of their research to date and their future plans within the framework of the CRP. These were thoroughly discussed and critiqued in line with what was agreed on during the first RCM in Canada. Briefly, the objective of the first phase of the CRP was a proof of concept by conducting in vitro screening of commercial fibrolytic enzymes to identify two to four best-bet candidates and optimum dose ranges for further evaluation in animal trials. All enzyme candidates were to be assayed by each RCH for enzyme activity using standardized methodology.

Additionally, the teams were to survey for and collect samples of fibrous feed materials available and/or were used in their region for chemical compositional analysis. This was to be followed by initial in vitro batch cultures to identify enzyme candidates and optimum dose rates for the forages of interest using 24 and 48 h dry matter (DM) and neutral detergent fibre (NDF) degradation followed by more detailed in vitro batch cultures or continuous culture incubations to measure other variables of interest such as digestibility, kinetics of digestion, methane production, microbial protein synthesis, rate of gas production, volatile fatty acid production and concentrations, microbial ecology of the rumen, etc.

The results of the technical contract were presented, followed by group work between each RCH and the RAH to revise and refine their individual work plans, which were again presented in the plenary, re-evaluated and finalized in the context of the objectives of the CRP. Finally, conclusions arising from the meeting were drawn and recommendations made. These were discussed and adopted.

- The objectives of the meeting were accomplished. All the planned activities for the first phase of the CRP were satisfactorily completed by most of the RCH.
- During the first RCM, it was agreed that all should adapt a standardized screening protocol for both the measurement of enzyme activity and for in vitro screening to ensure reproduceability of results. A clear step-by-step screening protocol to assay, characterize and formulate enzymes/enzyme preparations for ruminant diets was therefore developed. Although most RCH adopted the protocol, some did not. It was emphasized that all RCH should use the agreed upon protocols and in case there was a need for deviation due to some unforeseen circumstance, these should be discussed with the Technical Officer and agreement holders for concurrence.
- It was recognized that the mode of application or delivery of enzymes especially in extensive grazing systems would be a challenge. Suitable modes of delivery and/or pre-treatment will need to be investigated further.
- Furthermore, although the potential benefits of using enzymes were expected to be moderate during the 1st RCM, the in vitro results to date were better than expected and are more promising. Nevertheless, there were still some grey areas which need further elucidation. Some questions that need to be answered include: what constitutes an effective enzyme? What is the mode of action? Molecular characterization? To pre-treat or post-treat after ingestion?

- A technical contract to Athol Klieve at University of Queensland, Australia, to undertake qPCR (both 16S rRNA and mcrA genes) and DGGE for methanogen populations for the group was recommended. Teams will extract DNA from their sample which will then be sent to A. Klieve via Vienna for analysis.
- All RCH should include a cost-benefit analysis in their trial and conduct some of the trials on-farm and/or establish demonstration farms to start introducing farmers to their research.
- The CRP will increase our understanding of the nutritive value of local feeds in the different countries, increase local technical capacity to use nuclear and related technologies to improve livestock productivity and increase South-South and South-North research collaboration and sharing of knowledge.
- Although the results to date have been impressive (one book on nutritional strategies in animal feed additives has been published, one MSc thesis, six papers have been published in peer-review journals, seven papers have been accepted for publication and ten manuscripts submitted for publication. Additionally, 15 presentations and abstracts were presented at meetings and conferences), enhanced collaborate, cooperate and networking between different laboratories is encouraged. This should include communication, exchange of data and other information, training and the transfer of technology.

Visit of GALVmed

Technical Officer: Adama Diallo

Baptiste Dungu, the Senior Director of Research & Development and Grant Napier, the Trypanosomosis Programme Manager at GALVmed (Global Alliance for Livestock Veterinary Medicines), visited the IAEA on 3 June 2013 to discuss a prospective collaboration that would support the assessment of different diagnostic assays, which have been developed by their different partners for African animal trypanosomosis (*Trypanosoma congolense* and *T. vivax*). The University of KwaZulu Natal (South Africa), University of Dundee (UK) and University of Bordeaux (France) have been working on antigen and antibody assays that potentially can be used to diagnose active trypanosome infections in the field.

Messrs A. Diallo, B. Dungu, and G. Napier

The antibody assays developed so far are at the stage of independent evaluation before progressing into a lateral flow format. The IAEA was approached to support the evaluation process. It was agreed to send a panel of test sera and the antigen together with protocols to be tested at the P3 laboratory facilities of AGES (Austrian Agency for Health and Food Safety) by the Animal Production and Health Laboratory staff. In addition, it was agreed to initiate a coordinated research project for field testing of antibody assays that were shown to be satisfactory by counterpart laboratories.

National training course on Artificial Insemination with Frozen Semen in Oestrus Synchronized Cows/Heifers (SIL/5/013)

Technical Officer: Mohammed Shamsuddin

The aim of the course was to provide hands-on training to technicians in Sierra Leone on semen collection, evaluation, processing and artificial insemination (AI) technique in cattle. The training course was organized by the Animal Science Department, Njala University (Njala Campus), Moyamba District as part of the activities of IAEA TC SIL5013 project.

The course was conducted from Monday, 25 February to Friday, 8 March 2013, including the weekend. Paul Egesa Eganga from Central Artificial Insemination Station, Ministry of Livestock and Fisheries Development, Nairobi, Kenya, was the IAEA expert and external lecturer. The local organizer was Abdul Rahman Sesay, Animal Science Department, University of Sierra Leone, Freetown, Sierra Leone.

Course participants in action.

The course was attended by 17 veterinarians, animal science graduates and graduate students, and laboratory technicians from Animal Science Department, Sierra Leone Agriculture and Research Institute, (SLARI) and Ministry of Agriculture, Forestry and Food Security, Sierra Leone Animal Welfare Society (SLAWS). The prac-

tical training was conducted at the Animal Science Department Laboratory and in the University Cattle Range.

Lectures and practical sessions included:

- Lecture on functional anatomy and practical review of male and female reproductive tracts from slaughterhouse;
- Review of reproductive physiology of ruminant females; the female reproductive system, endocrinology of female reproduction, reproductive cycle;
- Oestrous cycle, signs of oestrus, importance of secondary oestrous signs and oestrus detection and timing of insemination;
- Abnormalities of the oestrous cycle, manipulation of the oestrous cycle, oestrus and ovulations synchronization;
- Semen, morphology and structure of spermatozoa, semen collection, evaluation, processing and preservation as liquid and frozen semen, properties of cryoprotectants and effects of temperature changes on semen quality and fertility;
- Proper semen handling; semen storage, storage time of liquid semen and its effects on fertility in the field, semen inventory, thawing of frozen semen;
- Care, sterilization, management and use of AI equipment, management of liquid nitrogen (LN2) to ensure semen quality, care of LN2 containers;
- Artificial insemination technique; restraint of the animal on oestrus, rectovaginal insemination technique, animal welfare and disposal of A.I. consumables
- AI records and data management;
- Causes of failure of AI and management of infertility; human factors, factors associated with female animals, management factors, bull and semen factors, economic importance of infertility;
- Pregnancy diagnosis by rectal palpation and by alternative methods, determination of progesterone in blood and milk by using radioimmunoassay, ultrasonography.

All participants passed the practical and theoretical examinations at the end of the course and qualified for the award of Artificial Insemination Certificates. These technicians should do 100 AIs each, supervised by professionals/senior technicians with a conception rate of 50% or more before they are given a certificate as AI practitioner.

National training course on Bovine Artificial Insemination (MAG/5/020)

Technical Officer: Mohammed Shamsuddin

The aim of the course was to provide hands-on training to technicians in Madagascar on the practice of artificial insemination (AI) in cattle. The training course was organized by the Département de Recherches Zootechniques et Vétérinaires (DRZV) as part of the activities of IAEA TC MAG5020 project.

The course was conducted from Monday, 6 May to Friday, 10 May 2013. Naceur Slimane, École Nationale de Médecine Vétérinaire, Sidi Tabet, Tunisia was the IAEA expert and external lecturer. The local organizer was Norbertin Ralambomanana, Département de Recherches Zootechniques et Vétérinaires; Centre National de la Recherche Appliquée au Développement Rural; Ministère de la Recherche Appliquée au Développement, Antananarivo, Madagascar.

Demostration of rectal palpation by Naceur Slimane.

The course was attended by 15 participants from DRZV and the Department of Livestock. Lectures were presented at DRZV and the practical training was conducted at the facility of the Department of Livestock and private farms.

The theoretical part consisted of eight hours of lectures delivered on the following topics:

- Introduction of AI and its impacts on the development of livestock;
- Anatomy of the reproductive tract of the cow;
- Physiology of reproduction, ovarian cyclicity, follicular phase and luteal phase and hormonal control of the sexual cycle in cows;
- Signs of oestrus and oestrus detection;
- The optimal time of AI, life spas of ovum and spermatozoa, sperm capacitation, and fertilization;
- The selection of sires for breeding;
- The reproductive parameters, fertility and evaluation of the success of AI;
- Anomalies and diseases of reproduction in the cow: metritis, mastitis and infectious diseases of reproduction.

The practical part included 10 hours hands-on exercise/practice of transrectal palpation of the reproductive tract of the cow, catheterization of the cervix using the technique of the inseminator, semen handling and recording of data. Four empty cows and cows' genital tracts collected from abattoirs were used by the trainees for practicing AI. In relation to course participants, seven of

them had some experience on AI and therefore this was refresher training and they significantly improved their skills on AI practices. The other eight technicians learned the AI technique; however, before beginning AI practices independently, they should do at least 100 AIs under the guidance of senior inseminators and should achieve a conception rate equal to or greater than 50%.

Training course/workshop on Peste des Petits Ruminants (PPR) and Contagious Caprine Pleuropneumonia (CCPP) Diagnosis

Technical Officer: Adama Diallo

The training course/workshop took place from 10 to 21 June 2013 in Dar es Salaam, United Republic of Tanzania.

A three day workshop on the prevention and control of PPR in the Southern African Development Community (SADC) region was held in Dar Es Salaam, Tanzania from 10 to 12 June 2013. The workshop was jointly organized by FAO, OIE and IAEA and discussed the preparation of SADC countries in disease diagnosis, control and management of PPR. The workshop was attended by 40 participants, combining chief veterinary officers (CVO), laboratory directors and epidemiologists from Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe as well as experts from AU-IBAR, AU-PANVAC, SADC, CIRAD and the Royal Veterinary College (RVC, UK).

