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Nomadic herder with his cattle in Sudan.

To Our Readers

Dear Colleagues,

We are already into the second half of this year and the end of the year is looming. The first six months of this year have been a busy time for all personnel in the subprogramme as we progressively moved forward to increase our actions on the control of transboundary animal diseases and those of zoonotic nature. It is hoped that our inputs will serve the best interests of our Member States.

In response to many requests from our readers, I will continue to highlight a practical topic related to animal production and health in this section of the newsletter. Increasing the efficiency of animal reproduction is a critical component of a holistic approach to sustainably increase animal productivity in developing Member States. For example, the resources spent to formulate and obtain the ingredients for dairy rations are wasted when a significant proportion of the cows in the herd are dry due to delays in achieving pregnancy. Effective genetic selection to improve productivity is only possible if a regular supply of potential replacements is generated by the females already in the herd or flock. For this reason, improving reproductive efficiency is a key aspect of many of the APH projects.

IAEA International Atomic Energy Agency

The challenges faced by Member States in the field of animal reproduction can generally be divided into three categories

- Application and optimization of currently available procedures for improving female fertility,
- Adaptation and use of biotechnologies for increasing reproductive rates, and
- Identifying new reproductive technologies and incorporating them into animal production systems.

Exciting developments are occurring in all three of these areas, and will undoubtedly play a role in future APH activities. Although it cannot be viewed as a substitute for good nutrition, diligent heat detection, and the husbandry of breeds sufficiently adapted to the environment and production system, the use of hormones for reproductive management has become a valuable tool for farmers. Numerous protocols for strategic administration of prostaglandins, progesterone, and other hormones have been developed and used to synchronize oestrus and treat anoestrus in cattle. The use of these strategies has been particularly beneficial for smallholder dairy farmers. With only a few cows generating income, these farmers can ill afford to allow any of them remain dry and unproductive, so short calving intervals are important. In addition, the typical cut-and-carry systems in which cows remained tied all day decrease the opportunities for expression and subsequent detection of oestrus.

Ultrasonic scanning has played a major role the development of these treatment protocols and in general management of reproduction. Many Member States are now adopting the use of ultrasound, largely to complement technologies such as radioimmunoassay and ELISA for diagnosis of anoestrus and non-pregnancy. Because of the intimate tie between nutrition and breeding with reproduction, developments in these fields will also likely influence livestock reproduction.

Industrialized countries, which provide a large proportion of the germplasm for dairy cattle in developing Member States, have recently started considering female reproduction traits in their dairy breeding programmes. Although this practice is unlikely to result in big improvements in female fertility, due to the relatively low heritability and selection emphasis, at least it may slow the continual decline that has been seen over time. Because of the limited and irregular feed supplies faced in many Member States, research is being undertaken in matching feeding with the reproductive status of the female and observing the effects on her productivity and that of her offspring.

Artificial insemination is the reproductive biotechnology most commonly used in Member States. Although this technique is well established, further improvements in semen storage could be of great benefit in developing Member States, where costs to purchase liquid nitrogen can be up to 100 times greater than in industrialized countries. Purchasing of a dedicated production plant can be an option for AI centres, but gathering the initial capital is problematic. Some centres have bought plants, which have since broken down, and funds are not available for repair. The use of chilled- or room-temperature semen is an alternative, but the shorter shelf-life limits the geographic area of distribution. Freeze drying seems to hold promise for semen preservation, but has so far only been successfully demonstrated in mice. Sexing of semen would also be a particularly useful extension to AI, especially in Member States where religious beliefs prohibit the consumption of beef. The bulls born in these countries are typically neglected and represent a huge waste in resources, as well as a compromise to animal welfare.

Many of the Member State with operational AI centres are now showing interest in obtaining the capacity in multiple ovulation and performing embryo transfer (MOET) to increase the reproductive rate of females. By using MOET one can increase the number of offspring from genetically superior females. However, at the moment, few of these countries have the animal evaluation systems necessary to accurately identify the females that are truly genetically superior in place. Without this ability, MOET will only contribute to decreasing genetic variability. One immediate application for MOET can be seen, however. Many Member States have rare breeds that are in danger of extinction and MOET could be used to increase population sizes or contribute embryos for cryopreservation in genebanks. MOET could also help decrease generation interval in nucleus herds, which some Member States are now creating.

Embryo transfer following oocyte collection and in vitro fertilization (IVF) could hold more promise for increasing productivity than MOET. Some scientists have proposed that oocytes could be collected from culled dairy cows in industrialized countries, shipped to developing Member States, fertilized in vitro from bulls of indigenous breeds, and transferred into local recipients. Alternatively, oocytes from local females and exotic males could be used. Such a plan has several intriguing aspects. First, it would ensure a continual supply of F_1 crossbred females, taking maximum advantage of heterosis. Second, it would provide an incentive to maintain pure local breeds. Finally, the oocytes could theoretically be obtained at a relatively low cost. More research would be needed to make this a reality, however, to develop optimal embryo culture media and protocols and to test the financial feasibility.

With regard to future technologies, one technique that may be especially valuable in developing Member States is male germ cell transplantation. In this procedure, spermatogenic cells are transferred from one male to another, where they colonize the testes of the recipient. If repeated, the genes of one male can be dispersed at an

increased rate, through a type of 'natural' AI. Using this approach, superior genetics can be transferred into areas that cannot be easily served by existing AI centres. The need for heat detection can be reduced as well, if the male is in regular contact with the females. Finally, genomics are likely to have a continually bigger impact on reproduction as time passes. Already, a number of candidate genes affecting reproductive rate are known and some, such as the Fec-B gene in sheep, are being targeted in marker-assisted introgression programmes. International sequencing and genome analysis projects are yielding more and more information about genetic polymorphisms and will soon be followed by association studies to identify the genes making the largest contribution to genetic variability in reproduction. This work will be complemented by functional genomic studies, which will provide us with more knowledge about the biology of reproduction, which will aid in the development of new protocols for management of animal fertility. Thus, the future holds both promise and challenges in the area of animal reproduction and the APH will assist its Member States in identifying, developing and adapting the biotechnologies that can contribute to sustainable intensification of livestock production systems.

Both past and future activities are described in further detail in this newsletter and are also accessible at our website (http://www.iaea.org/programmes/nafa/d3/index.html).
Please contact us if you have any further 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.Schellander@iaea.org, to ensure that the next copy of our newsletter will be received. We will also be able to widen our network if the addresses of unsubscribed colleagues are sent to us. 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 would allow a better positioning of our Member States with respect to international trade and other livestock-related issues. In turn, this would promote improved quality assurance of animal husbandry and health practices, and also lead to a greater autonomy for Member States.

In our news from the subprogramme, we want to mention the two avian influenza molecular diagnostic training courses scheduled for the second part of this year – please see our newsletter and website for more information. Last but not least, I want to welcome Reem Kapatais, as administrative support staff to the subprogramme. She has joined us in February and will hopefully stay with us until the end of September 2007, when Svetlana Piedra Cordero, will rejoin us after her maternity leave. We want to wish her a pleasant time in the subprogramme.

Gerrit Viljoen,
Head, Animal Production and Health Section

Staff

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

Forthcoming Events

Regional Training Course on the Diagnosis of Avian Influenza for Africa

Technical Officers: Gerrit Viljoen/Adama Diallo

A TC Regional training course on Molecular Techniques for the Diagnosis of Avian Influenza will be held from 26 August to 6 September 2006 in Egypt.

This training course is sponsored by IAEA and FAO for participants from Africa. Its ultimate goal is to contribute to the early detection and early reaction capabilities in Member States. It will be an intensive course which includes lectures on the epidemiology of highly pathogenic avian influenza, molecular technologies for the diagnosis of avian influenza and practical aspects for RT-PCR, RT-Realtime PCR and gene sequencing and typing of Avian Influenza virus for rapid characterization of the pathogen.

Consultants Meeting on Foot and Mouth Disease (FMD) Research Being Undertaken

Technical Officer: John Crowther

The consultants meeting on FMD research currently undertaken will be held in Vienna Austria in October 2007.

The objective of this meeting is to ensure that research conducted under various programmes on FMD are coordinated and built on each other to avoid duplication and competition and to ensure the maximum use of available resources as well as the identification of additional resources needed to realistically achieve the research outcomes needed for control and eventual eradication. A key process will be the identification of research gaps.

Second RCM of the CRP on Gene-based Technologies in Livestock Breeding: Characterization of Small Ruminant Resources in Asia (D3.10.25)

Technical Officer: Paul Boettcher

This Research Coordination Meeting (RCM) will take place from 29 October to 2 November 2007 at the Huazhong Agriculture University, Wuhan, China.

The purpose of the Research Coordination Meeting is to review the progress achieved by the Research Contract holders since the last Research Coordination Meeting and plan and agree on the research programme for the following year's activities. The phenotypic and molecular characterization will be completed prior to the meeting, so a major topic for discussion at the meeting will be the analysis and interpretation of the data and preparation of publications.

Regional Training Course on the Diagnosis of Avian Influenza for Asia

Technical Officers: Gerrit Viljoen/ Adama Diallo

A TC Regional training course on Molecular Techniques for the Diagnosis of Avian Influenza will be held in November 2007.

This training course is sponsored by IAEA and FAO for participants from Asia. Its ultimate goal is to contribute to the early detection and early reaction capabilities in Member States. It will be an intensive course which includes lectures on the epidemiology of highly pathogenic avian influenza, molecular technologies for the diagnosis of avian influenza and practical aspects for RT-PCR, RT-Realtime PCR and gene sequencing and typing of Avian Influenza virus for rapid characterization of the pathogen.

