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Nuclear Techniques in Food and Agriculture

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Method of identification and recording of animals in Iran (CRP D3.10.25)

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To Our Readers

Dear Colleagues,

Three animal disease issues, amongst others, dominated animal health activities in the world; the near eradication of rinderpest (RP), the continued threat of foot-and-mouth disease (FMD) to national and international trade and the ever spreading avian influenza (AI). The importance of early, rapid and sensitive diagnoses of merging diseases, with special reference to AI, can not be overstated and it has prompted our subprogramme to refocus our activities and efforts.

The rapid diagnosis and characterization of AI, particularly with respect to molecular tools, are important to determine whether it is H5N1 or another subtype. It is here that the Joint FAO/IAEA Programme can play a role in supporting the actions of the FAO, OIE, WHO and Member States. The subprogramme can provide technical assistance on (1) which tests and protocols to use, (2) technical and laboratory training, (3) expert missions (nominating relevant expert(s) or to perform expert missions by members of the subprogramme), (4) the analysis of AI samples (as primary diagnosis or as confirmation) utilizing the OIE reference status of our Seibersdorf laboratory (i.e. the analysis of translation products of the virus genome) and (5) the provision of technical quality assurance guidelines and support to ensure quality data and reporting.

IAEA International Atomic Energy Agency

In this issue of our newsletter I want to discuss AI in short. Please also visit our website and the websites of FAO, OIE and WHO for more information. Highly pathogenic avian influenza (HPAI) now commonly known as "bird flu" is caused by the infection with some strains of Influenza A virus. The different strains of this virus are classified into subtypes on the basis of their two external proteins named haemagglutinin (H) and neuraminidase (N). Techniques that are implemented for the diagnosis of AI aimed at demonstrating first the presence of the causal virus in pathological samples and then at assessing it's pathogenicity as highly or lowly pathogenic. Indeed, only some strains of AI, highly pathogenic (HPAI), are at the origin of outbreaks and they belong to the H5 or H7 subtypes. The current AI outbreak which started in Asia in 2004 is caused by a virus of H5 subtype. In addition, this virus was further characterized as of the N1 subtype which is able to cause deaths in humans. Although the H5N1 avian influenza virus has existed since 1996, the true crisis in Asia started in early 2004 with the almost simultaneous declaration that the disease was killing hundreds of thousand of chickens and ducks in ten countries. As per 1 May 2006 there have been more than 170 human cases with an almost 50% fatality, and more than 220 million dead or culled birds. Economic losses to the Asian poultry sector are estimated to be at least US$ 10 billion. Avian Influenza, due to Highly Pathogenic Avian Influenza (HPAI) H5N1 subtype (HPAI-H5N1), is threatening the livelihood of hundreds of millions of poor livestock farmers, jeopardizing smallholder entrepreneurship and commercial poultry production, and seriously impeding regional and international trade and market opportunities.

Usually, from the pathological sample, the virus is first isolated in embryonated fowl eggs which takes 4 to 7 days to complete. Then the subtype of the isolated virus is identified by a battery of specific antibodies raised against the different H (H1 to H15) and N (N1 to N9) proteins. This way of identification is carried out only in specialized laboratories. To confirm a subtype's pathogenicity, the isolate is then inoculated into 4 to 8 week-old susceptible chickens. For the World Organization for Animal Health (OIE), strains are considered to be highly pathogenic if they cause more than 75% mortality in inoculated chickens within 10 days. An alternative way to demonstrate the presence, and characterize the influenza virus in the pathological samples, is the specific detection of its RNA by nucleic acid amplification techniques (e.g. PCR and PCR sequencing, using either fluorescent or isotopic [P^{32}, P^{33} or S^{35}] markers). This molecular approach takes 1–2 days to complete. Furthermore, it is foreseen that this technology could be applied as early warning tools. In the case of avian influenza it is important for the rapid and differential diagnosis to classify isolates as highly pathogenic or not in order to activate appropriate control measures – this is seen as the bottleneck activity for most developing countries.

So – what is the Animal Production and Health subprogramme doing – An "emerging disease and AI" consultants meeting was convened in May 2006 to map out the future actions of the subprogramme which will be followed by a HPAI H5N1 specific training course later this year. Please find more information in this Newsletter, on our "new look" website or contact me directly.

Looking back at the activities of the past six months, we had several workshops, training courses, and a consultant meeting. Activities scheduled for the next half-year include project review meetings, RCMs, inter-regional training courses and regional workshops. Both past and future activities are discussed in further detail in this Newsletter and are also accessible at our website.

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.

An evaluation of the Animal Production and Health subprogramme is currently being performed. In order to assist us in this process we would appreciate your cooperation in filling out the questionnaire on page 21 and return it by mail, facsimile or email.

Finally, some information about the people working in our subprogramme. Mr. Traoré Abdallah returned to his institute, the Laboratoire Central Vétérinaire at Bamako, Mali, in April after a six month training period at the Animal Production Unit, Seibersdorf. We hope that the training provided will be useful for his work in Mali. Mr. X.B. Chen joined the subprogramme as an animal science IT consultant and as a result we are able to present a new and improved animal production and health website. We also want to introduce and welcome Phil Vercoe, who has joined us on a one year sabbatical from the Faculty of Natural and Agricultural Sciences, University of Western Australia, Perth, and Corinna Herden, who is replacing Svetlana Piedra Cordero during her maternity year.