Workshop participants.

The presentations during the three sessions addressed issues regarding PPR spread, lineage evolutions, research priorities, the SADC situation, key principles of control strategies, lessons learned from rinderpest eradication, various PPR control programmes and the SADC regional strategy. Specific thematic presentations were on wildlife, laboratory diagnostic and epidemiology, socio-economics and vaccines. The experts from the three organizing international institutions (IAEA, FAO and OIE), CIRAD and the RVC explained how the global control strategy will be prepared, which accompanying existing tools are to be used, developed or strengthened, including the new OIE Terrestrial Code articles, monitoring and evaluation tools, laboratory and epidemiology networks, post-vaccination monitoring tools and a global research and development network.

The recently adopted (May 2013) articles of the OIE Terrestrial Code related to PPR establishing a new official free status and opening the possibility to present national PPR control strategies to OIE for official endorsement are considered to be important steps for countries to engage on PPR control and eradication programmes.

The participants considered that:

- PPR control in endemic countries is to be progressive and risk based according to the contexts, PPR prevalence and socio-economic impact and according to the country economical capabilities. Such a progressive risk based approach is supposed to be a phased approach with successive steps from endemic situation with no control activities to eradication of the infection. This implies that a tool be developed to monitor the implementation of the PPR control strategies as well as an accompanying assessment tool. The meeting supports the monitoring methodology proposed by the Global Framework for the progressive control of Transboundary Animal Diseases (GF TADs) group of experts which includes the definition of four steps with relevant activities, expected outcomes and precise criteria for entering the next step. The combination within the monitoring tool of PPR specific activities/outcomes and Veterinary Services critical competencies (according to the OIE PVS Evaluation tool) is well understood and is to be put into practice.
- Capacity building and training in several fields are key components of the national and regional strategies as well as communication. The workshop participants welcomed the 10 day training course adjoint to the workshop and called for such courses in view of building human capacities for PPR diagnosis and control.

The SADC PPR control strategy was presented by the SADC Secretariat. It was prepared by the SADC Working Group on Control and Eradication of PPR and the SADC TADs project in collaboration with the Epidemiology and Informatics and Laboratory and Diagnostic Subcommittees of the Livestock Technical Committee. This strategy describes a comprehensive list of key components such as policy and legislation, early warning and preparedness, control options, diagnosis and quality control, regional coordination and communication, post vaccination process and research. Such a document is supposed to be an evolving document according to the possible evolutions of the situation in different regions. Regular updating or revision of the strategy may take place in the future and it will be important to consider the coherence with the GF TADs Global PPR Control Strategy.

The workshop was immediately followed by a training course on PPR and CCPP diagnosis (13-21 June 2013) for laboratory diagnosticians at the Tanzania Veterinary Laboratory Agency (TVLA), Temeke, Dar es Salaam. Fifteen trainees from Angola, Botswana, Democratic Republic of the Congo, Lesotho, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe participated in this training course. The course lecturers were experts from CIRAD and IAEA.

Regional training course on Risk analysis for Transboundary Animal Diseases (RAS/5/060)

Technical Officer: Hermann Unger, Gerrit Viljoen

The training course is part of the activities of TC Project RAS/5/060. The training course took place from 10 to 14 June 2013 in Indonesia.

The purpose of the training course was to provide comprehensive and up-to-date, theoretical and practical information on risk analysis procedures and tools for trans boundary animal diseases in the context of import or export of livestock. Twenty participants from Bangladesh, China, Indonesia, Islamic Republic of Iran, Iraq, Cambodia, Malaysia, Mongolia, Nepal, Pakistan, Palestine, Philippines, Singapore, Sri Lanka, Thailand, Vietnam and Yemen were nominated to attend the training.

To allow for a rational approach to disease control at the national level, risk analysis tools enable the assessment of the situation for the most relevant pathogen, the focus of this training course was to learn the basics of this approach and work on examples and case studies. Participants learned how to gather the most important risk analysis data, ways of analysing these data and how to design strategies to avert disease outbreaks. The course comprised lectures to understand the principles of risk analysis with a focus on import of diseases through livestock trade and the design appropriate procedures for national implementation based on WTO/SPS agreement and OIE International Health Code. Finally the participants performed basic risk assessment for some disease scenarios and carried out an evaluation of performance of veterinary services as part of a general risk management.

Regional (ARASIA) training course on Advanced Molecular Genetic Tools for Characterization and Improvement of Indigenous Small Ruminants (RAS/5/063)

Technical Officer: Mario Garcia Podesta

The training course took place from 17 to 21 June 2013 at IAEA Laboratories in Seibersdorf, Vienna, Austria.

Thirteen participants from ARASIA countries (Iraq, Jordan, Oman and Yemen) attended the course. Pamela Burger (University of Veterinary Medicine, Austria), Paolo Ajmone Marsan (Universita Cattolica del Sacro Cuore, Italy) and IAEA staff lead by Kathiravan Periasamy lectured and conducted the practical work during the week.

The purpose of the training course was to enhance knowledge and capacity building of participants on practical applications of advanced molecular genetic tools for evaluation, characterization and genetic improvement of indigenous small ruminants.

Training course participants

The programme of the training course consisted of the following main topics:

- Phenotypic characterization of indigenous livestock breeds and development of breed descriptors;
- Molecular tools and analytical approaches for characterization of farm animal genetic diversity;
- Multiplex genotyping of short tandem repeat markers for diversity analysis of livestock breeds, statistical analysis and interpretation of genotypic data;
- Sequencing mitochondrial genome and analysis of sequence data for molecular phylogeny;
- Single Nucleotide Polymorphism (SNP) genotyping methodologies and applications of SNP microarrays in animal breeding;
- Introduction to next generation sequencing technology and its applications in evaluating farm animal genetic diversity.

Regional workshop on Coordinated Control of Emerging and Re-emerging Transboundary Animal Diseases (TADs) (RER/5/016)

Technical Officer: Ivancho Naletoski

The workshop took place from 18 to 20 June 2013 in Athens, Greece.

The purpose of the workshop was to review the current status of preparedness and discuss the future plans and needs for response to selected emerging and re-emerging TADs (classical and African swine fever, West Nile fever, Rift Valley fever, peste des petits ruminants, sheep and goat pox, lumpy skin disease, foot and mouth disease, Crimean–Congo haemorrhagic fever, and Brucellosis) at the regional scale.

Twenty participants from Tajikistan, Serbia, Montenegro, The Former Yugoslav Republic of Macedonia, Latvia, Hungary, Greece, Georgia, Cyprus, Croatia, Bulgaria and Albania attended. Two international experts, M. Groschup and M. Radakovic lead the workshop and support the establishment of an integrated system for early detection and rapid reaction to outbreaks of animal diseases, including those with zoonotic impact.

Stories

IAEA technical support to Botswana National Veterinary Laboratory

Botswana is considered as a middle income country having one of the fastest growing economies in Africa during the last decade. Diamond export is the main factor behind high growth rates in recent years as it accounts for more than one third of GDP. Despite this, the agricultural sector remains a fundamental source of subsistence. Livestock production is an important socioeconomic activity in the farming communities where the cattle industry is the principal sector with a major contribution to beef export to the EEC market.

Daily activities at BNVL.

There are 2.5 million heads of beef cattle, 0.6 million heads of dairy cattle, 1 million goats and 0.5 million sheep among other livestock species. In this scenario, transboundary animal diseases such as foot and mouth disease (FMD) and contagious bovine pleuropneumonia (CBPP) can have significant economic impact on trade, demand and supply, and food security. These diseases continue to be a threat for livestock productivity in the country since the diseases are present in the neighboring countries. Other infectious diseases like tuberculosis, rabies, and brucellosis also pose significant threats to public health.

The Botswana National Veterinary Laboratory (BNVL) has the mandate to carry out testing of samples for animal disease diagnosis and surveillance. The laboratory used to rely more on conventional test methods, which are not sensitive and fast enough to provide timely and reliable results. This caused delayed disease detection, delayed response to disease outbreaks and uncontrolled disease outbreaks. The diagnostic capacity needed to be strengthened by training and through the introduction of modern techniques like PCR and isotopic methods for confirmatory diagnosis, thereby helping to adopt effective prevention and control measures besides helping to establish an early warning system.

CBPP is a cattle lung disease which is endemic in some countries in southern Africa. Currently it is present in Angola, Democratic Republic of the Congo, Namibia, and Zambia. Botswana had an outbreak in 1995 after 56 years of freedom from the disease. However, the disease was eradicated through slaughter policy in 1997 which resulted in more than 300 000 cattle being destroyed, that costed Botswana $96 million. This was followed by re-stocking in Ngamiland.

In case of the disease reincurring, early detection is of paramount importance for controlling CBPP before becomes pandemic. For early detection abattoir surveillance and sero surveillance are carried out in high risk areas of Botswana. Detection of CBPP agent in the lung tissues and nasal swabs require use of molecular techniques such as PCR, which are more sensitive and specific than the classical methods. The IAEA supported the improvement of the molecular diagnostic capacity of BNVL through training and provision of laboratory personnel, reagents and equipment. The surveillance carried out has demonstrated that the country is still free from CBPP.

The BNVL has been collaborating with national laboratories in neighbouring countries in the provision of critical reagents, training, and organization of ring trials for CBPP diagnostic tests, thus contributing to the control of CBPP in the region. The capacity attained with help of the IAEA and collaboration with national and international laboratories resulted in the BNVL being granted the status of an OIE reference laboratory for CBPP in May 2012.

Collecting blood samples in the field.

Group training at BNVL.

Rift Valley fever (RVF) is a zoonotic disease of domestic ruminants caused by mosquito borne virus of the family *Bunyaviridae*, genus *Phlebovirus*. The disease is most severe in sheep, cattle and goats, producing high mortality rates in newborn animals and abortion in pregnant animals. Historically, RVF was first recognized in the Rift Valley in Kenya in 1930. Since then, the disease has been recorded in several other countries in Africa. In recent years, Botswana, Namibia and South Africa have reported outbreaks of RVF in the susceptible populations.

The 2010 outbreak in Botswana was suspected by pathology at BNVL and the confirmation was made at South Africa's Onderstepoort Veterinary Institute (OVI) using PCR and serological techniques which were not available at the BNVL at that time. The disease was controlled by vaccination and the Department of Veterinary Services (DVS) carried out passive surveillance on abortion cases to ensure early detection and control of the disease.