Announcements from Member States

13th Symposium of the World Association of Veterinary Laboratory Diagnosticians (WAVLD) 2007: Preparing for the Animal Health Challenges of the Future

The Symposium will be held from 11 to 14 November 2007 Melbourne Australia and will feature presentations, papers and posters on

1. The global risks and challenges from new and emerging diseases including zoonotics as well as transboundary animal diseases, avian influenza, foot and mouth disease, classical swine fever;
2. Preparing for the future laboratory issues involving biosecurity, bio-safety, new technologies, quality assurance and data management; and
3. An OIE Biotechnology Symposium on the application of new technologies to veterinary pathology including in-sit-hybridization, remote imaging, confocal microscopy, digitalization and in-situ-PCR/pathogen localization.

More information: www.wavld2007.com

The PRINT-Training Programme in Animal Health and Animal Production

The Promotion of Regional Integration (PRINT) in the Southern African Development Community (SADC) Livestock Sector livestock project is funded by the European Union's 9th European Development Fund and implemented in conjunction with the Food, Agriculture and Natural Resources Directorate (FANR) of the SADC. The PRINT livestock project is designed to support the Regional Indicative Strategic Development Plan (RISDP) of SADC and more specifically its policy of regional livestock sector integration and sustainable livestock production. Its main objective is to support increased productivity and trade flows in the SADC livestock sector. In order to achieve this objective, three intervention tools are being implemented, i.e. (i) the establishment of a Livestock Information Management System, (ii) the implementation of regional and national studies, and (iii) a training programme that will build capacity to support improved collection of quality data in animal health and production.

More information can be received from the website:
http://web.up.ac.za/default.asp?ipkCategoryID=265
"click" - "Academic Courses"
"click" - "PRINT

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Past Events

Second RCM of the CRP on the Veterinary Surveillance of Rift Valley Fever (D3.20.23)

Technical Officer: G. Viljoen

This RCM was held from 5 to 9 March 2007 in Nairobi, Kenya.

The CRP focuses on improving the serological and molecular diagnostic capacities of Member States, with reference to Rift Valley Fever (RVF). This will be achieved by evaluating, validating and standardizing existing and newly developed serological tests for the surveillance of RVF and by introducing and transferring suitable molecular, as well as isotopic technologies, for virus detection and characterization. Genomic and genetic techniques will allow for rapid and early virus detection and genetic typing, without the risks of accidental laboratory infection. This should enable participants of the CRP to develop, and/or use, harmonized protocols and procedures, and also to exchange their research data and findings. The implementation of validated serological techniques (for example ELISA) will help to determine the RVF sero-prevalence and/or conversion status of individual animals and herds; while the molecular techniques will assist in the rapid and early detection of the virus to enable the timely implementation of quarantine and control measures, including the differentiation between vaccine and field strains.

The recent outbreak of Rift Valley fever in Kenya, where about 1% of humans infected with the disease (i.e. more than 100 people) died since December 2006, highlights the timeliness and importance of the IAEA's CRP and indeed the RCM. The meeting was attended by both the veterinary and human diagnostic institutions in Kenya, who both made presentations. The group reported on their progress with respect to the development, evaluation and validation of serological and molecular diagnostic tests and the timeframes of activities for the next CRP year were defined. Two indirect RVF whole virus ELISA formats were validated; a recombinant nucleocapsid ELISA and dip-stick was developed and two real-time molecular diagnostic tests (real-time PCR and an isothermic LAMP) were developed and evaluated. Their implementation within the CRP was discussed and endorsed. The continuation of the CRP was supported by both the CRP group and other institutions attending.

Conclusions

1. The economic impact of the current outbreak of RVF, and its implications to humans and animal trade has shown the importance of effective surveillance as an early warning tool.
2. The participating countries in the CRP all reported activity of RVF, with an outbreak of the disease in Kenya.
3. Not all RVF activity was associated with outbreaks and the epidemiology of the disease is poorly understood.
4. The current tests have been assessed and their fitness for purpose defined. This has clearly identified the limitations and thus the need for new diagnostic platforms.

5. The current vaccine is unsafe and confuses the serology in the wake of an outbreak, therefore all efforts should be supported to have new vaccines available (e.g. clone 13, R566).
6. There is a need for reference material and epidemiological database.

Recommendations

1. All affected countries need to increase their surveillance programmes. This should be based on a statistical sampling frame (similar to the Rinderpest model).
2. Efforts are needed to increase and assure better quality reporting to WHO and OIE.
3. Collaboration between veterinary, medical and wildlife sectors should be encouraged to elucidate the interphase between human, cattle, sheep, wildlife and insects.
4. Indirect ELISA, Inhibition ELISA and Sandwich ELISA have limitations as diagnostic tools and validation of the recombinant nucleo-capsid platforms is encouraged. This validation is seen as a two step process. This should receive the highest priority since it will have the highest international impact.
5. The registration of safe RVF vaccines such as clone 13 and R566 should be done in a timely, but urgent, fashion and made available to control the disease. Future investigations into 'differentiating infected from vaccinated animal' (DIVA) should be encouraged.
6. Accredited quality assured reference material is needed to harmonize laboratory proficiency in different countries; this is paramount for epidemiological understanding and control of the disease. In addition laboratory capacity should be increased.
7. There is need for sharing of scientific data to facilitate exchange of information and epidemiological modelling. This is a critical step in understanding the current disease situation.
8. Collaboration with the existing FAO database should be investigated.

Regional Training Course on Participatory Approaches (RAF/5/054)

Technical Officer: Paul Boettcher

This training course was held from 18 to 22 March in Khartoum, Sudan. The event was hosted by the Department of Radioisotopes of the Central Veterinary Research Laboratory, with Dr. Yousif Elmansoury serving as the local organizer. The course was attended by 17 foreign and 7 local participants. Dr. Francis Lelo of the Egerton University in Kenya and Mr. Henri Bayemi of the Institut de recherche agricole pour le développement (IRAD) in Cameroon were the instructors. The course addressed the theoretical background and practical tools associated with using participatory methods to interact with stakeholders in designing and implementing agricultural development activities. As part of project RAF5054, scientists are expected to identify and prioritize the major constraints to improving animal productivity and apply interventions to alleviate the constraints. The Participatory Rural Appraisal and Economic Opportunity Survey were presented as approaches to accomplish these objectives. These two tools have been successfully applied in the CRP on Peri-urban Dairy Production (D3.10.23). Instruction on other tools developed for that CRP, the LIMA database and partial budgeting, for organization of data and economic analysis of interventions, respectively was also given. The course included a field trip to a local farming village, where participants were allowed to apply the training received.

First RCM of the CRP on the Early and Rapid Diagnosis of Transboundary Animal Diseases: Phase I - Avian Influenza

Technical Officer: J. Crowther

The first RCM took place from 19 to 23 March 2007 at the VIC, Vienna.

The first RCM brought together Research Contract and Agreement holders as well as observers from International organizations and commercial companies. A major theme of the meeting was to devise work plans that address the validation of tests. The "fitness for purpose" has to be worked out before there is exploitation of a technology. When examining the efficacy of a new technology, strong consideration should be given to the advantages over existing tests. One advantage of the CRP system is that people from a large number of countries are brought together and a network is established so that samples and conditions needed for evaluation of a test represent a wider range than would be expected from most interactions between developers and outside laboratories. The process of examining how far a test matches its perceived fitness for purpose, in a wide a range of scenarios, under controlled conditions, is the process of test validation. At the end of such an exercise, the data produced, is analysed statistically, and defines the performance of a test. This can then be assessed by outside parties and possibly be used by them to help solve problems. Along with the examination of new technologies it is vital to examine performance against existing tests, another role determined for the CRP.

Research Contract holders gave country reports highlighting what they were doing concerning the control of AI. Power Point presentations are shown in individual files. The expert, observers and commercial companies also participated in discussions and most made presentations. Discussions ranged from defensive measures

being taken by countries as yet unaffected; to countries where there was active AI infection. Surveillance was discussed whether purposive or passive. There was believed to be a need to re-examine the criteria behind both measures in terms of statistical design. The problems of public awareness were illustrated whereby campaigns to educate the public resulted in swamping laboratories with wild birds killed by any means, road kills etc., and the capacity for testing was questioned in some laboratories. The specificity of tests to discriminate between AI isolates was discussed down to the highly pathogenic level. The use of dip stick technologies was discussed.

Emphasis was placed on fitness for purpose of any systems, including those currently used and it was felt that there was poor validation data for most tests used and on the market. The use of devices in the field and potential to instantly both perform a test and report it was discussed. The feasibility of this has been greatly increased through the development of machines able to extract and process a sample through a thermocycling PCR as a single operation. Of most interest was the device shown by DxNA Company. The use of LAMP PCR was also thought to be important to offer flexibility to detection systems.

Possible advantages of modern technologies in the field

The use of field or pen side devices was debated both before and during the meeting. Press releases indicating a device capable of processing and analyzing a sample in the field and instantly reporting results caused great interest. Some factors are

1. Simplicity of use by relatively unskilled workers.
2. Fool proof methods, almost independent of operator bias (error).
3. Rapid results (minutes, instead of days).
4. Possibility of sample processing and analysis in single operative procedure.
5. Instant submission of data from a test to a 'remote' data base (epidemiological unit).
6. A large increase in the scope of diagnosis through measurement of more disease agents or evidence of their activity (e.g. antibodies) through multiplexing.
7. Enabling field staff to have instant results.
8. High capacity for testing (more relevant to the laboratory).