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

4th International Veterinary Vaccines and Diagnostics Conference (IVVDC)

Technical Officer: Gerrit Viljoen

The Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture is cooperating in the organization of the fourth IVVDC, which will be held from 25 to 29 June 2006 in Oslo, Norway.

Molecular Diagnostic PCR Fellowship Training Course

Technical Officer: Gerrit Viljoen

The fifth workshop of this kind is planned to be held from 7 August to 1 September 2006 in Pretoria, South Africa. This workshop will be held in cooperation with The Microbiology Department, University of Pretoria.
The course coordinator is Prof. Luis Nel, email: louis.ne.@up.ac.za.

Alternative Feed Resources: A Key to Livestock Intensification in Developing Countries

Technical Officer: Phil Vercoe

This meeting will be held in cooperation with Writtle College and The British Society of Animal Science and their Ethnoveterinary Medicine Conference Harvesting Knowledge, Pharming Opportunities, which will be held at Writtle College, Chelmsford, Essex, UK, on the 12 and 13 September 2006.

Training Course on the Diagnosis of Avian Influenza

Technical Officer: Adama Diallo

This Training course will take place from 9 to 20 October 2006 at the FAO/IAEA Agriculture and Biotechnology Laboratory in Seibersdorf, Austria.

First RCM on the Diagnosis and Surveillance of Contagious Bovine Pleuropneumonia (D3.20.24)

Technical Officer: Hermann Unger

This Research Coordination Meeting (RCM) will take place from 30 October to 3 November 2006 in Windhoek, Namibia.

This meeting will focus on the final steps of validation for 2 CBPP ELISAs; results obtained so far will be analysed and the work plans harmonized. Presentations will be given on an experimental intra-dermal test and on a new iso-thermic PCR for early detection. Finally molecular epidemiology will be introduced and its potential application discussed. Agreement holders from France, Switzerland and Austria will support this meeting

Consultants Meeting on Reference Material and Standards for the Control of Diagnostic Assays used for the Diagnosis and Control of Transboundary Diseases Affecting Livestock and Man

Technial Officer: John Crowther

This meeting is scheduled to be held in November 2006 at the VIC, Vienna.

Fourth RCM of the CRP to Develop Methodologies for Demonstrating Increases in the Productivity of Peri-urban Dairy Cattle using an Integrated Approach to Nutrition, Reproductive Management and Disease Control (D3.10.23)

Technical Officer: Paul Boettcher

This RCM will take place from 4 to 8 December 2006 at the University of Edinburgh, UK. This meeting will be the final RCM for this CRP. The primary purpose of the RCM is to discuss and evaluate the results of interventions made on the farms participating in the various country projects. The interventions made were designed to increase the quality of diets, reproductive efficiency and general health of the cattle. Specific attention will be paid to the economic aspects of the interventions, however, and will particularly consider the costs and benefits of the techniques applied. Because this will be the final meeting of the project, one session of the programme will be devoted to strategies to ensure sustainability and increased adoption of the most successful interventions.

Announcements from Member States

CTA Training Support: Web-based Module in Community-based Animal Health and Research Methodology

The Department of Veterinary Tropical Diseases (DVTD), Faculty of Veterinary Science, University of Pretoria and its partners have developed a wide range of modules in tropical animal health that can be taken online for continuing professional development (CPD)
The ACP-EU Technical Centre for Agricultural and Rural Cooperation (CTA), the Netherlands have made 20 scholarships available for each of the modules, namely, Community-based Animal Health: Veterinary Communication and Extension and Research Methodology for candidates from the SADC Region and other African-Caribbean-Pacific (ACP) countries.
For more information please contact Ms Linda Venter (linda.venter@up.ac.za). The Project Office, Department of Veterinary Tropical Diseases, Private Bag X04, ONDERSTEPOORT, 0110 South Africa
fax number +27 12 529-8312

Further information can be found under URL http://www.up.ac.za/academic/veterinary/depts_vtd_cpdweb/index.htm

Past Events

Consultants Meeting on Molecular Techniques Applied to Foot-and-Mouth Disease Diagnosis and Surveillance

Technical Officer: John Crowther
The meeting was held from 6 to 8 December 2005 in Vienna.
The meeting conclusions and recommendations are as below.