The BNVL has established PCR and ELISA systems for RVF to improve diagnostic capacity for rapid detection of the disease. The IAEA provided the necessary training and equipment. This facilitates timely decision making by the authorities and hence protection of public health.

BNVL has been implementing a quality management system according to the ISO 17025 standard since and accredited seven tests in 2007. Implementation of the management system is important in assurance of the quality of test results as this is required to effectively control diseases in the country and also for export purposes.

The IAEA supported BNVL in the improvement of the management system through scientific visits to accredited laboratories and expert missions. This led to the increase in the number of accredited tests to 22, comprising of Food Microbiology (x14), Histopthology (x1) and Serology (x7). Accreditation is an ongoing process which requires continuous improvement. This contributes to the competitiveness of the livestock industry in accessing international markets.

The Joint FAO-IAEA Division is supporting Member States to combat H7N9 avian influenza - A new avian influenza virus concern for humans

Avian Influenza, also known as "avian flu" or "bird flu" is caused by a virus that has a reservoir in wild birds. Usually wild birds are resistant to the disease but do carry and secrete the virus, transmitting it to domesticated birds (chicken, duck and turkey) that are susceptible and can become sick and die. The influenza A virus is found in the saliva, nasal secretions, and faeces of the birds. There are several subtypes of influenza A virus based on differences in two proteins on the virus membrane: hemagglutinin (HA) and neuraminidase (NA). There are 17 known HA subtypes (H1 to H17) and 9 NA subtypes (N1 to N9) and therefore, there are many possible combinations of HA and NA. Some of the strains are of the "low pathogenic" form causing mild, if any, clinical signs in poultry and others are "highly pathogenic" causing high morbidity and mortality, e.g. the H5N1 that killed millions of birds and forced the culling of several hundreds of millions in more recent years, especially in Asian regions.

Since 31 March 2013, an H7N9 avian influenza A virus has been detected in four provinces of eastern China and has infected 131 people of which 36 have died; some 1000 contacts are under medical observation (situation as of 24 May 2013). Importantly, this is the first time that this subtype has been found in humans. The virus is classified as low pathogenic (i.e. infected birds look healthy even though they carry the H7N9 virus and therefore are a potential threat to human health). It is a new subtype found in humans and it is derived from the combination of genes from three different avian influenza viruses. While there is clear indication of the transmission of the H7N9 virus from poultry to humans, there has been no indication of human to human

Sample collection in search of H7N9.

transmission and therefore, the risk to public health at present seems to be low. No cases of this new H7N9 subtype have been reported outside China.

The Chinese Center for Disease Control and Prevention has published genetic sequences of H7N9 identified in humans confirming that it is derived from avian influenza viruses. Preliminary data indicate that the H7N9 avian virus has mutated in poultry over time allowing it to adapt and grow at the normal body temperature of mammals.

Since the H7N9 avian influenza virus is sub-clinical in poultry (i.e. infected or carrier birds look healthy and normal but pose a risk to humans in contact), the Joint FAO-IAEA Division's Animal Production and Health Laboratory (APHL) is investigating the use and adaptability of early and rapid molecular diagnostic technologies to identify poultry that are infected or that carry the H7N9 virus. The diagnostic primers and probes available to amplify both the Matrix and H7 genes of the Chinese H7N9 by real time PCR are based on published sequences, but it is still important to determine whether these reagents will detect all variable gene sequences circulating in poultry.

The Animal Production and Health Laboratory at Seibersdorf is ready to support Member States on this problem in several ways:

- Provide surveillance and sampling guidance and advice;
- Provide real-time PCR standard operating procedures (SOPs) for the early and rapid diagnosis of the H7N9 avian influenza subtype in poultry, and associated capacity building and training;
- Provide technical and expert services (advice, guidance, protocols, guidelines);
- Provision of reagents (primers and probes) and procedural guidelines;
- Technical and expert on-site assistance and services;
- Updated information on H7N9 situation.

Important H7N9 avian influenza links:

- Q&A: http://www.fao.org/news/story/en/item/173704/icode/
- FAO press release: http://www.fao.org/news/story/en/item/173655/icode/
- WHO FAQ on H7N9 virus: http://www.who.int/influenza/human_animal_interface/faq_H7N9/en/
- Centers for Disease Control and Prevention: http://www.cdc.gov/flu/
- World Organisation for Animal Health (OIE): http://www.oie.int

These stories as well as other articles are also available under 'Highlights' on our Homepage
http://www-naweb.iaea.org/nafa/aph/index.html

Coordinated Research Projects

Project Number	Ongoing CRPs	Scientific Secretary
D3.10.26	Genetic variation on the control of resistance to infectious diseases in small ruminants for improving animal productivity	Mohammed Shamsuddin
D3.10.27	The use of enzymes and nuclear technologies to improve the utilization of fibrous feeds and reduce greenhouse gas emissions from livestock	Nicholas Odongo
D3.20.26	The early and sensitive diagnosis and control of peste des petits ruminants (PPR)	Adama Diallo
D3.20.28	The control of foot and mouth disease (FMD)	Gerrit Viljoen
D3.20.29	The use of irradiated vaccines in the control of infectious transboundary diseases of livestock	Adama Diallo
D3.20.30	Use of stable isotopes to trace bird migrations and molecular nuclear techniques to investigate the epidemiology and ecology of the highly pathogenic avian influenza	Ivancho Naletoski

Genetic variation on the control or resistance to infectious diseases in small ruminants for improving animal productivity

Technical Officer: Mohammed Shamsuddin

The objective of the CRP is to improve productivity in smallholder livestock production systems by using gene based and related technologies. The specific objectives are:

- To develop capacity in developing countries in the use of molecular and related technologies and create opportunities for international research collaboration;
- To establish or improve programmes for animal identification and data recording for small ruminants in developing countries, allowing for the monitoring of production, reproduction and health traits and generating populations suitable for molecular genetic studies;
- To collect phenotypic data and DNA samples from goat and sheep breeds or populations within breeds with a history of infectious disease resistance;
- To develop expertise on the use and development of bioinformatic tools for the analysis of large datasets of genomic data related to parasite resistance in various breeds;
- To provide valid data for the identification of genetic markers associated with infectious disease resistance and to initiate the development of tools for molecular diagnostics and assisted breeding.

Twelve research contract holders from Argentina, Bangladesh, Brazil, Burkina Faso, China, Ethiopia, Indonesia, the Islamic Republic of Iran, Nigeria, Pakistan, Saudi Arabia and Sri Lanka and four agreement holders from Brazil, Italy, Kenya and the United States of America are currently participating in the CRP.

The first part of the experimental work, the artificial challenge with infective L3 *Haemonchus contortus* larvae to animals representing resistant and susceptible breeds to quantify the relative resistance to gastrointestinal parasites has been completed in most of the participating countries, DNA has been extracted and some RC holders have sent subsets of DNA to the Animal Production and Health Laboratory in Seibersdorf, Vienna. Most contract holders are currently working on a large field trial using at least 500 animals of a single breed, collecting information related to body weight, FEC, PCV, and FAMACHA scores. Blood samples for DNA analysis are also being collected. Both the experimental challenge and the field trial were completed by the end of 2012.

The first research coordination meeting was held in Vienna, Austria, from 21 to 25 February 2011, and the second RCM was hosted by the Bogor Agricultural University from 11 to 15 February 2013 in Indonesia. Please see report under past events. The third and final RCM will take place in 2015.

The use of enzymes and nuclear technologies to improve the utilization of fibrous feeds and reduce greenhouse gas emissions from livestock

Technical Officer: Nicholas Odongo

The CRP is implemented under the IAEA project 2.1.2.1 titled Integrated management of animal nutrition, reproduction and health and is titled The use of enzymes

and nuclear technologies to improve the utilization of fibrous feeds and reduce greenhouse gas emission from livestock (D3.10.27). The overall objective of the CPR is to improve the efficiency of using locally available fibrous feed resources to improve livestock productivity while protecting the environment. The CRP was initiated in September 2010 with the award of eleven research contracts, three research agreements and one technical contract.

The first RCM was held from 7–11 February 2011 in Lethbridge, Alberta, Canada, and it was attended by all the contract and research agreement holders and one observer. The objective of the first phase of the CRP was a proof of concept by conducting in vitro screening of commercial fibrolytic enzymes to identify two to four best bet candidates and optimum dose ranges for further evaluation in animal trials.

The second RCM was held at the VIC in Vienna, Austria, from 13 to 16 May 2013. The objective of the meeting was to review the results from the studies conducted during the first 18 months of the CRP as the basis for revising and updating the programme of work and activities to be undertaken during the second 36 months of the CRP, which will focus on in vivo evaluation of best bet candidate fibrolytic enzymes to determine effects on animal productivity and to establish a possible mode of action. The results of the first phase of the CRP are reported under past events.

The third and last RCM will be held in 2015.

The early and sensitive diagnosis and control of peste des petits ruminants (PPR)

Technical Officers: Adama Diallo, Herman Unger

Peste des petits ruminants (PPR) is a highly contagious transboundary animal disease of wild and domestic small ruminants caused by a morbili virus similar to rinderpest virus and is on the list of economically important animal diseases to be reported to the OIE. PPR spread in endemic regions through nomadic herdsmen and livestock trade. High morbidity and mortality rates up to 90% in affected herds make PPR a killer disease for small ruminant populations. This not only affects rural economies severely but also reduces the genetic resources and endangers breeding policies. Clinically, PPR is characterized by high fever, depression and anorexia followed by ocular and nasal discharge, pneumonia and severe diarrhea. These symptoms can easily be confounded for pasteurellosis or rinderpest and diagnostic tests for RP were giving positive results due to the cross reactions.

The disease is endemic in parts of Africa, the Near and Middle East and South Asia and the incidence is gradually expanding and the Animal Production and Health Subprogramme receives regular requests from Member States for support. In Africa PPR was limited to countries north of the equator, but since 2007 Gabon, Democratic Republic of Congo, Kenya, Angola, and Uganda amongst others reported outbreaks. The situation is similar in the former Soviet Union countries of Asia. In addition, PPR is one of the targets of the United Nation Food and Agriculture Organisation's (FAO) Emergency Preventive System (EMPRES) programme.