Conclusions

1. The DxNA machine as applied to testing for AI should be further investigated.
2. Specific primer sets to allow identification of AI as well as discrimination from Newcastle Disease Virus (NDV) in the DxNA machine were agreed.
3. It was agreed that the DxNA Company would produce defined modules (cassette for machine with specific primers for AI.
4. It was agreed that the modules and machines would be provided to S. Belak, Sweden (2), S. Hietala USA (1) and J. Hammond (1) so that they could rapidly verify the efficacy of the primers as well as test the machine-product claims.
5. It was agreed that this process should be finalized by the end of August, 2007.
6. The funding of the first phase in validation (testing by laboratories above) was discussed and a figure of $50 000 was required. Subsequently, a technical contract was awarded to DxDNA to produce the primer modules and provide machines for the first phase validation in the reference laboratories named above).
7. It was hoped that Research Contact holders could receive machines and modules as soon after August 2007 as possible, to obtain validation data comparing the performance of the DxDNA machine and modules with stored and fresh samples as well as taking the machine to the field. The methods to be used will be discussed with technical officers before active work begins on this.
8. It was stressed that the ability of the machine to send data directly to a central collation point would be an enormous advantage in certain scenarios for rapid response to diseases. It was agreed that the necessary adaptation could be made easily, but that discussion as to the exact nature and form of the communication peculiar to different national regulations was needed.
9. The LAMP system for AI diagnosis will be developed and primers selected. A machine is to be tested and further developed through the IAEA that can read the reaction (turbidometric) of the PCR in the LAMPCR and transmit data in real time. The Netherlands laboratory agreed to make the necessary adaptations.

The meeting brought together a diverse range of interested parties as well as eliciting great media interest. A considerable amount of cross fertilization of technologies was made through contacts which may well lead to improve the end users ability to diagnose disease. One golden aim; that of being able to process and test a sample in a single process as well as transmit the result in real time breaks down the often painfully slow process between the field, the laboratory and action. The CRP will take a leading role in justifying the claims of the machine as well as developing the process for disease reporting. It is hoped and expected that the systems deployed will work and that within the next year a fully functional direct test and data transmission system will be in place for AI. Such systems are adaptable to any livestock disease so that they should be of great appeal to countries with the need for constant surveillance against foreign diseases where a rapid response is needed. The biggest drawback in identifying disease and action is the reporting of an incident and sending of samples for confirmatory laboratory work.

Participants:

Research Contract and Agreement holders:

Mr Li Gang, China , Mr Nguyen Tien Dzung Vietnam, Mr Boussini Hiver, Burkina Faso , Mr Couacy-Hymann Emmanuel, Côte d'Ivoire, Ms Elnur Abdel Rahman,

Sudan, Mr Maikano Issoufou, Niger, Mr Awuni Joseph Adongo, Ghana, Ms Hietala Sharon, USA, Mr Belak Sandor, Sweden, Mr Kooi Bart, Netherlands
Other participants
Mr Hammond Jeff, CSIRO, Australia, Mr Gradinaru Dragos, Dragos GRADINARU France, Mr Janulaitis Arvydas, FERMENTAS UAB, Lithuania, Mr Rosenfeld Mark, DxNA, USA, Mr Bickmore William, DxNA, USA, Mr Kucharczyk Krzysztof , Kucharczyk T.E. Spzoo, Poland, Mr Leiser Robert-Matthias, nexttec GmbH, Germany, Mr Rebeski Dierk, Lohmann Animal Health GmbH & Co. KG, Germany, Mr Merza Malik, SVANOVA, Sweden, Mr Harder Tim, Friedrich-Loeffler-Institut, Germany
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Training Course in Molecular Methods in Fasciola Diagnosis (SUD5028)

Technical Officer: Hermann Unger
This training course took place from 23 March to 4 April 2007 in Khartoum, Sudan.

Fasciolosis and schistosomiasis are major constraints on animal productivity in Sudan. In addition, schistosomiasis causes serious disease and morbidity in humans. Under the umbrella of a Technical Cooperation Project on snail borne diseases a national training course was held to train 21 researchers and technicians in all aspects of both diseases including practical work as the application of different ELISA's in the quantitative detection of fasciolosis in feces and western blotting for protein identification. Two experts from Canada (Prof Spithill) and Australia (Prof. Piedravita) and seven national experts lectured on epidemiology and prevalence, standard diagnostic techniques and development of new tests. A major focus was on the immunology of these diseases and in this respect the development of vaccines. Dr. Ibtisam Goreish, head of the project, will now initiate field studies on the prevalence of Fasciola gigantica in cattle using the copro-antigen ELISA and evaluate the quantitative correlation of ELISA titers with the egg counts in the feces. PCR will be used to study the prevalence of cercariae in snails and the infectivity rate of snails in different locations. To support this exercise, Dr. R. Grams, Thailand, agreed to evaluate the applicability of an isothermic PCR in order to allow these examinations in the field. Later this year Dr. Goreish will visit Prof Spithill's laboratory and work on the production of expression antigens derived from Fasciola. These will be used in 2008 in vaccination trials in Sudan to define protection levels. Such a vaccine, reducing the parasite load in animals by a high percentage, would improve animal health and at the same time reduce the number of infected snails and the risk re-infection. Finally the production of the potential vaccine should be transferred to the central veterinary laboratory in. Khartoum.

Training Course on the Molecular Characterization of Small Ruminant Breeds

Technical Officer: Massoud Malek
A Specialized Training Course jointly organized by ICARDA/ILRI in ICARDA campus, Aleppo, Syrian Arab Republic, from 1 to 12 April 2007.
Trained personnel are the key element for the successful handling of biotechnological tools. ICARDA/ILRI/FAO-IAEA jointly offered this short-term training course. The course was attended by 16 participants from local and CWANA regions. This course aimed to build capacity in developing countries in Asia to use modern molecular methods and bioinformatics to characterize and use the available genetic advantages in indigenous small ruminants, enabling optimum management of these natural resources. It developed methodologies, generate information and formulate decision support systems for defining phenotypic and molecular genetic diversity, using microsatellite DNA marker and related technologies, and enable the development and implementation of national, international and regional strategies for optimum use, improvement and conservation of small ruminant genetic resource in Asia.
Many studies have now shown that considerable genetic biodiversity exists in small ruminants in developing countries, much of which controls advantageous traits influencing adaptability to harsh environments, productivity or disease resistance. However, these indigenous genetic resources are underutilized in conventional breeding programmes due to a failure to identify animals carrying the most advantageous traits and/or alleles. Mapping of quantitative trait loci (QTL) and genes controlling such traits, and subsequent use of this information in selection and breeding programmes, could provide considerable gains in productivity. The course was designed to enhance knowledge and provide practical training on current molecular marker techniques and experimental design in small ruminant genetics and breeding, focusing on the characterization of small ruminant biodiversity and application of marker assisted selection in breeding programmes.
Aims of this course were to

- Introduce participants to theoretical aspects of using DNA molecular marker techniques
- Provide practical experience in DNA marker technologies especially microsatellites (SSR) markers genotyping and analysis
- Introduction to other DNA techniques (DNA sequencing, SNP genotyping etc.)

- Introduction to functional genomics (variation in gene expressions) and populations genomics for the identification of functional and neutral variations
- Introduction to the application of genetic markers for genes identification, breeding improvement and conservation genetics

The course included classroom lectures and hands-on practical training in ICARDA's biotechnology laboratories. The lectures were given in English. Intensive theoretical and practice components were included in the training course such as a manual, A Practical Approach to Microsatellite Genotyping with Special Reference to Livestock Population Genetics".

Second RCM of the CRP on the Development and Use for Rumen Molecular Techniques for Predicting and enhancing Livestock Productivity and Training Workshop (D3.10.24)

Technical Officer: Paul Boettcher

The RCM was held from 19 to 21 April 2007, followed by a training workshop from 23 to 28 April at the Department of Animal Sciences at the University of Illinois Urbana-Champaign. Most of the participants also attended the Conference on Gastrointestinal Function, which was held in Chicago from April 16 to 18.

Research Coordination Meeting

The meeting was attended by seven of eight Research Contract holders (RCH), two research associates, five Research Agreement holders (RAH), two Technical Contract holders (TCH), and Harinder Makkar, a former Technical Officer who served as an IAEA consultant. The meeting included presentations by all RCH, updating the status of their work. In addition, the RAH and TCH presented lectures on topics related to the CRP. These presentations were followed by discussions of workplans for the continuation of the project. The following conclusions and recommendations were drawn up as a result of the discussion:

1. The project is making good progress. Six of the eight RCH have achieved all the main goals of the project in terms of developing and applying an in vivo system of measuring methane production, applying real-time PCR to enumerate rumen microbes and integrating these methodologies to evaluate plants and plant-based products for antimethanogenic compounds.
2. More than 200 plants and plant extracts and continue to screen new plants for antimethanogenic activity.
3. The use of coconut oil for decreasing methane production in vivo was investigated by six groups, with variable results. Four groups showed lower methane production on addition of 7.5% coconut oil in the diet while two groups observed adverse effects on intake and health of animals. The reason for this was not clear, but was attributed to different sources and quality of coconut oil.
4. A ring test for evaluating real-time PCR technology to quantify specific functional groups in the rumen was conducted. The analysis of relative population size of several microbial groups yielded similar results from all RCH. Accuracy and precision will be improved by the RCHs by implementing quality control systems within their respective laboratories.
5. There has been continued interaction among the RCH and Agreement holders, including visits and staff transfers. This interaction between the partners has been of benefit to all partners.
6. The RCHs have undertaken only limited work on the effect of conventional supplementation strategies on methane production, and will seek to obtain this information from published literature.
7. This project offers an excellent platform to investigate rumen microbial biogeography. In order to achieve this it was suggested to organize a microbial biodiversity workshop, for which Agreement holders will try to raise funds.
8. The RCHs are screening plants available in their respective countries for antimethanogenic compounds and enhancing livestock productivity, and hence the work could be exploited commercially.
9. Given the technical difficulty of the methods, the RCHs are to be congratulated; it is pleasing that the majority of the RCHs have now established the technical capabilities necessary to both quantify microbial numbers by real-time PCR and measured methane production in vivo.