1. Future studies should concentrate on the fitness for purpose of molecular based tests.
2. It is clear that there are several different purposes when considering FMD diagnosis and control. The interest in FMD disease free developed countries dominates current developments, where there is acute fear of contamination of disease. Appropriate technologies should be considered by individual countries, including all conventional approaches such as tissue culture and serological tests such as ELISA. Molecular based tests may offer advantages by replacing such tests but confidence in data is achieved only through a combination of approaches relevant to the resources and perceived needs of a country.
3. In the light of the OIE guidleines on validation, it was agreed that most molecular based assays are not validated beyond stage 1 or 2. Basically in-house development has been made, although there have been some harmonization exercises. The statistical basis of validation of molecular based tests needs reassessment as compared to serologically based tests. The validation of real time PCR is progressing. It was noted that even the conventional PCR lacks enough data to satisfy the Stage 3 requirements of the OIE guidelines.
4. Efforts have been made to increase the capacity of the real time PCR through robotics to take care of the possible large number of samples in an extensive surveillance following an outbreak. There are problems associated with robotics such as avoiding internal contamination in high throughput of infected samples, which have to be controlled very carefully. Robotics are expensive. The scale of operation perceived is very large and probably inappropriate for many developing countries in terms of expense.
5. Developments of penside mobile laboratories using PCR have also been made but their exact advantage in initial confirmation of FMD is debatable in terms of what rapid diagnosis means. The diagnostic sensitivity and specificity of chromatographic strips are esentially suitable for initial confirmation of clinical FMD at an index case. Penside molecular techniques may have an advantage in differential diagnosis. Development of mobile real time PCR systems should be considered based on newly emerging PCR methods.
6. The real time PCR methods offer advantages for direct and differential diagnosis. Although full validation is required for specific purposes some generalized observations can be made based on current data. The real time PCR is highly sensitive and superior to tissue culture in detecting evidence of FMD infection. The diagnostic specificity and sensitivity profiles from a number of studies suggest them to be superior to all other methods.

There are problems associated with the use of specific primers where attention to FMD virus evolution has to be made as well as addressing problems associated with specific viruses from different serotypes (e.g. SAT 1, 2 and 3). On a more cautionary note, the technique requires a very high level of training, expensive equipment and reagents, good ability to interpret results and a very high quality laboratory with rigid management. The advent of cheaper machines to read real time PCR and the reduction of reagent costs will make this technique more suitable to the realistic needs of developing countries; therefore, the method should receive support.

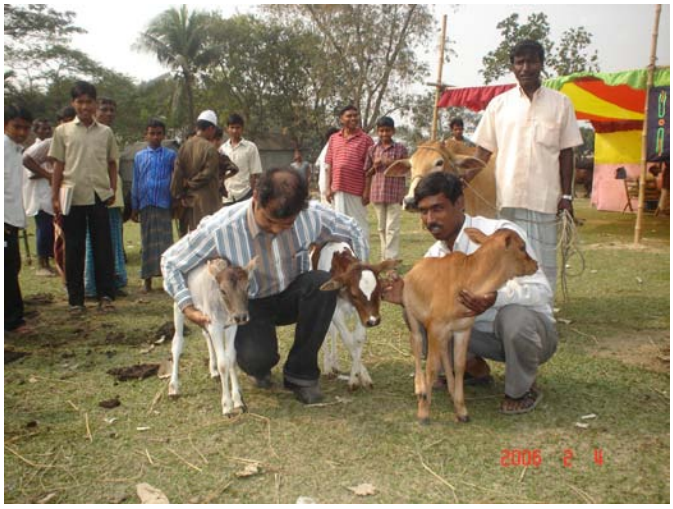
7. Conventional PCR offers a method of confirming diagnosis and also obtaining a PCR product for sequencing. Many laboratories can now use this method and there should be a better attempt at unifiying their approaches for conventional PCR. It was noted that there is no accepted protocol nor agreed validation document for this method, even though variations are used widely. The conventional PCR provides a product that can be sequenced (particularly VP1) so that strains can be compared at the genome level and this is important. Sequencing of products should be made using commercial of international organizations as was recently exemplified in Mongolia.
8. Molecular epidemiology was seen as a very important feature of studying the spread and evolution of FMD. It was noted that still there is a great reluctance of developing countries to send samples to be sequenced, even if this is free of charge. Offers to sequence the entire genome are not taken up. The setting up of a Web based portal to encourage information exchange, by the USA (Davis California), was seen as a good step towards furthering confidence and cooperation in this area.
9. Although one of the meeting aims was to assemble protocols, this is not possible. This highlights the need and indicates that after many years with the conventinal PCR, no one has harnessed the information to allow a standardized methodology. This causes confusion as to what protocols (primer sets, methods of cycling etc.) should be used. It also emphasizes that research into the technology has been made in many laboratories without an initial decision about fitness for purpose.
10. Standards are needed. The nature of the standards and their use in harmonizing tests should be examined soon.
11. It was stressed that molecular methods above all need a total management package. Well trained staff are vital and high levels of laboratory practice with quality control issues being addressed.
12. It was hoped to include working protocols in this report. However, there are some IP issues. Attempts to assemble protocols will be made to allow a document to be produced for publication in the OIE Review to aid laboratories interested in molecular methods.

Experts Meeting on Selection Criteria for Breeding Heifers (RAS/5/044)

Technical Officer: Paul Boettcher

The meeting was held at the Bangladesh Agricultural University in Mymensingh, Bangladesh, from 6 to 10 February 2006. Participants in the meeting included

five experts who contribute to country projects in RAS/5/044, two regional experts and the Technical Officer. The purpose of the meeting was to discuss current cattle breeding practices, traits of economic



importance, and prospects for the future. The output of the meeting will be a set of guidelines, both general and country specific, for selection of cattle, with an emphasis on improving the genetic value of females owned by smallholder farmers. The guidelines will be posted on the section website and then made into a publication for distribution to stakeholders in Member States.