It is not easy to isolate PPRV in cell culture and might need up to two to four weeks for a positive result to be confirmed. In the late 1980s specific reagents (monoclonal antibodies) and nucleic acid techniques (DNA probe hybridization and polymerase chain reaction (PCR)) became available and allowed more precise diagnosis. Today different ELISA's and PCR procedures are in use. However, these techniques are evolving quickly and need constant adaptation. An APH organized consultancy meeting in 2007 on the early and rapid diagnosis of emerging and re-emerging transboundary animal diseases concluded that amplification systems, in the form of real time PCR (rt-PCR), as well as isothermal amplification (IA) approaches, have moved from research environments to routine diagnostic applications. The APH Subprogramme was encouraged to foster the transfer of these new technologies to IAEA and FAO Member States. Their application of early and sensitive PPR diagnostic tools, in combination wtih protective and DIVA (differentiation between infected and vaccinated) vaccines to PPR, would improve our management and control of the disease.

The overall objective of the CRP is to develop, validate and transfer to Member States sensitive, specific and rapid tests for the diagnosis of peste des petits ruminants (PPR) to help them better manage and control this TAD.

The specific research objectives are:

(a) Evaluate and validate current Reverse Transcriptase-PCR (RT-PCR) methods in use for the diagnosis of PPR;
(b) Evaluate and validate real time PCR;
(c) Design and evaluation of the loop-mediated isothermal amplification (LAMP) assay;
(d) Evaluate and validate a penside test currently under development for rapid and cheap identification of PPR virus in the field;
(e) Evaluate and validate the use of ELISA in epidemiological studies of disease prevalence and protection due to vaccination;
(f) Contribute to the build up a PPRV gene sequence data bank for molecular epidemiology analysis.

Eleven research contract holders from Bangladesh, Burkina Faso, Cameroon, China, Cote d'Ivoire, Ghana,

Mali, Nigeria, Pakistan, Sudan and Turkey, and four agreement holders from Australia, Ethiopia, France and Sweden participated in the CRP.

The final RCM was held from 19 to 22 November 2012 at the IAEA in Vienna and IAEA Nuclear Sciences and Applications Laboratories in Seibersdorf.

The control of foot and mouth disease (FMD)

Technical Officer: Gerrit Viljoen

The FMD CRP investigates vaccine matching procedures, vaccine potency testing methods and guidelines, and procedures by which an FMD vaccine's ability to induce production of protective antibodies in cattle without the need for animal challenge experiments can be evaluated.

The first research coordination meeting (RCM) of the coordinated research project (CRP) on The Control of Foot and Mouth Disease, FAO, Rome, Italy, from 10 to14 January 2011, was held in collaboration with FAO and EU-FMD. It was attended by all, but one, research contract holders and agreement holders, as well as several observers from EU-FMD and FAO and foot and mouth (FMD) vaccine and diagnostic manufacturers and producers. Discussions were focused on: (1) the status of FMD in the participating counterpart's respective countries (e.g. FMD free vs. FMD free zone with or without vaccination vs. FMD endemic) with respect to the risks and threats; (2) what is currently being done in terms of vaccine matching; (3) what criteria are being used to choose FMD vaccines and how they are being applied; (4) how is vaccine potency being determined and utilized; (5) how are post-vaccination monitoring and surveillance being performed; (6) the status of counterpart's vaccine laboratory quality assurance and FMD laboratory analysis and diagnoses (i.e. their analysis and/or diagnostic laboratory proficiencies and capacities both for routine testing and research, laboratory infrastructure and procedures). The work plans of all the research contract holders (RCH) and the agreement holders (AH) were developed and discussed, and all the agreement holders will supervise (based on their respective expertise) identified aspects of the work plans.

Foot and mouth disease is one of the most important livestock diseases known to man due to its high infection rate (ease of spread) and its effect on the limitation of livestock movement and trade. An outbreak of FMD can have a devastating effect on a country's food security with direct impact on national and international trade. The confirmatory diagnosis of FMD and its effective control through prophylactic, quarantine or slaughter procedures are therefore of paramount importance as they have financial and trade implications. Vaccination with inactivated FMD virus is undertaken to control FMD in endemic countries or countries at risk. Vaccines, whilst widely available but which should match (i.e. should be of homologous serotype and strain isolate) with virulent FMD viruses circulating in the region of vaccine use, are of variable quality, not from the homologous outbreak serotype/strain isolate, and are often stored under inadequate temperature conditions and therefore might be not as effective in the field as determined in animal experiments. Due to insufficient knowledge on vaccine strength and antigenic match (antigenic cartography) between vaccine strain and outbreak virus, it is often not possible to pinpoint the weakness of the vaccination strategy and to take action on this weakness. Vaccine effectiveness can be determined by animal challenge, but this is both costly and difficult. In vitro systems have been developed in different countries since the 1980s, but these are not standardized for international use. Many countries now produce FMD vaccines but often without proper consideration of their effectiveness.

In many developing countries, vaccination will continue to be an essential component for the progressive control of FMD. Maximizing the effectiveness of current vaccines and supporting research to improve the effectiveness and quality of those and or new vaccines will be critical. Countries using locally produced vaccines need to assure trade partners that they are using quality assured vaccines in order to overcome the restrictive effects of endemic FMD. The provision of internationally accepted guidelines for quality assurance and alternatives to the present need for animal challenge vaccine trials would be a significant step forward. It is likely that control and eventual eradication in endemic areas with a low level resource base (much of Africa, parts of Asia and Latin America) will require the use of quality assured vaccine preparations, correct vaccine formulations (i.e. homologous strain or isolate vaccine to protect against outbreak, new generation vaccines with a broader protection base (i.e. cross protection between different strains and isolates) or alternative formulations of existing vaccines).

All the counterparts developed their work plans such that, individually and or collectively, they worked towards creating solutions set by the objectives of the FMD CRP.

It is important to:

- Establish methods and develop internationally agreed protocols for measuring the potency of FMD vaccines using in vitro methods;
- Establish guidelines for optimum population vaccination intervals based on in vitro measurements of potency and duration of the antibody response to structural proteins, after the vaccination of cattle and small ruminants with commercially available FMD vaccines, and including the evaluation of reduced dose

options such as intradermal administration of FMD vaccine;
- Establish protocols and guidelines for application and interpretation of vaccine matching methods (antigenic cartography) to identify the extent of expected cross-protection of type A or SAT viruses;
- Provide further global coordination of current research into FMD vaccines for use in endemic settings and to cooperate with other FMD institutions such as EU-FMD and PANAFTOSA;
- To evaluate and standardize:
  - Virus neutralization (VN) tests,
  - Early and rapid lateral flow and dip-site technologies and their application and use,
  - Antigenic cartography (at IAH and OVI) in relation to virus neutralization tests (VN).

The second RCM took place from 8 to 12 April 2013 at FAO Headquarters in Rome, Italy. Please see 'Past Events' for more information. The final RCM will take place in 2015.

The use of irradiated vaccines in the control of infectious transboundary diseases of livestock

Technical Officer: Adama Diallo

Many of the vaccines used today rely on technologies developed over 100 years ago involving some form of attenuation, i.e. the use of an alternative or mutant strain of a pathogenic organism that has reduced virulence whilst maintaining immunogenicity, or inactivation, where chemical or physical methods are used to kill virulent pathogenic strains. Amongst the success stories where control has been achieved can be included smallpox and rinderpest, two diseases that had a global impact but have now been eradicated.

For some viral and bacterial diseases there are good vaccines, but for many parasitic and helminth diseases there are limited control measures. Parasitic infections, including tick borne diseases, animal trypanosomoses and helminthoses, also have a significant impact on productivity causing poor growth, low calving and reduced milk yield. Historically, chemotherapeutic drugs have been the mainstay of treatment and control of diseases caused by animal parasites. They have been viewed as cheap, safe and effective, although of course they are required to be constantly administered to ensure animals will thrive. Their greatest drawback has been in the emergence of drug resistance that reduces their efficacy or prevents their use; in contrast, there is no evidence that similar genetic adaptation to vaccine induced immunity ever occurs.

With protozoal infections, a few vaccines have been produced based mainly on live parasites that result in a low level infection that stimulates a protective immune response similar to that produced by the natural infection. These methods include vaccination with low doses of infective organisms (*Eimeria*), infections controlled by chemotherapy (*Theileria parva*), attenuated vaccines (*Babesia, Theileria annulata*) or truncated life cycles (*Toxoplasma*). Multicellular helminth parasites such as trematodes (e.g. *Fasciola, Schistosoma*), nematodes (e.g. *Haemonchus*) and cestodes (e.g. *Taenia*) present an even greater challenge to the development of suitable vaccines since they are large, complex multicellular organisms that, unlike smaller organisms, cannot be internalized by the hosts' phagocytic immune mechanisms. Not surprisingly, few vaccines have been developed to protect against infections with helminth parasites. There is however one commercially available vaccine against the lungworm *Dictyocaulus viviparus,* consisting of radiation attenuated, infective L3 larvae. Nevertheless, research to develop other irradiated vaccines hasn't been seriously pursued for the past twenty years.

There is now good reason to re-evaluate the use of irradiation attenuation for vaccine production. The recent successful development of an irradiated vaccine for human malaria has demonstrated anew the feasibility and practicalities of this technique and indicated that technical problems can be overcome using existing knowledge without recourse to sophisticated technology.

The general objectives of the CRP are:
(a) To develop protocols for the attenuation of animal pathogens and to define parameters for their use as vaccines against the causative agents of transboundary parasitic and other infectious diseases;
(b) To evaluate the effect of radiation on the potency of the irradiated products;
(c) To examine the potential of irradiation to inactivate viruses as an alternative to chemical treatment.

Eleven research contract holders from Argentina, China, Ethiopia, Georgia, India, Islamic Republic of Iran, Kenya, Sri Lanka, Sudan, Thailand and Turkey, and four agreement holders from Belgium, China, UK and USA are currently participating in the CRP.

The first RCM was held from 11 to 15 October 2010 at the IAEA Headquarters, Vienna, Austria, and the second RCM took place from 25 to 29 June 2012 in Nairobi, Kenya. The third and final RCM is scheduled to take place in 2014.