Training Workshop

The purpose of this workshop was to train the participants in molecular and numerical techniques in microbial community analysis. The workshop was designed to provide participants with research tools and not simply a set of protocols to be followed. Therefore, the curriculum covered the entire process of microbial community analysis, from experimental design to sample collection, sample processing, and numerical analysis. The workshop included: 1) 'hands-on' sessions to teach technique; 2) lectures and demonstrations illustrating troubleshooting, customization, and examples of application; 3) discussions about issues specific to the participants' research; 4) tours of some of the University of Illinois biotechnology facilities; and 5) seminars by guest lecturers working in the fields of microbial research and climate change. The laboratory manual provided participants with a diverse collection of resources that included methodological protocols, "do-it-yourself" troubleshooting guides, excerpts from the manuals of demonstrated software, tutorials, and reprints of original research articles and reviews that introduce, apply, or discuss the focal techniques.

The foci of the workshop were two PCR-based microbial community fingerprinting techniques, denaturing gradient gel electrophoresis (DGGE) and terminal restriction fragment length polymorphism (T-RFLP).

The acquisition and analysis of DGGE/T-RFLP data were also principal topics. The relative merits and weaknesses of each of these methods were discussed, but participants were left to determine for themselves the suitability of each for their own research programmes. Participants simultaneously carried out both DGGE and T-RFLP procedures. Eubacterial and Archaeal small subunit ribosomal RNA genes were the targets for each approach. Participants set up the PCR reactions for DGGE and T-RFLP, and they evaluated the PCR results by electrophoresis on an agarose gel.
Using the data generated by the DGGE and T-RFLP conducted during the workshop, participants were introduced to multivariate data analyses and trained to use cost-free software available on the internet.

In addition to training participants in the procedures directly related to DGGE/T-RFLP data generation and analysis, the workshop exposed the participants to a variety of related topics in microbial community research and discussed how these approaches could be applied to the participants' research. Laboratory and computer-based demonstrations were given to introduce the participants to: 1) RNA extraction and reverse-transcriptase PCR; 2) cultivation of anaerobic microorganisms; 3) mining online databases for DNA sequences; 4) examination and evaluation of DNA sequencing chromatograms; and 5) alignment of DNA sequences for primer design.
Participants toured University of Illinois facilities devoted to high-throughput clone library construction, DNA sequencing, microarray fabrication and analysis, and proteomics. Finally, participants had the opportunity to hear several guest speakers deliver lectures on relevant topics such as metagenomic approaches to rumen microbial communities, multilevel microbial research from the genome to the phenotype, and the science, economics, and politics of global climate change.
The participants displayed a high level of enthusiasm and understanding of the subject matter, suggesting that the workshop was successful in presenting the techniques as part of a useful research framework that the participants will adapt, refine, and ultimately share with their colleagues.

Ongoing Activities

Education to Improve the Quality of Research in Developing Countries

Technical Officer: John Crowther

The site which holds the education package under development can be visited under URL: researcher-training.org.

Coordinated Research Projects

Integrated Approach for Improving Small-scale Market Oriented Dairy Systems (D3.10.23)

Technical Officer: Paul Boettcher

The primary activities of this CRP have been completed. The final RCM was held in Edinburgh, UK, from 4 to 8 December 2006. The participants, comprising ten Research Contracts, one Technical Contract and four Research Agreements are undertaking the final analyses of data regarding the costs and benefits of interventions applied. Most of the interventions applied were found to be economically beneficial. Final reports will be prepared for publishing in a special issue of a scientific journal. In addition, the participants are developing and applying approaches to help ensure that the various interventions will be continued, without the financial support provided by the project. Several counterparts have already created associations of farmers and veterinarians to carry-on with the most successful interventions of the project.

Development and Use of Rumen Molecular Techniques for Predicting and Enhancing Productivity (D3.10.24)

Technical Officer: Paul Boettcher

There are currently eight Contract holders and five Agreement holders in this CRP. The second RCM was held from 19 to 21 April 2007 at the Department of Animal Sciences at the University of Illinois Urbana-Champaign (see details in 'Past Events' of this newsletter). The RCM also included a Training workshop on molecular and numerical techniques in microbial community analysis. The project is progressing as planned toward its objectives. Six of the eight RCH have developing and are applying an in vivo system of measuring methane production, enumerating rumen microbes and evaluating plants and plant-based products for anti-

methano-genic compounds. Several plant compounds have been identified that merit additional research.

Gene-based Technologies in Livestock Breeding: Phase 1: Characterization of Small Ruminant Genetic Resources in Asia (D3.10.25)

Technical Officer: Paul Boettcher

The nine counterparts participating in the project have sampled or will sample DNA from more than 2500 individuals from approximately 90 breeds of sheep and goats. The genotyping of goat breed has been completed. One of main activities foreseen for 2007 is genotyping of the sheep samples, which will be done at the Joint ILRI/CAAS animal molecular genetics laboratory in Beijing. Project counterparts have the option of sending a research associate for training and genotyping or simply sending the samples. A second activity that is currently being undertaken is phenotypic characterization of the breeds, which will be performed by the counterparts. In addition, the breeds are being genotyped for microsatellites on the Y-chromosome and mitochondrial d-loop. Kits for the analysis of these markers were developed by the IAEA Collaborating Centre in Animal Genomics and Bioinformatics in Brazil and distributed to each of the Research Contract holders. The IAEA Animal Production Unit in Seibersdorf is also developing protocols for evaluation of single nucleotide polymorphism in various candidate genes that may influence traits of economic importance in small ruminants. The results of all activities will be presented at the second RCM of the project, which will be held from 29 October to 2 November 2007 at the Huazhong Agriculture University, Wuhan, China.

Veterinary Surveillance of Rift Valley Fever (D3.20.23)

Technical Officer: Gerrit Viljoen

Rift valley fever (RVF) is a mosquito borne viral disease affecting both livestock and people. In animals it mainly causes abortions while humans show influenza like symptoms leading in a small percentage to death. The disease is endemic to Africa with sporadic major outbreaks following extreme humid conditions. In 2000, imported RVF infected cattle from Somalia caused an epidemic on the Arabian Peninsula resulting in the death of nearly 300 people and several thousand abortions in ruminants. This expansion in the epidemic area to the Arabian Peninsula raises the possibility of RVF spread to other parts of Asia and Europe, especially since RVF virus (RVFV) can be spread by a wide range of mosquito vectors.

The CRP focuses on improving the serological and molecular diagnostic capacities of Member States, with reference to Rift Valley Fever (RVF). This will be achieved by evaluating, validating and standardizing existing and newly developed serological tests for the surveillance of RVF and by introducing and transferring suitable molecular, as well as isotopic technologies, for virus detection and characterization. Genomic and genetic techniques will allow for rapid and early virus detection and genetic typing, without the risks of accidental laboratory infection. This should enable participants of the CRP to develop, and/or use, harmonized protocols and procedures, and also to exchange their research data and findings. The implementation of validated serological techniques (for example ELISA) will help to determine the RVF sero-prevalence and/or conversion status of individual animals and herds; while the molecular techniques will assist in the rapid and early detection of the virus to enable the timely implementation of quarantine and control measures, including the differentiation between vaccine and field strains.

The recent outbreak of Rift Valley fever in Kenya, where about 1% of humans infected with the disease (i.e. more than 100 people) have died since Dec 2006, highlights the timeliness and importance of the Agency's CRP and indeed the RCM. The meeting was attended by both the veterinary and human diagnostic institutions in Kenya who both made presentations. The group reported on their progress with respect to the development, evaluation and validation of serological and molecular diagnostic tests and the timeframes of activities for the next CRP year were defined. Two indirect RVF whole virus ELISA formats were validated; a recombinant nucleocapsid ELISA and dip-stick was developed and two real-time molecular diagnostic tests (real-time PCR and an isothermic LAMP) were developed and evaluated. Their implementation within the CRP was discussed and endorsed. The continuation of the CRP was supported by both the CRP group and other institutions attending.

Research Contract holders (C) and Agreement holders (A) are from research institutions in Burkina Faso (C), Guinea (C), Mali (C), Mauritania (C), Senegal (C), Kenya (C), Uganda (C), Yemen (C), Gambia (C), Congo (C) South Africa (A), Germany (A) and France (A).