Regional Workshop for the Planning of the Control of Fascioliasis and Good Agricultural Practices (GAPs) in the Latin American Region

Technical Officer: Gerrit Viljoen

This workshop was held from 27 February to 3 March 2006 in Mendoza, Argentina

The workshop was attended by six regional fasciolosis diagnosticians from Panama, Cuba, Bolivia, Uruguay, Argentina, and Mexico and one expert from Spain. The workshop was hosted by the Universidad Nacional de Cuyo (MAZA), Mendoza, Argentina. The first two days of the workshop were devoted to the introduction of the logframes methodology with the subsequent three days focussing on the development of a regional logframe and work plan (integrating the national work plans).

Consensus was reached about the importance of the disease in public health and food security, mainly concerning children and females in contact with infected animals. However, it was noticed that not all participating countries consider fascioliasis as top priority for their respective country. Exchange of information showed that this is a transboundary health problem that should be addressed by concerted international cooperative efforts. Discussions revealed a pronounced heterogeneity of scientific knowledge, information and data available about the characteristics of the disease in the different countries, including several countries in which some baseline studies still had to be performed with tools appropriate to ascertain the present situation. Information analyzed suggests an urgent need to implement international and national intervention activities to establish the appropriate control and prediction measures. Furthermore, the complexity of the disease necessitates the multidisciplinary cooperation between national agencies responsible for public health, food, and agriculture; science and technology experts; and the education sector; and that partnerships with other international organizations and donor organizations be sought. Because livestock plays such an important role in the cycle of this disease, and to establish a foothold on the disease, the participants decided that animal fascioliasis should be addressed first, with human fascioliasis to follow (the one will however, not exclude the other). Diagnostic, treatment, surveillance and epidemiological characterization methods utilizing appropriate tools will be evaluated, validated and implemented in endemic countries without delay.

Regional Training Workshop on Selective Breeding and Gene Technologies (RAS/5/044)

Technical Officer: Paul Boettcher

This workshop was held from 3 to 7 April in Daejeon, Republic of Korea. The National Livestock Research Institute served as the technical organizer and the Nuclear Training Centre of the Korean Atomic Energy Research Institute was the host organization. The

course was attended by 16 official participants, from 12 different countries within the Asia Pacific region. Drs. Karen Marshall and Sanghong Lee of the University of New England in Australia were the instructors. The purpose of the meeting was to transfer to the Member States the basic theoretical background and appropriate technologies for application of selective breeding of livestock populations. Key topics in both quantitative and molecular genetics were addressed, including basic concepts of quantitative genetics and selection, genetic evaluation, detection of economic trait loci, and marker assisted selection.

Regional Training Course on Methane Emission Methodologies (RAS/5/044)

Technical Officer: Phil Vercoe

This regional training course was held in Khon Kaen, Thailand from 17 to 28 April 2006 and was associated with the nutrition component of the TC Regional project RAS/5/044. The purpose of the meeting was to provide theoretical and practical training to scientists from Member States in five techniques for measuring methane emissions from ruminants *in vivo*. The five techniques covered during the course were: the "head box" chamber, respiration chamber, SF6 tracer method, the stable isotope method and the low-cost tunnel method. Lectures on these techniques were provided by

Dr. Takehiro Nishida from the Japan International Research Centre for Agricultural Sciences (JIRCAS), Khon Kaen Animal Nutrition Research and Development Centre, Tha Pra and Dr. Roger Hegarty from the NSW Department of Primary Industries, NSW, Australia. There were 14 foreign participants from 10 different countries and 2 local Thai participants at the RTC. The participants will use the knowledge they have

gained from this RTC to establish the best system for measuring methane from ruminants *in vivo* in their home countries. This will enable them to establish the "baseline" methane emissions from ruminants under current management practices in each region and monitor the changes in emissions that occur in response to the introduction of feed types and management practices.

Consultants Meeting on Devices and Systems for Early and Rapid Detection of Animal Diseases, Early Response to Emerging Diseases

Technical Officer: Gerrit Viljoen

This consultants meeting was held from 16 to 18 May 2006.

Purpose: To evaluate progress and recommend future direction in the development of tools used for detection of transboundary animal diseases, including zoonotic agents. The goal is to provide early warning tools used globally for improvement of livestock production and health.

Overall conclusion: The rapid spread of avian influenza between countries and into new species, continues to intensify the risk of a pandemic, and critically emphasizes the need for global efforts to provide early detection and diagnosis of high-threat transboundary animal diseases. The findings and direction proposed during the prior Joint FAO/IAEA Consultants Meeting were used by the international community in introducing new technologies for disease detection and diagnosis to the member states. Additionally, the identified need for enhanced collaborative efforts involving private industry, governmental agencies, and researchers were recognized, with progress in this area exceeding expectations in advancing appropriate technologies, including robotics, for field and laboratory use. Continued efforts are needed to improve affordability, enhance flexibility, and provide seamless integration from sample collection through reporting that would allow routine use by the farmer, by veterinary authorities, as well as by the range of local, regional, and reference veterinary laboratories.