Use of stable isotopes to trace bird migrations and molecular nuclear techniques to investigate the epidemiology and ecology of the highly pathogenic avian influenza

Technical Officer: Ivancho Naletoski

Among several important issues in the epidemiology of the highly pathogenic avian influenza (HPAI) that need attention is the role tha wild water fowl (WWF) populations might play in the dissemination of infection. Tracing the movements of WWF in relation to where they originated as well as their stopover points during their migration between breeding and non-breeding grounds is a particularly challenging task.

It is necessary to utilize methods that can be used on a larger scale and not biased to initial capture location if we are to fully comprehend the role of migratory birds in the spread of avian influenza. A suitable technique that has already been used to trace migrants is based on the stable isotope (SI) signatures of the tissues of birds, especially those in feathers. Of most interest are deuterium (δD) ratios in tissues that reflect those in surface (lakes, rivers, oceans) and ground waters. Since hydrogen isotope composition of environmental water varies spatially across the globe in a predictable manner, and its presence relayed to feathers, δD analyses of feathers provide a way of linking SI data on water isoscapes with those in the feathers.

Faecal samples will be used for the detection of AI viruses eventually present in the faeces and extraction and analysis of somatic DNA to detect the bird species. These two techniques will be used to link the AI carrier status and the carrier species without even capturing the birds, and may thus be used as a non-invasive platform to generate important epidemiological information on migration pathways (obtained by SIA) and the transmission of the virus to a certain geographical area. Faecal samples should be collected randomly at the same sites where feathers are collected. Samples will undergo two test procedures:

(a) DNA barcoding (species identification), adapted at the Avian Disease Laboratory; College of Veterinary Medicine; Konkuk University, South Korea. The technique is based on detection of a short gene sequence from a standardized region of the genome as a diagnostic 'biomarker' for species. The target sequence has been the 648-bp region of the mitochondrial gene, cytochrome C oxidase I (COI), already optimized as a DNA barcode for the identification of bird species. The optimization of a DNA barcoding technique for faecal samples has been performed by comparing DNA from the faecal samples with the DNA from tissue samples (muscle, feather, and blood) from already known bird species (domestic poultry and WWF), collected from live bird markets, the Conservation Genome Resource Bank for Korean Wildlife and from the Seoul Grand Park Zoo. The results of bird species identification, using COI gene sequences from tissues matched the faecal samples of the same individuals.

(b) Detection of the AIV in the faecal samples using optimized protocol in five phases: i) detection of M gene to detect the presence of influenza A viruses using PCR technique (positive samples should be inoculated in SPF eggs for virus isolation), ii) positive samples should be tested using H5 or H7 protocol on PCR, iii) H5 and H7 positive samples should undergo molecular pathotyping (cleavage site sequencing), iv) M gene positive, H5 and H7 negative, should be further typed in order to differentiate the subtype using conventional (HI-test) and/or molecular methods, v) positive samples and a portion of negatives will be tested using loop mediated isothermal amplification (LAMP) protocol.

The main pathway of AIV transmission is faecal contamination. Natural water reservoirs are the media where WWF faeces is excreted in the water, contaminating it randomly. However, the survival of the AIV in natural water reservoirs depends on numerous environmental, physical and chemical influences, as well as on the period between excretion by an infected and infection of a healthy WWF. Testing of natural water reservoirs will generate information on the level of (eventual) contamination and the risk of AIV transmission via these media at different geographical and environmental conditions. Water samples should be collected from different points of each selected area, in an amount of approximately 500 ml per sample. Each sample should be tested for the presence of AIV, using PCR with previous concentration of the virus. Using a standardized protocol it is possible to quantitatively evaluate the level of contamination based on a comparison with a known titrated virus isolate.

Of great epidemiological interest would be the potential application of the same technology to trace short-range migration in wildlife carriers, in order to determine their role in transmission of animal and/or human pathogens.

Seven research contract holders from Bulgaria, China, Egypt, Nepal, Russian Federation, Tajikistan and Turkey, two agreement holders from Germany, and three technical contract holders from Canada, Republic of Korea and the UK are currently participating in the CRP.

The first RCM was held at the IAEA from 31 October to 2 November 2012. The next meeting is planned for 2014.

General information applicable to all coordinated research projects

Submission of Proposals

Research Contract proposal forms can be obtained from the IAEA, the National Atomic Energy Commissions, UNDP offices or by contacting the Technical Officer. The form can also be downloaded from the URL: http://www-crp.iaea.org/html/forms.html.

Such proposals need to be countersigned by the Head of the Institutions and sent directly to the IAEA. They do not need to be routed through other official channels unless local regulations require otherwise.

Complementary FAO/IAEA Support

IAEA has a programme of support through national Technical Cooperation (TC) projects. Such support is available to IAEA Member States and can include additional support such as equipment, specialized training through IAEA training fellowships and the provision of technical assistance through visits by IAEA experts for periods of up to one month. Full details of the TC Programme and information on how to prepare a project proposal are available at the URL http://pcmf.iaea.org/.

Activities of the Animal Production and Health Laboratory

Animal Health

Molecular epidemiology of capripox

Since 2007, the animal production and health laboratory has been working to improve the molecular epidemiology of capripoxviruses. To this end, the APHL accepts samples from Capripox outbreaks that have occurred in different Member States. In early 2013, the APHL completed the molecular characterization of capripoxvirus field isolates and vaccine strains received from three Member States in late 2012. Capripoxviruses were identified and molecularly characterized from three cattle samples collected in 2008 in Senegal, one sheep sample collected in 1985 in Mauritania and the sheep vaccine strain currently in use in Senegal. Other samples that were analysed were: four field samples and one vaccine sample from Sudan of cattle origin, 9 samples from Ethiopia that were collected during capripox outbreaks in cattle (6), goats (4) and sheep (1). The sequencing data of nucleic acid fragments that were amplified from those samples were added to the gene data bank. They showed that one sample collected from sheep in Ethiopia was located outside the group corresponding its host of origin. Indeed, it was found to be a goat poxvirus.

Molecular epidemiology of parapox

Recently, APHL extended its ruminant poxvirus studies to the parapoxvirus, the Orf virus, a virus that can cause disease in humans. In late 2012, it received 16 specimens that were collected from Orf suspected sick sheep and goats in Ethiopia. An Orf virus gene was amplified by PCR, sequenced and compared to those of other Orf virus sequences retrieved from GenBank. The results show that at least three different strains of Orf virus are circulating in Ethiopia.

Molecular epidemiology of African swine fever (ASF)

The APHL initiated a study to characterize ASFV isolates collected from different outbreaks (2011 and 2012) in Central Africa and Western Africa (1983 to 2008). Gene sequencing data of ASFV samples from Cameroon, Central African Republic, Chad, Democratic Republic of the Congo and Senegal were analysed and compared to those of other isolates available from public databases (GenBank). The results showed that all western and central African isolates were from the ASFV genotype I and that Cameroon ASFV isolates could be subdivided into subtypes within the genotype I. This analysis also revealed that three different viral strains were involved in the recent ASF outbreaks in Cameroon. ASFV identified in two samples collected from Chad were similar to two of the Cameroon genotype I subtypes.

A sample collected from DRC in 1989 showed a different profile when compared to those involved in recent outbreaks in Cameroon and Chad. This work is still in progress to provide useful information for more effective control strategies in these regions.

Peste des petits puminants (PPR) in Africa

In order to identify possible temporal and spatial changes to PPRV circulating in the Democratic Republic of the Congo (DRC), the Laboratoire Vétérinaire de Kinshasa supplied APHL with PPR pathological samples collected from 2009 to 2012. Gene sequence analysis of those samples showed all PPRV identified in those samples were of lineage IV and there was little genetic variation between the isolates.

The PPRV that were identified in specimen collected during suspected outbreaks in Ethiopia in 2011 and Angola in 2012 and analysed in APHL are from the same lineage. These results and other obtained in APHL and samples from other regions and also results obtained from other laboratories indicate that now all four PPR lineages are present in Africa. The lineage IV that was seen as an Asian PPRV lineage but detected in Cameroon in late 1990s, in Morocco in 2008 and Sudan in 2009 is expanding in Africa. The lineage II is expanding in West Africa. In opposite, lineage I and III seem ‘to lose the ground’.

The classification of PPRV strains into lineages, actually four lineages, has been based on the partial sequence of two protein genes, the fusion and the nucleocapsid proteins. In order to obtain better information on the evolution of the virus, a study has now started in APHL for the virus full genome sequencing. Currently, the full genome sequencing of six African PPRV isolates is nearly completed.

Animal genetics

Genetic variation on the control of resistance to infectious diseases in small ruminants for improving animal productivity

Assessment of livestock health conditions in developing countries for identification of priority diseases to be targeted for control, revealed helminthosis as the most important disease for sheep and goat. The annual treatment cost for Haemonchus contortus alone had been estimated to be $26 million in Kenya, $46 million in South Africa and $103 million in India. Identification of DNA markers associated with parasite resistance will help breeding of animals for enhanced level of host resistance and reduce the risk of disease in sheep and goats. In continuation of the efforts of APHL in this direction, 41 single nucleotide polymorphic markers discovered earlier were genotyped in about 300 animals for association with phenotypes generated in ten indigenous sheep breeds (Corriedale, Pampinta, Indonesian Fat Tail, Indonesian Thin Tail, Thalli, Kajli, Kachi, Karakul, Madras Red and Mecheri) of different Member States (Argentina, Indonesia, India and Pakistan). The results of association study with phenotypes generated under challenge trial revealed six SNP (single nucleotide polymorphism) markers being important with differences in mean faecal egg count of different genotypes. Two of these six SNP markers showed statistically significant differences among genotypes while the other four SNP loci indicated their potential as useful markers for parasite resistance.

Meta-analysis for global diversity analysis of indigenous sheep breeds

The CRP Gene Based Technologies for Livestock Breeding Phase I: Characterization of small ruminant genetic resources of Asia was implemented by the Joint FAO/IAEA Division from 2005 to 2010. The project generated data on about 35 sheep breeds/populations from seven countries in Asia including Bangladesh, China, Indonesia, Islamic Republic of Iran, Pakistan, Sri Lanka and Vietnam. In order to assess the genetic structure of indigenous sheep breeds across different geographical regions, the FAO and Joint FAO/IAEA Division initiated a global analysis of microsatellite genotypes and mitochondrial DNA sequences by merging data from different projects including IAEA-CRP, ECONOGENE consortium, Nordic Gene Project and national projects from different countries.