The Control of Contagious Bovine Pleuro Pneumonia in Sub-Saharan Africa (D3.20.24)

Technical Officer: Hermann Unger

The CRP on control of CBPP in Africa has 10 Research Contract holders from Cote d'Ivoire, Zambia, Botswana, Uganda, Burkina Faso, United Republic of Tanzania, Namibia, Kenya, Zimbabwe, Cameroon and 2 Agreement holders from Switzerland and Austria. The first Research Coordination meeting took place from 30 October to 3 November in Windhoek, Namibia.

Zambia, Botswana and Zimbabwe unite to battle CBPP

Contagious Bovine Pleuropneumonia (CBPP) has been a problem in the Kazungula district of Zambia since an

outbreak in 1997 and has caused concern in the Southern Africa Development Community (SADC). Zambian officials recently updated the situation for participants during the Research Coordination Meeting for the CRP on Controlling CBPP, held in Windhoek in November 2006. The Kazungula district borders with Botswana and Zimbabwe, leaving these two countries at high risk of CBPP infection from Zambia. The Zambian government initiated a large-scale test and slaughter-out exercise with compensation to farmers in November 2006. The IAEA helped supported the exercise as part of the CRP, by sponsoring three Zimbabwean and two Botswanan veterinary laboratory and research officers to join the Zambian veterinary personnel. The CRP also contributed to training in diagnosis, by providing LppQ ELISA kits, LppQ intradermal test antigens and c-ELISA kits to the three countries and used this event for the evaluation of the tests. This Tri-state training exercise was undertaken from 20 to 28 November 2006 and the Zambian team continues with the exercise to date.

Proceedings of the test and slaughter out exercise

The Zambian department of Veterinary Services provided a mobile laboratory facility to Kazungula. Herds with a history of CBPP infection and those with some animals showing clinical signs were selected. All animals from selected herds were bled and serology was performed. Field post-mortems were carried out on animals showing typical clinical signs of CBPP. All serum samples were tested using the Complement Fixation Test (CFT), LppQ ELISA and c-ELISA. The CFT was used as the reference herd test.

In addition, the LppQ intradermal test was carried out in 10% of the animals in each of the selected herds. The positive animals were then sent for slaughter and post-mortem at abattoirs in Livingstone town. The accuracy in disease detection and confirmation of the 3 laboratory tests were compared to each other and to the post-mortem findings.

Test and Slaughter-out results: November 2006 to March 2007

A total of 3625 cattle tested positive by at least one of the 3 laboratory tests and were slaughtered during the above-mentioned reporting period. Among the animals that tested positive and were slaughtered, 76% had pathological lesions typical of CBPP and only 56% were detected by CFT, indicating that CFT sensitivity was very low. Data on the test results for the c-ELISA and LppQ ELISA were not statistically analysed during this period, but the results obtained from the LppQ intradermal test were not conclusive and further studies on the immunogenicity of this synthetic antigen are necessary.

Conclusion

The test and slaughter-out exercise is still going on. Although the disease is not yet controlled, SADC countries commend this Zambian-IAEA initiative to control CBPP in Kazungula. It is believed that once the exercise is over, the risk of CBPP spread in other SADC countries will be minimal. This exercise provided an opportunity for veterinary researchers, especially from Zimbabwe, to have a first time exposure to CBPP clinical signs and pathological lesions. This exercise also gave an opportunity for the laboratory personnel to use the three laboratory tests in the field and compare their sensitivities. The IAEA-CRP project succeeded in bringing veterinarians of the three countries work together towards CBPP control, which is a big step towards future regional cooperation in control of transboundary animal diseases.

The Early and Rapid Diagnosis of Transboundary Animal Diseases such as Avian Influenza (D3.20.25)

Technical Officer: John Crowther

The first Research Coordination Meeting was held in Vienna in March 2007. A report is in 'Past Events' in this newsletter.

African Swine Fever Technical Contract 11294 (D3.00.00)

Technical Officer: John Crowther

Indirect ELISA kits are still available from the Institut Sénégalais de Recherches Agricoles ISRA, Laboratoire National de l'Elevage et de Recherches Vétérinaires (LNERV), for the detection of antibodies against ASF. Each kit includes plates, tips and reagents for testing 2800 samples and costs US$ 2000. Applications for kits should be sent to the Senegal laboratory directly (Dr. Joseph Sarr; Josarr@refer.sn).

New Coordinated Research Projects

The Early and Sensitive Diagnosis and Control of Peste des Petits Ruminants (PPR)

Technical Officer: Adama Diallo

PPR is a highly contagious transboundary viral disease of small ruminants. Because of its high morbidity and mortality rates, which may be up to 80-90% in affected herds, PPR is the main constraint to sheep and goat productions in all areas where it is endemic. Because of its economic importance, PPR is in the list of animal diseases to be reported to the World Organisation for Animal health (OIE). It is also part of the FAO EMPRES programme. Currently, this disease is emerging in many countries in both Asia and Africa where it has progressed southward past the equator. Isolation of the causal agent, the PPR virus (PPRV), in cell culture might take a couple of weeks to complete if successful. Molecular and monoclonal antibody-based diagnostic tests have proved to be the most appropriate techniques for early and specific identification of PPRV. As a consequence of the numerous requests for support in PPR diagnosis it received in the last couple of years, the APH Subprogramme of the IAEA has developed a new CRP on PPR entitled The Early and Sensitive Diagnosis of Peste des Petits Ruminants (PPR). The main objectives of this project are to standardize and validate RT-PCR tests currently in use, develop and validate new molecular-based (real-time PCR, LAMP) PPR diagnostic tools and a penside test for early and sensitive diagnosis of PPR to enable FAO and IAEA Member States to better manage and control this TAD.

Proposals

Scientists who are interested in that CRP are encouraged to send their applications with proposals by 31 July 2007. For the submission, each applicant will have to present his/her project in the light of current equipment and human resources with experience levels available in his/her laboratory. The proposal should highlight the potential impact of the CRP in the applicant's laboratory and on the PPR control in the country. Selection of proposals for award of contracts is expected to be by August 2007.

Implementation procedure

Selected proposals for award of Research Contracts will be provided with funds, maximum of US$ 10 000/year, on a cost-sharing basis, to cover part of the local costs during the first year of the project. Subsequently, annual renewals will be available, based on satisfactory progress, up to a total of five years. It is mandatory that contract holders have support from their institutes for part of the local costs of the project. In addition to the award of Research Contracts, scientists with international expertise in the fields covered by this project will be considered for award of Research Agreements, which do not carry monetary grants. They will function as resource persons in this project to provide assistance to Contract holders in particular for the test validation and the implementation of ring tests that will be organized during this CRP.

A Research Coordination Meeting (RCM) will be held at the commencement of the project, to which all Contract and Agreement holders will be invited. This meeting will discuss the proposed work plans of each research team and elaborate a unified and coordinated approach to the studies that will be undertaken during the first two years. A second RCM will be held after 18–24 months to present results from each research team, review progress and define further work plans for the remainder of the project period. It is expected in particular that a standardized RT-PCR protocol for PPRV identification will be made available at that meeting. A final RCM will be held at the conclusion of the project to present the final results and to prepare the papers be included in an IAEA-TECDOC or a Peer-reviewed Journal.

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://www-tc.iaea.org/tcweb/default.asp

For further information contact Roswitha Schellander (r.schellander@iaea.org)

Activities of the Animal Production Unit (APU) at the FAO/IAEA Agriculture and Biotechnology Laboratory

Development of a Marker Vaccine for the Control of Peste des Petits Ruminants (PPR)

With partners from Africa and Europe, the APU is involved in the development of PPR marker vaccine with its companion test. In this project, one of the APU work packages is the mapping of the PPRV nucleoprotein (N) to identify its interaction sites essential for its functions. In AP&H Newsletter No 44, we reported on the identification of two regions involved in the nucleocapsid formation. The PPRV Np mutants that were generated during that study have been further studied by electron microscopy (EM) following their purification by unltracentrifugation on CsCl gradient. This EM observation indicates that the full length N and the mutant NpΔ420-525 proteins present herringbone-like structures which resemble to the authentic viral nucleocapsid of Paramyxoviruses. The N-terminus and central deletion mutants (NpΔ1-145, NpΔ120-145, NpΔ120-241 and NpΔ120-278) form aggregate crystalline structures. In addition to those aggregates, the NpΔ120-241 and NpΔ120-278 mutants contain inconstant helical structures that are different from those of full length N. These data indicate that the N-terminus domain of N protein, aa 1 to 241, is essential and critical for the stable helical nucleocapsid formation while the c-terminal fragment aa 421-525 is dispensable for this structure.

Analysis of the antigenic Structure of the PPRV nucleocapsid protein (N)

In order to characterize the antigenic structure of the PPRV N protein and in particular to determine the most antigenic regions, the full length recombinant N protein, the recombinant deleted mutants mentioned above and the overlapping N peptides were used in indirect ELISA test (iELISA) with PPR positive and negative sera obtained from goats and sheep. Compared to negative sera, the positive sera reacted well with N and in some extend with all deleted N mutants except the deletion mutant NpΔ120-277. The reaction with the deleted mutant NpΔ120-241 is weak. These results might indicate the importance of the region aa 120-277, and particularly aa 241-277 in the serological response of sheep and goat against PPRV N. The denatured N protein is partially recognized by the positive sera. From all these results taken together, it was concluded that antibodies anti N developed by small ruminants are recognizing conformational epitopes mainly.