Current and future devices: Technology is expanding to better adapt to fit-for-purpose use, encompassing a broader range of environments and diverse capabilities from rapid on-site detection to high-throughput multiple disease diagnosis and agent characterization. Alternate sampling technologies, including environmental-air sampling tools have demonstrated feasibility for detection of pathogens in animal environments, and now require appropriate validation in the field. Amplification systems, in the form of realtime PCR as well as isothermal amplification approaches have moved from research environments to routine diagnostic application. Biosensors and micro-array technology in solid (gene-chip, protein chips) and liquid (bead-based) formats are currently being developed and validated specifically for livestock applications. Broad distribution of standardized and specific reagents has been facilitated through bio-stabilization, in turn expanding user-accessibility to technologies ranging from dipstick and ELISA based antigen or antibody detection to closed-system realtime PCR. To ensure that affordable and quality diagnostic tools continue to be developed and available to the global veterinary community will require an expanded and sustainable partnership of academic, governmental, and commercial stakeholders.

Reagent stabilization, miniaturization, micro-fluidics and information technologies should be combined to provide tools for complete integration of the diagnostic process from sample collection, through processing, testing, to reporting. Lab-on-a-chip and autonoumous-linking of devices that address the needs to detect, diagnose, and confirm are now being developed for

veterinary applications. These rapid advances in technologies can facilitate the transfer of appropriate applications to developing country diagnostic laboratories

and national veterinary authorities to assist them to address transboundary animal diseases of threat.

Conclusions and recommendations

- The Joint FAO/IAEA Programme should continue to aid in coordination of global efforts to develop, deploy, and support the use of early warning technologies for detection of animal and human pathogens or toxic agents that threaten the safety of the world's food supply and public health by Member States.
- International guidelines and coordinated efforts will be needed to assure the sustainable use of appropriate tools through continuous training, education, communication and backstopping.
- The broad and coordinated use of appropriate devises and tools is critical to the success of early warning alert systems.
- Gene amplification technology has demonstrated value and warrants further expansion of multiplex capabilities, miniaturization, speed, portability, and ruggedness.
- Technologic advances will allow tools with full integration of sampling, detection, diagnosis, and reporting processes, this approach should be promoted and indeed here the Joint FAO/IAEA Programme should play a critical role in technology transfer, training and outreach to Member States.
- Veterinary diagnostic laboratories should be enabled and prepared to respond to emerging diseases of threat and targeted training to pivotal personnel provided.
- Application of appropriate tools should be encouraged and promoted through international cooperation in field validation and deployment efforts.
- Harmonization of methods used in detection and diagnosing of diseases should be provided through accessible reference standards, proficiency evaluations, and ongoing field validation.
- A follow-up meeting should be scheduled within the next 12 months because of the rapid rate of diagnostic tools development.

IAEA Technical Workshop to Define Breeding Strategies for South American Camelids (PER/5/027)

Technical Offier: Paul Boettcher

This meeting was held from May 31 to June 2 in Lima, Peru, with local support provided by the Peruvian Nuclear Energy Institute (IPEN). The meeting was funded by the IAEA TC Project PER/5/027. The objectives of the meeting were to discuss current and future prospects on breeding of camelids and to establish a cooperative regional network of scientists working on camelid genetics. The meeting was attended by 67 participants from Argentina, Bolivia, Brazil, Chile, Ecuador, and Peru. Day One of the meeting included presentations by experts on the use of nuclear and other technologies in breeding programmes and potential applications to camelids. Day Two comprised presentation by talks by camelid breeders and industry representatives on the current status and future needs of existing programmes, followed by break-out sessions for discussion of the most critical issues. The meeting concluded on Day Three with the proposal and acceptance of a set of recommendations of activities to be undertaken by breeders, industry personnel, scientists, and government agencies.

Ongoing Activities

The Development of Strategies for the Effective Monitoring of Veterinary Drug Residues in Livestock and Livestock Products in Developing Countries (D3.20.22)

Technical Officer: Andrew Cannavan

Work is ongoing on the final phase of the project. A summary of the results of the CRP to date was presented as a poster at the 2nd International Symposium on Recent Advances in Food Analysis in Prague, Czech Republic, 2-4 November 2005. The final RCM will be held at Munich Technical University, Germany, in November 2006.

Early Warning Devices and Tools to diagnose Known and Unknown Emerging Diseases with Special Reference to Avian Influenza

Technical Officer: Gerrit Viljoen

Background

The detection and characterization of specific nucleic acids and proteins of medico-veterinary pathogens have proven invaluable for diagnostic purposes. Apart from hybridization and sequencing techniques, ELISA and PCR and numerous other methods have contributed significantly to this process. The integration of amplification and signal detection systems including on-line real-time devices, have increased speed and sensitivity and greatly facilitated the quantification of target proteins and nucleic acids. Rugged portable real-time instruments for field use and robotic devices for processing samples are already available commercially.