However, data of indigenous sheep breeds from certain regions were still not available including that of Middle East Asia, Latin America and India. Hence, sequencing and genotyping of about 380 samples collected from these regions were started to supplement information on global diversity analysis. As part of this effort, 10 indigenous sheep breeds Junin, Hamdani, Shal, Madras Red, Mecheri, Pattanam, Nellore, West Palmisnka, Karakachanska, Sumenska were genotyped at 19 FAO recommended microsatellite loci. Out of these, data on four different breeds viz. Pattanam, Nellore, Madras Red and Mecheri at 15 loci were analysed. Moderate to high genetic diversity was observed among all the four breeds with most of the loci showing observed heterozygosity more than 60%.

Global reference genetic repository of livestock breeds for animal genetic research

In order to strengthen the collaborative animal genetic research across different Member States, a global DNA bank of livestock breeds was established at the Animal Production and Health Laboratory, Joint FAO/IAEA Division in Seibersdorf. The DNA bank activities involve collection, preservation and maintenance of genomic DNA from distinct breeds of various livestock species including cattle, sheep and goat. The genetic repository is constantly strengthened by the addition of new DNA samples. More than 230 DNA samples including that of Iranian and Austrian sheep (Ghezel, Moghani, Makui, Krainer Steinschaf), indigenous cattle (Pyar Sein) and chicken (Sittagaung, Naked Neck and Inbinwa) of Myanmar were added to the repository during the last six months.

Capacity building

Wu Xu, Associate Professor, Fujian Agriculture and Forestry University in China worked at the APHL as a cost free expert on radiation hybrid panel mapping and genetic characterization of indigenous livestock from September 2012 to February 2013.

Shuo Li from China joined the APHL as an intern from November 2012 to May 2013. Ms Li, a veterinarian and a recent PhD graduate from the University of Edinburgh, worked on the full genome sequencing of PPR.

Technical Cooperation Projects

TC Project	Description	Technical Officer(s)
ALG/5/027	Strengthening Animal Health and Livestock Production to Improve Diagnostic and Reproductive Capacities in Animal Breeding and Support Expertise for the Feasibility Study of a Biosafety Laboratory, Level 3 (BSL3) **Objective:** To contribute to the improvement of animal health and livestock production by using nuclear and nuclear related technologies to strengthen reproductive and diagnostic capacities in animal breeding; to support expertise for the feasibility study of a bios.	M. Shamsuddin / I. Naletoski
ANG/5/010	Characterizing Indigenous Animal Breeds for Improving the Genetic Quality of Local Cattle Breeds and Small Ruminants **Objective:** To undertake phenotype and genotype characterization of indigenous animal breeds for improving the genetic quality of local and adapted cattle breeds.	M. Shamsuddin
BEN/5/006	Improving Animal Health and Productivity **Objective**: To strengthen, diagnose, and control African swine fever, and increase animal productivity.	H. Unger / A. Diallo
BEN/5/007	Soil, Crop and Livestock Integration for Sustainable Agriculture Development Through the Establishment of a National Laboratory Network **Objective:** An interdisciplinary project that aims at a sustainable intensification of peri-urban agricultural production through the integration of cropping-livestock systems was developed.	N. Odongo / G. Viljoen
BKF/5/011	Improving the Health and Productivity of Small Ruminants through Efficient Animal Feeding, Identification of Genetic Markers for Breeding Programmes and Better Health and Reproductive Management **Objective:** To improve small ruminants productivity through efficient use of local plant resources in animal feeding and health, identification of genetic markers for use in breeding programmes and better health and reproductive management.	M. Shamsuddin
BOH/5/001	Reducing the Incidence of Brucellosis in Animals and Humans by Surveillance and Control **Objective:** To reduce the incidence of brucellosis in animals and humans in Bosnia and Herzegovina	I. Naletoski
BOT/5/008	Using Nuclear and Molecular Diagnostic Techniques for Improved Diagnosis of Animal Diseases **Objective**: To employ nuclear and molecular diagnostic techniques to improve diagnosis of animal diseases.	G. Viljoen, A. Diallo
BZE/5/006	Establishing Early and Rapid Diagnosis of Transboundary Animal Diseases to Support Food Security **Objective:** To establish an early and rapid nuclear/nuclear related serological/molecular diagnostic and control capability for transboundary animal diseases:- Building capacity, strengthening of a national diagnosis and surveillance system for transboundary/zoonotic.	G. Viljoen
CAF/5/005	Enhancing Livestock Productivity through the Improvement of Selection and Use of Artificial Insemination for Increased Meat and Milk Production **Objective:** Improve cattle productivity by implementing a reliable artificial insemination (AI) programme in the country.	M. Shamsuddin
CHD/5/004	Improving Cattle Productivity through Genetic Improvement, Including Artificial Insemination, to Contribute to Reducing Poverty and Combating Food Insecurity **Objective:** Improve the productivity of local cattle breeds by means of artificial insemination.	M. Shamsuddin
CMR/5/018	Improving Productivity of Indigenous Breeds and Animal Health **Objective:** Improved productivity of indigenous breeds and animal health.	H. Unger

TC Project	Description	Technical Officer(s)
ELS/5/011	Enhancing Livestock Productivity and Decreasing Environmental Pollution through Balanced Feeding and Proper Manure Management **Objective:** Enhance livestock productivity and decrease environment pollution through balanced feeding and proper manure management.	N. Odongo
ERI/5/009	Enhancing Small Scale Market Oriented Dairy Production and Safety for Dairy Products through Improved Feeding and Cattle Management, Higher Conception Rates and Lower Calf Mortality **Objective:** To increase dairy production through improved feeding and cattle management and higher conception rate and lower calf mortality, and improve farmers livelihood in Eritrea.	M. Shamsuddin / N. Odongo
ETH/5/017	Improving Livestock Productivity through Advances in Animal Health and Production **Objective:** Improvement of livestock productivity through advances in animal health and production.	A. Diallo
IVC/5/032	Establishing Epidemiological Surveillance of Peste des Petits Ruminants (PPR) and Studying Its Socio-Economic Impact on Rural Populations by Developing Diagnostic Tools and Providing Economic Data to Veterinary Services **Objective:** To develop diagnostic tools and provide economic data to assist veterinary services in developing a proper strategy to control peste des petits ruminants in Cote d'Ivoire.	G. Viljoen / A. Diallo
KAM/5/002	Using Nuclear and Molecular Techniques to Improve Animal Productivity and Control Transboundary Animal Diseases **Objective:** To improve livestock productivity for food security by integrated management of animal nutrition, reproduction and health which includes: early pregnancy diagnosis for better reproductive management, metabolic profiles in livestock for assessing nutrition.	G. Viljoen / M. Garcia
KEN/5/033	Using an Integrated Approach towards Sustainable Livestock Health and Nutrition to Improve Their Production and Productivity for Enhanced Economic Development **Objective:** To use an integrated approach to manage both livestock health and nutrition in order to improve their production and productivity for enhanced economic development.	N. Odongo / A. Diallo
LES/5/002	Using Nuclear and Molecular Techniques for Improving Animal Productivity and Control of Transboundary Animal Diseases to Enhance Livestock Production and Health **Objective:** To improve livestock production and health.	G.Viljoen
MAG/5/016	Applying Nuclear Techniques to Optimize Animal Production **Objective:** To increase animal production through the improvement of animal health and control reproduction in the Amoron'i Mania region.	M. Shamsuddin / N. Odongo / I. Naletoski
MAG/5/020	Improving Stockbreeding Productivity Through the Application of Nuclear and Related Techniques for Reducing Rural Poverty **Objective:** To contribute to reducing rural poverty by improving the productivity of stockbreeding.	M. Shamsuddin
MAR/5/021	Improving Smallholder Dairy Productivity through Better Nutrition by Using Locally Available Forage and Browse Species **Objective:** To contribute to the improvement of smallholder dairy productivity through better nutrition using locally available forage and browse species.	N. Odongo

TC Project	Description	Technical Officer(s)
MLI/5/025	Improving National Capacities to Characterize Serotypes of Major Animal Diseases Using Molecular Biology Techniques for the Development of a National Disease Control Strategy **Objective:** The main objective is identification of the various serotypes of the foot and mouth disease virus. The project would help the elaboration of a national strategy for control of the disease by formulating vaccines which are currently imported from Botswana.	I. Naletoski
MLW/5/001	Strengthening the Essential Animal Health and Veterinary Infrastructure for Disease Control and Management Services in Urban and Rural Areas **Objective:** To develop capacity and strengthen infrastructure for animal disease control and management services in urban and rural areas of Malawi.	H. Unger
MON/5/020	Improving the Health Status of Livestock by Developing a Technology to Produce the Vaccine and Diagnostic Kit for Transboundary Animal Diseases **Objective:** To improve the health status of livestock by developing a technology to produce the vaccine and diagnostic kit of transboundary animal diseases.	G. Viljoen
MON/5/021	Improving the Productivity and Sustainability of Farms Using Nuclear Techniques in Combination with Molecular Marker Technology **Objective:** To improve the productivity and sustainability of livestock and crop integrated farms through utilization of high yield, disease resistant new wheat varieties and other cereal varieties developed by the combined application of nuclear and molecular marker.	N. Odongo
MYA/5/022	Improving Animal Productivity through the Use of DNA-Based Technology and Artificial Insemination **Objective:** To improve livestock productivity through the selection of superior breeding stock and to improve capacity in the use of molecular and related technologies for raising the genetic quality of local and adapted livestock breeds.	M. Shamsuddin
NAM/5/011	Establishing Research and Diagnostic Capacity for the Effective Control of Animal Diseases in the Northern Communal Areas and Improving Veterinary Public Health Services **Objective:** To control transboundary and parasite-borne animal diseases in the Central and Northern Communal Areas (NCA) and to improve veterinary-public health.	H. Unger
NEP/5/002	Improving Animal Productivity and Control of Transboundary Animal Diseases Using Nuclear and Molecular Techniques **Objective:** To improve livestock productivity for food security by integrated management of animal nutrition, reproduction and health.	I. Naletoski
NIC/5/008	Improving Technical Capabilities for Detection of Diseases and Residues in Agriculture **Objective**: To improve capacity in detection of diseases and residues in animal and plant commodities for food trade.	G.Viljoen, J Sasanya
RAF/5/057	Strengthening Capacities for the Diagnosis and Control of Transboundary Animal Diseases in Africa (AFRA) **Objective**: To strengthen the diagnostic capacity of national veterinary services to monitor and control major transboundary animal diseases, particularly foot and mouth disease, peste des petits ruminants and contagious bovine pleuropneumonia.	H. Unger / A. Diallo
RAS/5/060	Supporting Early Warning, Response and Control of Transboundary Animal Diseases **Objective:** To establish a regional/national network of laboratories and training centres on early diagnosis, response and control of transboundary animal diseases and eradication programmes for zoonotic diseases.	H. Unger