Development of a c-ELISA for the diagnosis of Foot and Mouth Disease: Use of Non-Structural-Protein (NSP) of Foot and Mouth Disease Virus for Differentiation between Vaccinated and Infected Animals (DIVA)

A couple of years ago, the APU produced monoclonal antibodies against the Foot and Mouth Disease virus (FMDV) non-structural protein (NSP) 3ABC. Characterization study of those monoclonal antibodies (mAb) allowed identifying a mAb which recognize a B-epitope on the 3B fragment of the NSP. This mAb was used to develop an NSP-based c-ELISA to differentiate FMDV infected animals from non-infected or vaccinated animals. Primarily studies carried out on few positive and negative sera indicated that the test is highly specific, 93 to 100%, with sensitivity at around 84%, results which are similar to the performance of the indirect ELISA that was developed by APU a year ago. Further studies to validate and confirm the primary results will be carried out in the coming months on important numbers of positive and negative FMD sera.

Development of a test to detect the FecB gene mutation: a tool for breeding programme to increase small ruminants prolificacy.

The autosomal Booroola fecundity gene (FecB) mutation in sheep increases ovulation rate and litter size. Booroola genotypes carry a point mutation in the kinase domain of *the receptor*, at nucleotide n° 746 of the coding region (A to G transition) which results in a change from a glutamine in the wild type to an arginine residue in the Booroola animals. This mutation is a marker which offers a possibility for selecting sheep with high levels of prolificacy by genetic introgresion of the desire trait. By using a simple detection system such as the TaqMan technology, it is possible to select certain breeds containing the Boorola mutation. Specific primers were designed to enable the detection of the Boorola single mutation by TaqMan technology. The test is performing well.

Training in the APU

Fellowship

The fellow, Mrs. Ivona Dimitrova, from Bulgaria is sponsored by the IAEA Technical Cooperation Programme (TC). She will work at Seibersdorf Laboratory for three months. The main objective of her work is to standardize and validate the analysis of single nucleotide polymorphisms (SNPs) in sheep and goat breeds in the scope of the current CRP on Small Ruminants Genetic Characterization in Asia (D.3.10.25). By performing this task, she will assist the APU - IAEA in the implementation of the new technology of SNP analysis.

Internship

Ms. Irene Guendel is a cost-free intern from Costa Rica who will work at Seibersdorf Laboratory for eight months. The objective of her work is to develop the system of reagents for SNP analysis to be used by counterparts under the CRPs in this field.

Both the intern and fellow will receive training on site during their stay, which be directed at the interface between quantitative and molecular genetics with the goal of using genomics and proteomics for genetic improvement of livestock. They will be trained on how to use available information on the genbank and other public data bases as well as a new database under development at the unit for the identification of putative SNP sites related to traits of interest. This exercise will be also a good resource for their training in the use of bioinformatics tools to select candidate genes for genomics work. They will be trained to use various tools to identify the genes underlying the phenotypic variability in traits of domestic animals and to develop strategies to improve the possibility that the gene products are produced in such a way to optimize the resulting phenotype.

Technical Cooperation Projects

TC Project	Description	TO
ANG/5/004	Monitoring and Control of Transboundary Animal Diseases **Objective:** To strengthen the diagnostic capacity of the Central Veterinary Laboratories (CVL) in Luanda and Lubango to monitor and control transboundary diseases, particularly contagious bovine pleuropneumonia (CBPP) and trypanosomosis.	Crowther
ANG/5/007	Improvement and Veterinary Assistance to Local Small Stock Breeds (Not yet funded) **Objective:** The sustainable improvement of small-scale livestock production systems.	Viljoen
BEN/5/002	Diagnosis and Control of Animal Diseases **Objective**: Assistance for the control and diagnosis of major diseases affecting livestock.	Crowther Viljoen
BEN/5/003	Veterinary Drug Residue Monitoring Programme **Objective:** To develop a capacity for veterinary drug residue monitoring in livestock products.	Cannavan Byron Viljoen
BKF/5/002	Development of a Veterinary Medicine to Combat the Fowl Pox Virus **Objective**: To make available to traditional poultry farmers, rural population medicines against fowl pox virus based on extracts of galls from Guiera Senegalensis, thus reducing the poultry mortality rate in traditional poultry farming systems.	Viljoen
BKF/5/006	Establishment of Feeding Tables for Feedstuffs that are Locally Available to Stockholders in Burkina Faso **Objective:** To improve the reproductive performance of local livestock bred through food supplementation strategies, develop feeding table for locally available food resources, characterize genetic types of cattle used for milk production, improve the effectiveness of artificial insemination on local cattle breeds, and train a qualified team on animal production (nutrition, feeding, reproduction and genetics).	Boettcher

TC Project	Description	TO
BOL/5/016	Diagnosis & Molecular Characterization of the Foot & Mouth Disease Virus **Objective**: To improve and strengthen the system of epidemiological surveillance of the national programme for the eradication of foot and mouth disease.	Crowther
BYE/9/006	Rehabilitation of the Chernobyl-Affected Territories **Objective**: To minimize the impact of the Chernobyl accident on human health and to create favourable conditions for the sustainable development of the affected territories.	Crowther
CAF/5/002	Assistance for Epidemiological Surveillance of Animal Diseases **Objective**: To strengthen the diagnostic capacity of the Central Veterinarian Laboratory (LACAVET) to monitor and control major animal diseases.	Unger
CMR/5/011	Nuclear Techniques for Improving Local Ruminant Productivity **Objective**: To improve the local breeds of ruminants and devise strategies for integrated crop-soil-livestock systems by using artificial insemination (AI), radioimmunoassay (RIA), and nitrogen-15 isotope techniques.	Boettcher
CMR/5/015	Use of Nuclear Techniques for Improving Ruminant Productivity & Disease Control (Not yet funded) **Objective**: Develop capability for improved breeding by disease control and artificial insemination.	Unger Boettcher
CPR/5/014	Increasing the Productivity of Crop/Livestock Production System **Objective**: To increase livestock production in Northwest China using appropriate feed supplementation strategies coupled with achieving a sustainable increase in wheat and rice production through the application of biofertilizers.	TO Nutr.
ELS/5/010	Improving Nutrition Practices and Reproductive Efficiency in Cattle **Objective:** To increase milk production and profitability of dairy farms through development and use of appropriate feeding strategies using locally available feed resources and enhancing reproductive efficiency.	TO Nutr
ERI/5/003	Monitoring and Control of Transboundary Animal Diseases **Objective**: To strengthen the diagnostic capacity of the Central Veterinary Laboratory to monitor and control trans-boundary diseases, particularly foot and mouth disease and contagious bovine pleuropneumonia.	Viljoen/Unger
ERI/5/005	Zoonotic (diseases that can be transmitted from animals to humans) Disease Control and Analysis of Veterinary Residues in Foods **Objective**: The objective of the project is to determine: 1. The epidemiological prevalence of brucellosis and tuberculosis in the major dairy producing areas; 2. Baseline data on veterinary drug residues in milk and meat products.	Byron/Unger
ETH/5/012	Integrating Sterile Insect Techniques for Tsetse Eradication **Objective**: To eradicate the tsetse fly from the southern Rift Valley, thereby creating an environment conducive to livestock development and improved agricultural production.	Feldmann/Viljoen
ETH/5/014	Monitoring and Control of Major Animal Diseases **Objective**: To strengthen the diagnostic capacity of the National Veterinary Institute to monitor and control trans-boundary diseases, particularly foot and mouth disease and contagious bovine pleuropneumonia.	Viljoen
GAB/5/002	Diagnosis and Control of Animal Diseases (not yet funded) **Objective**: To aid identification and control of livestock diseases.	Crowther
HON/5/002	Improvement in the Nutritional and Sanitary Conditions of Cattle to Enhance their Productivity through Nuclear Methods **Objective**: To enhance the national capabilities for developing feeding strategies, improving the reproductive status of cattle and diagnosis of diseases in livestock herds through isotopic techniques.	Viljoen/TO Nutr

TC Project	Description	TO
HON/5/004	Improving the Nutrition and Health Conditions of Livestock in Honduras in Order to Increase Productivity and Reproductivity, Phase II (not yet funded) **Objective**: To strengthen and improve livestock production in Honduras.	TO Nutr
INS/5/032	Improving Beef and Dairy Cattle Production in Yogyakarta **Objective**: To develop supplementary feeding strategies based on locally available agricultural by-products; to improve reproductive performance through artificial insemination (AI); and to establish cost-effective cattle production systems to improve the economic status of cattle farmers.	Boettcher/TO Nutr
INT/5/148	Establishing Quality Systems in Veterinary Testing Laboratories **Objective**: To establish quality systems in 15 selected laboratories in Africa (5), Asia and the Pacific (5), and Latin America (5), and to train at least 15 specialists from these laboratories using the materials already available on this subject.	Viljoen/Crowther
IRA/5/012	Preparation of ELISA Kits for Diagnosis of Foot and Mouth Disease **Objective**: To establish the ability to prepare standardized assays for use in foot and mouth disease (FMD) control.	Crowther
IVC/5/028	Surveillance and control of African Swine Fever **Objective**: To diagnose, control and monitor the prevalence of African Swine Fever (ASF) from the pig population in Côte d'Ivoire using nuclear techniques and related techniques.	Diallo/Unger
MAG/5/012	Increasing Self-sufficiency in Domestic Meat and Milk Production **Objective**: To develop integrated nuclear technique-based approaches for better nutrition, reproduction, and disease control of diary cattle.	TO Nutr
MAU/5/002	Improving the National Capacity in Diagnostics for Animal Diseases (Infection and Parasitic Diseases) **Objective**: To strengthen the diagnostic capacity of the Centre National D'Elevage et de Recherches Veterinaires (CNERV) to monitor and control transboundary animal diseases, particularly foot and mouth disease and contagious bovine pleuropneumonia.	Unger/ Diallo
MLI/5/019	Improving Pneumopathies Diagnosis in Ruminants Using PCR **Objective**: To improve knowledge about the epidemiology of the dominant respiratory pathologies affecting small ruminants in Mali's agro-pastoral areas through improving the diagnosis of pneumopathies in small ruminants to support the national control and eradication programme.	Viljoen/Diallo
MON/5/012	Monitoring of Residues in Livestock Products and Surveillance of Animal Diseases **Objective**: To develop a capacity for veterinary drug residue and contaminant monitoring in livestock products and to expand serosurveillance capabilities to achieve rinderpest and foot and mouth disease (FMD) free status in the country or specific zones.	Cannavan/Crowther
MON/5/013	Diagnosis and Surveillance of Transboundary Animal Diseases and Production of Diagnostic Reagents **Objective**: To obtain international recognition of freedom from several transboundary animal diseases, to develop a capacity for the local production, standardization and validation of diagnostic reagents and diagnostic kits, and to establish a quality system for diagnosis of transboundary animal diseases using the local produced diagnostic kits.	Crowther/Viljoen
MON/5/016	Improving Productivity of Cattle, Camels and Yaks Through Better Nutrition and Reproductive Management (not yet funded) **Objective**: To increase milk, meat and wool production of yaks, cattle and camels by improving the quality and quantity of feed with high nutritional value and tolerance to low temperature and improving the genetic potential using artificial insemination coupled with radio immunoassay for progesterone.	Boettcher/Viljoen