Nucleic acid based technologies are making considerable contributions to the field of diagnostics. PCR-based assays are already being utilized routinely by many laboratories and on-going developments are refining as well as expanding their capabilities. The use of real-time PCR and automated sample processing devices have already made significant contributions in reducing contamination whilst improving test consistency, rapidity, sensitivity and throughput. Improving the sensitivity of detection would also obviate the need to perform amplification reactions and its requirement to have suitable primers to amplify the target sequence. Several alternative target, probe and signal amplification systems have been described (LCR, SDA, RCA, bDNA, invasive cleavase). In addition, technologies to enhance separation and detection of nucleic acids have been developed (capillary electrophoresis, mass spectrometry). Labelling and detection methods other than radioactivity are also making important contributions (enzymatic, fluorescence, chemiluminescence, and nanoparticle labelling). Nevertheless, conventional microbiological assays should be maintained to validate and guide further developments with the newer diagnostic approaches. Commercial kits for the molecular detection of the most important pathogens are increasingly becoming available. There is also a need to standardize nucleic acid assays through ring tests and the establishment of suitable guidelines and quality control programmes. The availability of lyophilized standards will assist in this process. The need for suitably trained staff to perform and evaluate nucleic acid- and protein-based assays, as well as the costs associated with many associated technological platforms is also an important requirement and in some cases an obstacle for their wider application. There is a need for centralized facilities to perform such tests but developments in integrated systems are likely to allow for future point-of-care testing. Rapid developments in biosensors are producing more effective biological recognition molecules as well as transducers. Many of these have the potential of generating signals following the detection of single molecules. Microarray technologies have the potential of parallel testing large numbers of pathogens simultaneously, and this can have significant contributions to the diagnostic capabilities of many laboratories. Developments on the integration of sample processing, amplification and analysis and the eventual production of effective commercial testing devices would herald an important achievement in allowing for point-of-care testing. Advances in nanotechnology have potentially important contributions to make in this process, with the likelihood that test results could be obtained within minutes. Suitable wireless communication systems with centralized data banks as well as access to decision making tools will allow for speedy therapeutic and prophylactic decision making, a desirable achievement in any effective diagnostics programme.

The IAEA, in collaboration with the FAO, OIE and WHO are aware of the dynamic changes in technologies and equipment and therefore organized this technical consultants meeting regarding Early Warning Devices and Tools to Diagnose Known and Unknown Emerging Diseases. The topics for discussion will include early warning devices and systems – the technology; amplification systems ("back-pack" lightcycler, self sustainable devices, on-line real-time PCR devices, hand held devises, "lab on a chip"); on-site types (dipsticks, non amplification systems); biosensors, remote sensing (e.g. infra red detection); nano-equipment; communications technologies (GPRS/mobile phone-IR-laptop-satellite-information centre etc., bioinformatics, electronics etc.), administrative, logistical set-ups, networks, partnerships etc.) and other items. The big issues of discussion: “Where is the technology now and how can we use it maximally?”.

Although the H5N1 avian influenza (AI) virus has existed since 1996, the true crisis in Asia started in early 2004 with the almost simultaneous declaration that the disease was killing hundreds of thousand of chickens and ducks in ten countries. As per 1 November 2005, there have been 122 human cases with 62 fatalities, and more than 140 million dead or culled birds. Economic losses to the Asian poultry sector are estimated to be at least US$ 10 billion. Avian Influenza, due to Highly Pathogenic Avian Influenza (HPAI) H5N1 sub-type (HPAI-H5N1), is threatening the livelihood of hundreds of millions of poor livestock farmers, jeopardizing smallholder entrepreneurship and commercial poultry production, and seriously impeding regional and international trade and market opportunities.

Highly pathogenic avian influenza (HPAI) now commonly known as “bird flu” is caused by the infection with some strains of Influenza A virus. The different strains of this virus are classified into subtypes on the basis of their two external proteins named haemagglutinin (H) and neuraminidase (N). Techniques that are implemented for the diagnosis of avian influenza aimed at demonstrating first the presence of the causal virus in pathological samples and then at assessing its pathogenicity. Indeed, only some strains of avian influenza, highly pathogenic (HPAI), are at the origin of outbreaks and they belong to the H5 or H7 subtypes. The current avian influenza outbreak which started in Asia in 2004 is caused by a virus of H5 subtype. In addition, this virus was further characterized as of the N1 subtype which is able to cause deaths in humans.

Usually, from the pathological sample, the virus is first isolated in embryonated fowl eggs which takes 4 to 7 days to complete. Then the subtype of the isolated virus is identified by a battery of specific antibodies raised against the different H (H1 to H15) and N (N1 to N9) proteins. This way of identification is carried out only in specialized laboratories. To confirm a subtype’s pathogenicity, the isolate is then inoculated into 4 to 8 week-old susceptible chickens. For the World Organization for Animal Health (OIE), strains are considered to be highly pathogenic if they cause more than 75%

mortality in inoculated chickens within 10 days. An alternative way to demonstrate the presence, and characterize the influenza virus in the pathological samples, is the specific detection of its RNA by nucleic acid amplification techniques (PCR and PCR sequencing, using either fluorescent or isotopic [P^{32}, P^{33} or S^{35}] markers). This molecular approach takes 1 to 2 days to complete. Furthermore, it is foreseen that this technology could be applied as early warning tools.