TC Project	Description	Technical Officer(s)
RAS/5/063	Improving the Reproductive and Productive Performance of Local Small Ruminants by Implementing Reliable Artificial Insemination Programmes **Objective**: To improve small ruminants productivity by implementing reliable artificial insemination programmes.	M. Shamsuddin / M. Garcia
RER/5/016	Supporting Coordinated Control of Transboundary Animal Diseases with Socioeconomic Impact and that Affect Human Health **Objective**: To reduce transboundary disease incidence in livestock and livestock products in the Euro-Asian region.	I. Naletoski
RLA/5/049	Integrated Control of Fascioliasis in Latin America (in support of National Programmes **Objective**: Integrated control of fascioliasis (in support of national programmes).	G. Viljoen / I. Naletoski
SIL/5/013	Establishing a Dual-Purpose Cattle Development Project for the Sustainable Contribution to Food Security, Poverty Alleviation and Improved Livelihoods of Communities Raising Cattle **Objective:** Sustainable contribution to food security, poverty alleviation and improved livelihoods of communities raising cattle.	M. Shamsuddin
SRL/5/042	Applying Molecular Diagnostics to Zoonotic Diseases **Objective**: To enhance the long term epidemic preparedness by developing competence in molecular diagnosis and surveillance of zoonotic infections.	Kashyap (NAHU) / H. Unger
UGA/5/032	Improving Animal Production and Productivity through Advanced Animal Disease Control and Animal Production Measures **Objective:** To improve animal production and productivity through advanced animal disease control and animal production measures.	H. Unger
URT/5/027	Improving Livestock Production and Productivity through Sustainable Application of Nuclear and Related Techniques **Objective:** The broad objective of this project is to improve livestock production and productivity in the United Republic of Tanzania through sustainable application of various nuclear and nuclear related techniques.	N. Odongo / M. Shamsuddin / M. Garcia
URU/5/026	Increasing the Profitability of Dairy Producers by Improving Reproduction Efficiency, Rational Sustainable Use of Genetic Resources **Objective**: To implement integrated management strategies to improve the profitability of medium size grazing dairy farms by means of (a) integrated nutritional strategies; (b) strategic reproductive interventions; and (c) marker-assisted selection.	M. Shamsuddin / N. Odongo
ZAI/5/021	Upgrading Laboratory Services for the Diagnosis of Animal Diseases and Building Capacity in Vaccine Production to Support the Sustainability of Food Security and Poverty Alleviation **Objective:** To support the sustainability of food security and poverty alleviation through animal diseases diagnosis and immunisation.	G. Viljoen / I. Naletoski
ZAM/5/028	Improving Productivity of Dairy Animals Maintained on Smallholder Farms through Selected Breeding and Effective Disease Diagnosis and Control Using Isotopic and Nuclear Techniques **Objective:** To improve productivity of dairy animals maintained on smallholder farms in rural areas through selected breeding, effective disease diagnosis and control, improved supply of quality feeds and application of assisted animal reproduction technologies.	N. Odongo / I. Naletoski / M. Shamsuddin / M. Garcia
ZIM/5/016	Strengthening Food Security and Safety by Advancing Technologies for the Rapid Diagnosis of Diseases of Major Economic and Zoonotic Importance and for Residue/Pesticide Control in Animals and Animal Products **Objective:** Strengthening the existing technology and capacity to rapidly diagnose diseases of major economic and zoonotic importance and enable proper and timely response to disease outbreaks.	I. Naletoski

Publications

Effects of exogenous enzymes on nutrient digestability, ruminal fermentation and growth performance in beef steers

A.Z.M. Salem, H.M. Gado, D. Colombatt, M.M.Y. Elghandour

Livestock Science 154 (2013) 69–73

Forty crossbred steers (Baladi_Friesian, average BW 15375.14 kg) were used to evaluate the effects of exogenous enzyme (ENZ) addition on nutrient intake, digestion, ruminal fermentation and feed conversion in beef steers. Steers were randomly assigned to two groups of 20 animals and fed individually a total mixed ration (TMR) without (CTRL) or with addition of 40 g/hd/d of an enzyme mixture (ZADOs). The ENZ mixture was added for 220 days and in vivo apparent digestibility was measured on days 210–220. Enzyme addition did not affect (P¼0.1) DM intake, whereas it increased (Po0.05) total tract apparent digestibility of all nutrients. The magnitude of improvement in digestibility varied among nutrients, with the highest improvement occurring in digestibility of NDF and ADF (21.8% and 26.7%, respectively). Addition of ENZ also increased (Po0.05) concentrations of rumen ammonia N and total short chain fatty acids (SCFA) before and 3 h post-feeding. Allantoin concentration total purine derivates were increased (P¼0.04) with enzyme addition while uric acid was not affected (P¼0.05). Live weight gain was also higher (Po0.01) in steers supplemented with ENZ. In conclusion, adding the exogenous enzyme product increased live weight gain by 16% due to increased nutrient digestibility.

The long journey: a brief review of the eradication of rinderpest

*F. Njeumi, W. Taylor, **A. Diallo**, K. Miyagishima, P.-P. Pastoret, B. Vallat, M. Traore*

Rev.sci.techOff.int.Epiz 31 (3) (2012) 729–746

In 2011, the 79th General Session of the World Assembly of the World Organisation for Animal Health (OIE) and the 37th Food and Agriculture Organization of the United Nations (FAO) Conference adopted a resolution declaring the world free from rinderpest and recommending follow-up measures to preserve the benefits of this new and hard won situation. Eradication is an achievable objective for any livestock disease, provided that the epidemiology is uncomplicated and the necessary tools, resources and policies are available. Eradication at a national level inevitably reflects national priorities, whereas global eradication requires a level of international initiative and leadership to integrate these tools into a global framework, aimed first at suppressing transmission across all infected areas and concluding with a demonstration that this has been achieved. With a simple transmission chain and the environmental fragility of the virus, rinderpest has always been open to control and even eradication within a zoosanitary approach. However, in the post-1945 drive for more productive agriculture, national and global vaccination programmes became increasingly relevant and important. As rinderpest frequently spread from one region to another through trade related livestock movements, the key to global eradication was to ensure that such vaccination programmes were carried out in a synchronized manner across all regions where the disease was endemic – an objective to which the European Union, the United States Agency for International Development, the International Atomic Energy Agency, the African Union-Interafrican Bureau of Animal Resources, FAO and OIE fully subscribed. This article provides a review of rinderpest eradication, from the seminal work carried out by Giovanni Lancisi in the early 18th Century to the global declaration in 2011.

Effects of exogenous enzymes on in vitro gas production kinetics and ruminal fermentation of four fibrous feeds

*M.M.Y. Elghandour, A.Z.M. Salem, M. Gonzalez-Ronquillo, J.L. Bórquez, H.M. Gado, **N.E. Odongo**, C.G. Peñuelas*

Animal Feed Science and Technology 179 (2013) 46–53

This study was conducted to investigate effects of increasing doses: 0 (control), 6 (low), 12 (medium) and 24 (high) mg/g DM of ZADO® enzyme preparation mixture (ENZ) on in vitro gas production (GP) and some ruminal fermentation parameters of the fibrous feeds Saccharum officinarum (leaves), Andropogon gayanus (leaves), Pennisetum purpureum (leaves) and Sorghum vulgare (straw). Rumen liquor was obtained from two Brown Swiss cows fitted with permanent rumen cannulae fed a total mixed ration of a 500:500 commercial concentrate and alfalfa hay ad libitum. The GP was recorded at 2, 4, 6, 8, 10, 12, 24, 48, 72 and 96 h of incubation. After 96 h, the incubation was stopped and the pH of the mixture was determined and filtrate used to determine dry matter degradability (DMD), partitioning factor (PF96), gas yield (GY24), in vitro organic matter digestibility (OMD), metabolizable energy (ME), short chain fatty acids (SCFA), and microbial crude protien production (MCP). In general, the crude protein (CP) content of the fibrous feeds was low and ranged from 23 g/kg DM (S. officinarum) to 44 (A. gayanus). The fibre

contents (i.e., NDFom and ADFom) were highest (P<0.05) in S. officinarum. Increasing ENZ dose linearly increased (P<0.05) GP of all fibrous feeds and had a quadratically increased (P<0.05) asymptotic gas production in P. purpureum and S. vulgare and rate of gas production in S. officinarum and S. vulgare. Addition of ENZ also quadratically increased (P<0.05) GP at all incubation times in S. officinarum and S. vulgare, and A. gayanus, but only at 72 h in A. gayanus. The parameters of ruminal fermentation of OMD, ME, GY24 and SCFA linearly increased (P<0.05) and MCP linearly decreased (P<0.05) with the ENZ addition. Addition of enzyme affected ruminal fermentation of our feeds differently, mainly dependent on their fibre content, although dosage of enzyme was also important as impacts generally increased at higher dosages of ENZ.

Enzymatic reporting of peste des petits ruminants virus genes ligating two specific probes on nanoparticles

Chunai Tao, Gang Li, Yong Wang, Huaxin Huang

Biotechnology Lett 35 (2013) 613–618

An alternative strategy for the detection of nucleic acid derived from peste des petits ruminants virus was developed omitting amplification. The assay is based on two probes complementary to the target sequences, one conjugated to magnetic microparticles the second to gold nanoparticles labelled with horseradish peroxidase. In the presence of target gene the two particles ligate via the probes and the complex can be magnetically separated. Applying substrate and chromogen a colour reaction results for a positive case. Under optimized conditions, the approach had a linear detection range from 10 fM to 1 µM for ssDNA corresponding to an RNA low detection limit of 17.6 ng/µl. The quick performance (45 min) and not requiring expensive instrumentations offer a new way of detecting nucleic acids for the clinical diagnosis in our case for peste des petits ruminants virus.