TC Project	Description	TO
MOR/5/030	Improving Sheep and Goat Production in Morocco through Genomic and Reproductive Physiology Characterization with the Help of Radio-immunoassay and Molecular Techniques (Not yet funded) **Objective**: Increase sheep and goats for consumption and producers' revenue while preserving natural resources.	Boettcher
MYA/0/006	Human Resource Development and Nuclear Technology Support **Objective**: To upgrade and strengthen the skills and capabilities of human resources within the broad range of the applications of nuclear science and technology.	Crowther
MYA/5/012	Diagnosis and Control of Swine Vesicular Disease and Swine Brucellosis **Objective**: To diagnose swine vesicular disease (SVD) and swine brucellosis; to improve control of these two diseases; and to increase pig production.	Crowther
MYA/5/013	Integrated Approach for Enhancing Cattle Productivity **Objective**: To improve smallholder dairy cattle production in Yangon and Mandalay regions.	Crowther
MYA/5/015	Strengthening the National Capacity for the Production of Veterinary Vaccines **Objective**: To enhance the national capacity for quality vaccine production to support efforts to control infectious diseases in livestock production, particularly FMD.	Crowther/Cannavan
NAM/5/007	Control of Animal diseases in Northern Namibia **Objective**: To create a sustainable veterinary diagnostic service that will contribute to the control of the major diseases affecting livestock in the northern parts of the country.	Viljoen
NER/5/011	Upgrading Laboratory Services for Diagnosis of Animal Diseases **Objective**: To support the Government effort in controlling main livestock trans-boundary diseases, mainly contagious bovine pleuropneumonia (CBPP), peste des petits ruminants (PPR) and foot and mouth disease (FMD). To help improve the national animal disease diagnosis capabilities at the Laboratoire Central d'Elevage (LABOCEL) in the use of modern techniques to obtain specific and rapid results with focus to CBPP, PPR and FMD.	Diallo/Unger
NER/5/013	An Integrated Approach for Improvement of Livestock Productivity **Objective**: To increase the productivity of livestock through implementation of an integrated programme dealing with nutrition and reproduction.	Diallo/TO Nutr
PAN/5/014	Improving Cattle Production and Quality Control for Monitoring of Animal Diseases **Objective**: To determine the effect of two zoonotic diseases (trypanosomiasis and fascioliasis) on reproduction and on the production of meat and milk in stockbreeding areas under the dual-purpose system using nuclear techniques.	Crowther/Viljoen
PER/5/027	Use of Nuclear Techniques to Improve Alpacas Productive and Reproductive Methods **Objective**: To improve reproduction performance of alpacas using nuclear and related techniques to recover and conserve the individual species.	Boettcher
PER/5/029	Genomics of the Alpaca: Identification of Expressed Genes and Genetic Markers Associated with Productivity and Embryonic Mortality (Not yet funded) **Objective**: To identify and characterize the factors associated with embryonic mortality in alpacas.	Malek/Boettcher
RAF/0/013	ICT-Based Training to Strengthen LDC Capacity **Objective**: To use new information and communication technology (ICT) for developing and delivering innovative learning/training modules to strengthen and expand the capacity in least developed countries (LDCs) to make use of specific nuclear technologies critically needed in key development projects/programmes supported by the Agency and other Technical Assistance or donor partners.	Crowther/Boettcher

TC Project	Description	TO
RAF/5/054	Improvement of Livestock Productivity through an Integrated Application of Technologies (AFRA III-4) **Objective:** To develop and facilitate the application of appropriate selection criteria for genetically improved stock; to institute integrated management, nutrition, healthcare and follow-up practices for genetically improved stock; and to use modern reproductive techniques to improve productivity and reproductive efficiency of livestock in the region.	Boettcher/TO Nutr
RAF/5/055	Support to African Union's Regional Programmes for Control and Eradication of Major Epizootics **Objective**: To support within the framework of a strategic partnership with the African Union, the global effort of control and eradication of major transboundary animal diseases affecting livestock in the region led by the Inter-African Bureau for Animal Resources (AU/IBAR). This programme will aim at helping African countries to improve and produce livestock to ensure their role and participation in international markets that will lead to poverty alleviation and increased livelihoods. The specific objectives of the project are (i) to provide support to selected national veterinary laboratories to implement a quality assured disease control programme; (ii) to transfer appropriate and state-of-the-art technology to support diagnostic, surveillance and epidemiological activities relating to the control of major livestock diseases; and (iii) to support the establishment of a regional centre in Africa (Pan African Veterinary Vaccine Centre [PANVAC]) that would be responsible for (a) the production, assembly and distribution of diagnostic kits; (b) evaluating and monitoring the development of quality assured animal vaccines and (c) advising on the use of vaccines and vaccine strategies.	Viljoen/Lelenta
RAS/5/035	Improving Animal Productivity and Reproductive Efficiency (RCA) **Objective**: To improve the productivity and reproductive efficiency of livestock in the East Asia and the Pacific region. The specific objectives are to consolidate and disseminate the use of strategic supplementary feeding using urea molasses multinutrient block (UMMB) and other non-conventional local feed resources; to improve the performance of artificial insemination (AI) services; and to promote better reproductive management by farmers.	Boettcher
RAS/5/041	Production of Foot and Mouth Disease Antigen and Antibody ELISA Reagent Kit (RCA) **Objective**: The overall objective is the control and eventual eradication of foot and mouth disease (FMD) in the East Asia and the Pacific region. The specific objectives are to produce enzyme-linked immunosorbent assay (ELISA) kits for antigen and antibody detection at a lower cost than currently commercially available for the diagnosis of FMD; and the development of the capability for diagnosing FMD using ELISA and molecular techniques by the FMD national laboratories in the region.	Crowther
RAS/5/044	Integrated Approach for Improving Livestock Production Utilizing Indigenous Resources and Conserving the Environment (RCA) **Objective**: To improve livestock productivity through better nutritional and reproduction strategies while conserving the environment. The specific objectives are to improve animal productivity and decrease discharges of selected greenhouse gases, (methane and carbon dioxide) and selected nutrients (nitrogen and phosphorus) into the environment; and to identify and adopt better breeding strategies that will improve animal productivity through the use of better selection criteria for offspring from cross-breeding programmes, optimum utilization of appropriate indigenous cows, benchmarking for growth and reproduction, and improving procedures for management, nutrition and healthcare programmes in dairy farms.	Boettcher/TO Nutr