Present activities related to avian influenza:

The IAEA, in particular the Joint FAO/IAEA Programme (related to the control of transboundary animal diseases) is supporting Member States in their efforts to control diseases of importance. To this effect we are involved, through FAO (AGAH and EMPRES), regarding individual technical requests from Member States (or any other party) in giving technical advice to Member States as to the diagnosis of the disease, the best "fitness for purpose" tools and quality assured procedures, including vaccines, to use in close collaboration and consultation with experts in the field. In the case of avian influenza it is important for the rapid and differential diagnosis to classify isolates as highly pathogenic or not in order to activate appropriate control measures – this is seen as the bottleneck activity for most developing countries.

Future plan of action

The molecular diagnosis of avian influenza is important – PCR to determine that it is avian influenza and PCR sequencing (fluorescent or isotopic based) to determine whether it is H5N1 or another subtype. It is here that the Joint FAO/IAEA Programme can play a role in supporting the actions of the FAO, OIE, WHO and Member States. The subprogramme can provide technical assistance on (1) which tests and protocols to use, (2) technical and laboratory training, (3) expert missions (nominating relevant expert(s) or to perform expert missions by members of the subprogramme), (4) the analysis of avian influenza samples (as primary diagnosis or as confirmation) utilizing the OIE reference status of our Seibersdorf laboratory (i.e. the analysis of translation products of the virus genome), (5) the provision of technical quality assurance guidelines and support to ensure quality data and reporting.

Development of OIE Guidelines for Submission of Tests for Approval and Registration

Technical Officer: John Crowther

The Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture in Vienna, Austria, has long experience in helping to develop and validate assays and has provided strong support in developing OIE norms. Scientific landmark OIE guidelines for validation of tests have been developed through cooperation with the Animal Production & Health Section. The guidelines concentrate on identifying the fitness for purpose of any test and demand justification of the criteria used to validate such tests. The guidelines can be seen on the OIE webpages http://www.oie.int/eng/en_index.htm.

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

Contracts are being given to develop three models:

i. Statistical approaches in animal sciences as models for good practice in research design and analysis.
ii. Writing scientific literature.
iii. Impact assessment of R&D investment in agricultural Projects.

IAEA Collaborating Centre in Animal Genomics and Bioinformatics

Technical Officer: Fernando Garcia

On 20 January 2006, the recently established IAEA Collaborating Centre in Animal Genomics and Bioinformatics was inaugurated at the Animal Biotechnology Laboratory – Escola Superior de Agronomia Luiz de Queiroz/ESALQ - University of São Paulo/USP – Brazil.

During the opening ceremony Mr. Garcia read the message from Mr. Werner Burkart (Deputy Director General of the Department of Nuclear Sciences and Applications – IAEA) This message highlighted the importance of the IAEA Collaborating Centres on the diffusion of nuclear knowledge by means of close and strong interactions with advanced technology centres. It also mentioned Mr. Burkart's commitment to working with other parties in order to implement the United Nations Millennium Development Goals, using the unique advantages of nuclear technologies.

After the inauguration ceremony, a meeting with the four constituting laboratories (including Mr. Luiz Coutinho – ESALQ/USP via conference call from the USA) took place. Focus should be on organizing a training course on molecular genetics and bioinformatics applied to livestock and the Collaborating Centre web page planned to be launched in the 2nd semester 2006.

During April/May 2006 the UNESP laboratory trained Mr. Juan Agapito Panta from the Instituto Peruano de Energia Nuclear (IPEN) in microsatellite DNA analysis under the IAEA TC project PER/5/010, aiming the implementation of a DNA analysis laboratory dedicated to the genetics of alpacas in Peru. A Technical Contract

was signed between APHS and UNESP in order to work on the development of a set of molecular markers on sheep and goat, that will be used in future APHS training and research activities.
A regional research and innovation initiative is in preparation and will be submitted to the Brazilian research development council (CNPq). The aim is to establish technology transfer mechanisms, specifically in the field of breeding and selection in livestock (mainly South American camelids and sheep living the Andean region). For this purpose a group of interested researchers from Ecuador, Peru, Chile, Bolivia, Argentina and Brazil was formed and is currently working on a project which will be submitted by the end of June 2006.

Coordinated Research Projects

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

Technical Officer: Paul Boettcher

This CRP is currently in its fifth and final year and has a full complement of participants, comprising ten Research Contracts, one Technical Contract and four Research Agreements. The final RCM is scheduled in Edinburgh, UK, from 4 to 8 December 2006. Contract holders are currently revising manuscripts on their Participatory Rural Appraisals and Economic Opportunity Surveys, which are scheduled to appear in a special issue of Tropical Animal Production and Health in 2006. In addition, the final data is being collected on the interventions applied to overcome the most serious constraints on farm income as identified by the Economic Opportunity Surveys. These results obtained will be reported at the upcoming RCM.