Isothermal loop-mediated amplification (LAMP) for diagnosis of contagious bovine pleuropneumonia

G. Mair, E.M. Vilei, A. Wade, J. Frey, ***H. Unger***

Bio Med Central Veterinary Research, 9: 108. doi:10.186/1746-6148-9-108

Contagious bovine pleuropneumonia (CBPP) is the most important chronic pulmonary disease of cattle on the African continent causing severe economic losses. The disease, caused by infection with *Mycoplasma mycoides* subsp. *Mycoides* is transmitted by animal contact and develops slowly into a chronic form preventing an early clinical diagnosis. Because available vaccines confer a low protection rate and short lived immunity, the rapid diagnoses of infected animals combined with traditional curbing measures is seen as the best way to control the disease. While traditional labour intensive bacteriological methods for the detection of *M.mycoides* subsp. *mycoides* have been replaced by molecular genetic techniques in the last two decades, these latter approaches require well-equipped laboratories and specialized personnel for the diagnosis. This is a handicap in areas where CBPP is endemic and early diagnosis is essential.

Comparative efficacy of the synchrony programmes in subestrus crossbred cows at smallholder farms in Bangladesh

Md Mostofa Kamal, Geert Opsomer, Nasreen Parveen, Harry W. Momont, ***Mohammed Shamsuddin***

Journal of Applied Animal Research, DOI:10.1080/09712119.2013.792736

The objective was to compare the reproductive efficacy of a Cosynch (GnRH-$PGF_{2\alpha}$– GnRH +TAI), PG programme (one shot $PGF_{2\alpha}$) with artificial insemination (AI) on observed estrus and untreated control (AI on observed estrus) in subestrus (cycling but not detected in estrus by ≥60 days postpartum) crossbred cows at smallholder farms. Ultrasonographic examinations were performed at AI, 7 d after AI and 28 d and 42 d after AI to determine the largest follicle, the new corpus luteum (CL) and to diagnose conception and pregnancy, respectively. Of the 69 enrollments in the estrus detection groups, 78.9% in PG programme and 54.8% in control were detected in estrus during the following two weeks (χ2=4.57; P=0.04). Of the inseminated cows in all groups, 75.7% in Cosynch, 76.7% in PG programme and 82.4% in control were ovulated (χ2=0.31; P=0.86). The size of the largest follicle at AI had a positive correlation with the resultant CL at d 7 (r=0.84, P=0.001). The follicle in cows that subsequently became pregnant was larger (P=0.01) than that in the non-pregnant cows (15.8±2.03 vs. 14.6±2.31), and this was smaller (P=0.001) in cows that experienced late embryonic mortality (12.3±1.03) than those with successfully maintained pregnancy (15.8±2.03) or have not conceived (15.6±2.67). In cows with an expected synchronisation response, the largest follicle size did not differ (P=0.18) between cows that subsequently became pregnant or non-pregnant. The conception rates (Cosynch: 54.1%; PG programme: 63.3%; Control: 64.7%) were not different between the groups (χ2=0.83; P=0.37). The embryonic mortality was 12% in the cows during d 28 until d 42. The overall final pregnancy rate was 41.5% that did not differ (χ2=1.56; P=0.64) between the groups (Cosynch: 45.9%; PG programme: 44.7%; Control: 32.3%). Therefore, selective administration of $PGF_{2\alpha}$ to subestrus cows would be economically advantageous because of a saving in hormone injection costs, and veterinary supervision can lead to an increase in the estrus detection efficiency of the herd personnel.

IAEA Publications, including IAEA-TECDOCs, are available electronically on:
www.iaea.org/books
Orders for hardcopies and requests for information may be addressed directly to:
Marketing and Sales Unit,
International Atomic Energy Agency,
Vienna International Centre,
PO Box 100, 1400 Vienna, Austria.
Telephone: +43 1 2600 22529 (or 22530);
Facsimile: +43 1 2600 29302;
E-mail: sales.publications@iaea.org

CD-ROMs

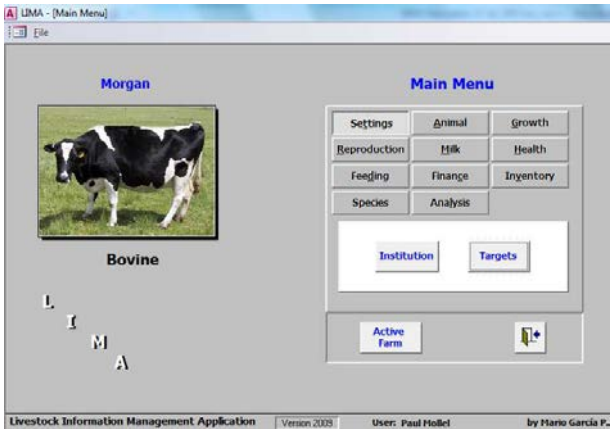
A CD-ROM is available dealing with training material for the diagnosis of rinderpest and for the preparation for the OIE pathway. It was produced under an IAEA Technical Cooperation project RAF/0/013 ICT based training to strengthen LDC capacity. Contact Gerrit Viljoen at g.j.viljoen@iaea.org for further information.

Database applications

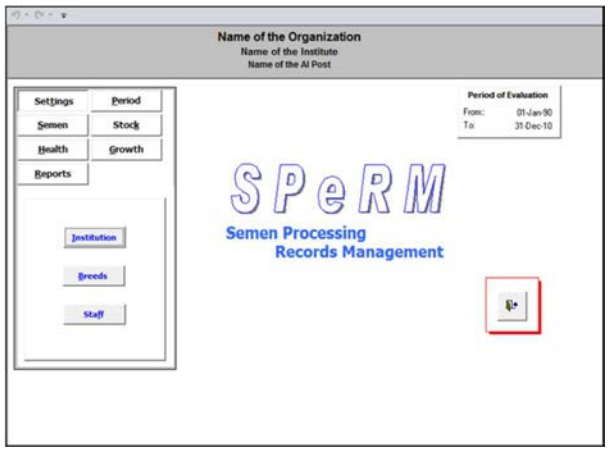
Four computer database applications to monitor livestock reproductive performance can be downloaded (software and manuals) from the IAEA ftp server ftp://ftp.iaea.org/pub/NAFA/APH/Mario/Databases/
These applications were developed through the implementation of various regional TC projects and have been updated several times, especially LIMA and SPeRM thanks to the suggestions and recommendations of the database users. All are available in English for downloading but LIMA can also be available in Spanish. French versions for LIMA and SPeRM are under preparation. It is recommended to contact Mario Garcia (M.Garcia-Podesta@iaea.org; mggarciap@gmail.com) before installing the application for advice.

Livestock Information Management Application (LIMA)

LIMA is a computer application to store and analyse a full range of information from livestock farms. LIMA is suitable for six livestock species, i.e. bovine, bubaline, ovine, caprine, and South American camelids (alpacas and llamas) and is available in English and Spanish. The application contains convenient and easy-to-use data entry forms for the identification of the animal, productive records (body weight, milk yield, wool and fibre production), reproductive parameters (heats, services, parturitions), health data (individual cases and collective preventive treatment), and economical information (farm income and expenses). Moreover, there is a wide collection of predefined reports for the analysis of the data, and facilities for data verification and export.

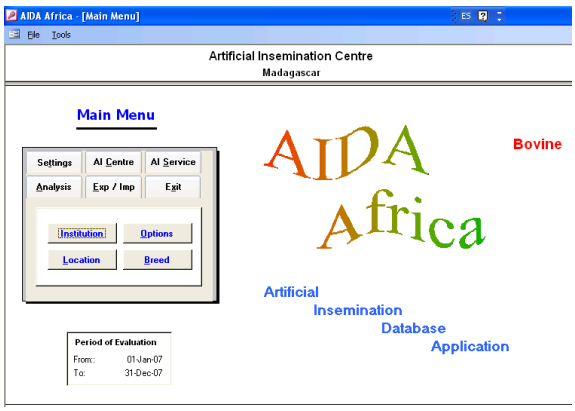


Semen Processing Records Management (SPeRM)



SPeRM is a computer application to store and analyse information from sires (bulls, bucks, and rams) that are used in semen processing or artificial insemination (AI) centres.

Artificial Insemination Database Application (AIDA Asia) / (AIDA Africa)



AIDA-Asia and AIDA-Africa are computer applications to store and analyse information from AI services (farms, females inseminated, semen, estrus characteristics, inseminator and pregnancy diagnosis data). Field data

can be complemented with progesterone radioimmunoas-radioimmunoassay data from milk or blood samples collected at four key times during artificial insemination service and the oestrous cycle. Both applications are very similar; however, AIDA-Africa has two levels of data entry as compared to three levels for AIDA-Asia, due to the more complex structure of AI in most Asian countries.

Information on new FAO titles:

To be regularly informed about new FAO titles, subscribe to FAO-Bookinfo, the free electronic newsletter from the FAO Sales and Marketing Group. Please send an email to mailserv@mailserv.fao.org, leave the subject blank and then put in the first line of the message the following: Subscribe FAO-Bookinfo-L.

REQUEST FOR COMPLETING A SURVEY FROM FAO: Towards Sustainable Animal Diets

Dear colleagues,
Livestock products provide 13% of all dietary energy and 28% of all dietary proteins worldwide and livestock contributes to the livelihood of one billion people as a source of income, food, traction, wool, manure, biogas. Animal feeding has an impact on the environment, the use of water and land, animal production, health and welfare, food safety and quality and animal welfare. *Can we move towards "Sustainable animal diets"?* Your opinion matters! We hope you can find the time to complete a survey on this topic. It will take you about 20 minutes to complete. We will analyse the results starting from 10 August 2013.

English questionnaire: https://www.surveymonkey.com/s/WNTFTZD

Each participant will receive a report of the survey analysis and a CD-ROM containing FAO publications in the area of feeding, feed and feed safety and other FAO flagship publications.

French Questionnaire en Français: https://fr.surveymonkey.com/s/YGDJ8WW
Español Cuestionario Español:https://es.surveymonkey.com/s/Y3XQ5DB

Impressum

Animal Production and Health Newsletter No. 58

The APH Newsletter is prepared twice per year by the Animal Production and Health Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture and FAO/IAEA Agriculture & Biotechnology Laboratory, Seibersdorf.

International Atomic Energy Agency
Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Printed by the IAEA in Austria, August 2013

13-23581