TC Project	Description	TO
RER/5/012	Regional Control of Brucellosis in Sheep and Goats (core 2003–2007) **Objective**: To improve control of the Brucellosis in sheep and goats through the establishment of regional collaboration of Member States affected by the disease, to set up a laboratory network using isotope-based technology, to detect Brucellosis antibodies, and to implement methods for the certification of milk and milk products as safe for human consumption.	Crowther
SIL/5/006	Improving the Productivity of N'dama Cattle **Objective**: To establish a national capability for the application of nuclear techniques to (i) assess the nutritional quality of locally available feed resources, and to develop optimal feeding strategies, (ii) evaluate the reproductive performance under different management and nutritional conditions, and improve artificial insemination (AI) services, and (iii) diagnose and determine epidemiological status of important diseases.	Boettcher/TO Nutr
SIL/5/010	Improving the Productivity of Ndama Cattle In Sierra Leone **Objective**: To strengthen the diagnostic capacity to monitor and control animal diseases affecting cattle, (ii) to apply feeding strategies and supplementation packages, and (iii) to produce hydrids with greater potential for increased growth rate and milk yields.	Boettcher/Viljoen/ TO Nutr.
SRL/5/041	Maximizing Productivity on Goat Farms through Cost-Cutting and DNA-Based Technology in Selection for Breeding (Not yet funded) **Objective**: To improve the productivity of goats of small-holder farmers in Sri Lanka, by introducing new strategies such as supplementary feeding, improved management practices and disease control and by transferring genetic technologies to assist in proper selection of superior breeding animals.	Boettcher/Viljoen
SUD/5/028	Epidemiology and Control of Snail-borne Diseases in Irrigated Areas **Objective**: The overall objectives of the project are to increase animal production, and maintain healthy and productive herds in irrigated areas by controlling snail-borne diseases.	Unger
SUD/5/029	The Characterization and Quality Assured Production of an Attenuated Theileria Annulata vaccine **Objective**: To protect cattle against tropical theileriosis through vaccination in order to improve animal health and reduce reliance on acaricidal/pesticide tick control. More specifically, to establish quality-assured procedures and protocols for T. annulata cell culture vaccine production.	Unger
SUD/5/031	Setting up a National Network for the Control of Livestock Diseases that affect Exports **Objective**: To establish capacity to diagnose Brucellosis in ruminants to improve food safety and secure animal exports.	Unger
TAD/5/003	Diagnosis and Control of Brucellosis in Cattle, Sheep and Goats (Not yet-funded) **Objective**: To improve diagnosis of brucellosis in cattle, sheep and goats in order to prevent the spread of the disease among animals and the human population in Tajikistan.	Crowther
TUN/5/021	Fodder Shrubs as Feed Resources to Improve Livestock Productivity **Objective**: The project aims at developing appropriate feeding strategies based on fodder shrubs and other non-conventional sources to meet feeding requirements of ovine and caprine under harsh environments.	TO Nutr.
UGA/5/028	Improving the Capacity for Diagnostic of Animal Diseases **Objective**: To strengthen the diagnostic capacity of the Diagnostics and Epidemiology Laboratory of the Ministry of Agriculture, Animal Industry and fisheries to monitor and control transboundary animal diseases of importance (e.g. CBPP, FMD, AI, Rabies, Brucellosis and RVF) to Uganda.	Viljoen/Unger

TC Project	Description	TO
URT/5/025	Support for the Delivery of Artificial Insemination services **Objective**: The sustainable intensification of milk and meat through the provision of efficient and reliable AI services.	Boettcher
YEM/5/006	Quality Management for Upgrading Animal Disease Control **Objective**: To improve the management of diagnostic testing for livestock diseases in Yemen, leading to increased assurance of results in aiding control programmes.	Crowther/Viljoen
ZAI/5/015	Upgrading Laboratory Services for Diagnosis of Animal Diseases **Objective**: Control and eradication of livestock transboundary diseases or other epizootics through the laboratory investigations using nuclear and related technologies.	Unger
ZAM/5/025	Development of Feeding Strategies for Smallholder Dairy Animals in Njolwe and Palabana Dairy Tenant Schemes **Objective**: To improve household food security and income generation among small scale farmers through increased production and marketing of livestock by developing sustainable feeding and breeding strategies based on increased use of locally available resources.	Boettcher
ZIM/5/010	Improvement of Veterinary Diagnostic Laboratory Services **Objective**: To enhance the capability of the Department of Veterinary Services (DVS) through the Central Veterinary Laboratory (CVL) in order to develop/adapt DNA-based diagnostic techniques for difficult to diagnose infections using conventional techniques; and to establish DNA/RNA-based molecular typing methods as epidemiological tools to study disease dissemination routes and sources of infection, and to characterize and differentiate between vaccine and field strains of diseases such as anthrax, rabies, and foot and mouth disease.	Unger

Publications

In Press

Improving the Reproductive Management of Dairy Cattle Subjected to Artificial Insemination

IAEA-TECDOC-1533, May 2007, English

Results from the IAEA Technical Cooperation AFRA Project on 'Increasing and improving milk and meat production', implemented with technical support of the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture.

The Use of Non-structural Proteins of Foot and Mouth Disease Virus (FMDV) to Differentiate Between Vaccinated and Infected Animals

IAEA-TECDOC-1546,

The publication presents results of the Coordinated Research Project on the Use of Non-strucutral Protein of Foot and Mouth Disease Virus to Differentiate between Vaccinated and Infected Animals.

FAO/IAEA Manual on Measurement of Methane from Ruminants

This manual will be published by Springer

This manual stems from a training workshop on Methodologies for Determination of Methane from Ruminants that was held in Zurich in 2005 under the Coordinated Research Project (CRP D3.10.24.) on Development and Use of Molecular Techniques for Predicting and Enhancing Livestock Productivity. The main objective of this CRP is to reduce methane (a greenhouse gas) emission from livestock and divert the energy being lost in methane production to increasing livestock production and simultaneously, reducing environmental pollutants. The key aspect of this work is having the ability to measure methane emissions from livestock so that the effect of any changes that are made to reduce methane emissions can be measured quantitatively. However, the methods for measuring methane from animals *in vivo* are complex and the capacity to measure methane from whole animals requires some specialized equipment, careful planning and

experience. If the specialized equipment can be purchased, then for most of the techniques used to measure methane *in vivo*, the remaining equipment can be constructed quite simply and cheaply. The objective of producing this manual is to provide researchers starting work in this field with all the necessary information they need to decide on the best method to use in their environment and then to establish that technique in their organization. This manual explains in detail the following 6 methods that are used to measure methane from ruminants:

- SF6 tracer technique
- Respiration chambers
- Tunnel System for methane determination using an infra-red detector and GC
- Chamber/box system for methane determination using a GC
- Indirect method for methane determination by infusion of labelled short chain fatty acids
- Direct method for methane emission by infusing labelled methane

The manual provides both theoretical and very practical details, including diagrams, equations and photographs, to enable a research team to set up and measure methane emissions from ruminants. It is also a source of references to key publications in this field.

In Preparation

Formulation of Guidelines for Manure Management in Asian Livestock Production Systems for Achieving Agricultural Sustainability

A publication about developing guidelines for efficient manure management in Asian livestock production systems is being prepared based on an Expert Meeting that was held under the IAEA/RCA Regional Technical Cooperation Project (RAS/5/044). The specific objectives of the nutrition component of the project are to improve animal productivity and decrease discharges of selected greenhouse gases (methane and carbon dioxide), and selected nutrients (nitrogen and phosphorus) into the environment. This publication is focussed on the management of nutrient waste component of the project.

Livestock manures and other agricultural waste products represent a valuable resource, which, if used appropriately with a minimization of losses can replace significant amounts of fertilizer in areas with intensive livestock production. On the other hand, the large volumes of animal manure are not only a source of valuable plant nutrients but also a threat to aquifers and surface waters. As livestock production intensifies, there are serious concerns that poor management and use of manure could jeopardize the sustainability of the production system, because of environmental damage and disease transfer, and reduce productivity levels to well below their potential. In this publication, information about state-of-the-art manure management practices, current practices in Asia, amounts of manure produced and barriers to effective manure management is combined to provide guidelines for the development of a sustainable, environmental friendly and sanitary livestock production in Asia. It highlights the pressing need for holistic research into strategies and technology for management and treatment of manure, residues and wastes, which can ensure a sustainable use of nutrients and reduce environmental impacts, including odour and ammonia emissions, greenhouse gas emissions and the spread of diseases

Managing Prenatal Development to Enhance Livestock Productivity

The need for a book dealing with managing prenatal development to improve livestock productivity was identified during a Consultants meeting on Research Needs for Improvement of Livestock Productivity in Developing Countries Through Manipulation of Nutrition in utero, held in October 2005.

There is a growing demand worldwide for livestock products and the role of developing countries in meeting this demand will increase. Within this, the current production systems will come under increasing pressure because of the access to feed resources and other environmental challenges. The reproductive female will be under the most pressure in the future because she will be expected to reproduce consistently, and at the very least, annually. The female will also face nutritional and other environmental challenges in meeting the developmental needs of the embryo and foetus throughout gestation and in the preweaning period. Therefore, the foetus is exposed to various challenges that are mostly, but not exclusively, of a nutritional nature. The question is whether these challenges impact on foetal development and subsequent health, growth, reproductive and lactational characteristics of the offspring.

The objectives of this book are to provide a quantitative assessment of the role of, and current state of understanding of the mechanistic basis to, environmental plasticity in producing healthy and productive livestock. The book will contain review papers covering all the key livestock species as well as chapters covering relevant information on non-livestock species.

Publication on Developing, Validating and Standardizing Methodologies for the Use of PCR and PCR-ELISA in the Diagnosis and Monitoring of Control and Eradication Programmes for Trypanosomosis

The publication has been completed and will be submitted for publication.

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 John Crowther at j.crowther@iaea.org for further information.

A new batch of CDs with a training package to help artificial insemination (AI) technicians to improve the performance of AI and field services provided to farmers was produced for users with a slow internet connection and is now available through the APHS. It is also accessible from the AP&H Section website: http://www-naweb.iaea.org/nafa/aph/index.html

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To be regularly informed on FAO new 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.

Websites

- The AP&H Section website is being updated on a regular basis. Please feel free to look at it and make comments. http://www-naweb.iaea.org/nafa/aph/index.html
- A training package to help artificial insemination (AI) technicians to improve the performance of AI and field services provided to farmers is now accessible from the AP&H Section website (http://www-naweb.iaea.org/nafa/aph/public/d3_pbl_1_10.html). It was produced under an IAEA Technical Cooperation Project – RAF/0/013 – ICT – Based Training to Strengthen LDC Capacity with the collaboration of the Animal Production & Health Section of the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture. This package is also available as a CD ROM for users who have no access to internet connection.

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