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

Technical Officer: Phil Vercoe

There are currently eight Contract holders and five Agreement holders in this CRP. During the last RCM held in Zurich from 12 to 16 September 2005 there were extensive discussions about the need to test the persistency of effects of different plant/plant extracts on rumen fermentation parameters. A technical contract has been prepared to evaluate a method for testing persistency that involves a continuous fermentation system and real time PCR. Contract holders have validated their real time PCR methodologies for quantifying methanogen populations using 2-Bromoethanesulphonic acid and are now starting to screen plant secondary compounds for their effect on *in vitro* methanogenesis, investigating ciliate protozoal activities using a ^{14}C-labelling technique and screening plants showing promise for initial studies for their persistency and microbial adaptation. The next RCM for this CRP is tentatively scheduled for February 2007 and a training course in analyzing microbial diversity and associated bioinformatics is also planned for 2007.

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

Technical Officers: 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 small ruminants. Between October 2005 and April 2006,

delegates from the counterpart institutions traveled to ILRI in Nairobi for training in microsatellite analysis and analysis of the resulting data for genetic characterization of the breeds. Preliminary analyses indicate that the goats sampled originated from three distinct genetic groups. These results will be presented at the upcoming Australia-Asian Animal Production meeting in September in the Republic of Korea. Other biodiversity related markers (mitochondrial DNA and Y chromosome markers) will also be included in this research, as well as functional markers (single nucleotide polymorphism – SNP). The protocols for the analysis of these markers are being developed through joint activities between the Animal Production Unit in Seibersdorf and the IAEA Collaborating Centre in Animal Genomics and Bioinformatics in Brazil.

The Development of Strategies for the Effective Monitoring of Veterinary Drug Residues in Livestock and Livestock Products in Developing Countries (D3.20.22)

Technical Officer: Andrew Cannavan

Work is ongoing on the final phase of the project. A summary of the results of the CRP to date was presented as a poster at the 2nd International Symposium on Recent Advances in Food Analysis in Prague, Czech Republic, 2–4 November 2005. The final RCM is tentatively planned for November 2006, venue yet to be agreed.

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.

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 now started. Proposals from eleven countries are accepted and will have support through the agreement holders from CIRAD-EMVT, University Berne and the Veterinary University Vienna. The focus will be in the first 18 months on the final validation of the c-ELISA and the LPPQ ELISA. We expect the first data already for our first Research Coordination Meeting (RCM) at the end of November in Windhoek. These data should guide us for planning the experiments on the remaining issues according to the OIE procedures. An intra-dermal test for CBPP will soon be assessed in Angola and primary data will be available for the RCM. Experiments carried out in Berne with an iso-thermic PCR show the potential to be used as a new tool for early diagnoses of the infection in the field. Details of this test and the necessary research on sampling and sample preparation will be discussed in Windhoek. Molecular epidemiology will be another hot topic and different strategies to delineate the "evolution" of CBPP and their useful application will be explored.

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

Development of Modern Technologies and Systems to Aid Field Side Rapid Diagnosis and Surveillance of Transboundary Livestock Diseases of Livestock and Man

Technical Officer: John Crowther

A CRP entitled Development of Modern Technologies and Systems to Aid Field Side Rapid Diagnosis and Surveillance of Transboundary Livestock Diseases of Livestock and Man is being prepared and advertised soon. It will focus on the use of modern technologies in diagnostic laboratories and field side systems to assist in the early and rapid diagnosis of known and unknown emerging diseases affecting animals and man. Improved opportunities exist today through developments in molecular methods and communication technologies to provide a system (i.e. the test, analysis and interpretation) whereby disease agents can be sampled, tested and results reported, in the space of minutes, alleviating the need to send samples to laboratories for primary diagnosis. Please see the section on the Early Warning Consultant Meeting for more information.

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.iaea.org/programmes/ri/uc.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.as

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 Standard RNA Sample to be Used as Positive Sample in PCR Test for PPR Diagnosis

In view to avoid test sample contamination with positive contol sample, the Animal Production Unit has now constructed an RNA which contains two fragments of PPRV RNA genome and used as targets for PPR diagnosis by PCR. A deletion of about 60 nucleotides has been introduced into each target RNA to enable their differentiation with the amplicons from test samples. It is forseen to introduce into this control PPR RNA a fragment of BVDV RNA corresponding to the target for pestiviruses diagnosis by PCR. This deleted control RNA will be used in the PPR PCR ring test the Animal Production and Health Subprogramme would like organize by the end of the year or early next year

Identification and Characterization of Single Nucleotide Polymorphisms in Candidate Genes Related to Parasite Resistance

Studies to identify molecular markers linked to parasite resistance have been initiated in recent in APU. QTL (quantitative trait loci) studies in sheep and goat by different researchers groups have confirmed the existence of several loci conferring resistance towards helminths. Using available information on the gene bank and data from other on-going research, the INFG (Interferon gamma) and MHC-DRB1 genes have been selected for the identification of putative SNP sites related to parasite resistance. The Animal Production Unit has started the search of possible SNP sites in both genes, with the main objective of obtaining markers to be used as a tool in breeding strategy to obtain small ruminants tolerant to helmint infection.

Development of a Diagnostic Test on Living Animals to Help Improve the Efficiency on Breeding Programmes to Increase Genetic Resistance of the Flocks to Scrapie

It is widely known that the presence of arginine (R) at codon 171 of the prion protein confers resistance to the prion protein undergoing the structural change associated with scrapie. On the other hand, the presence of glutamine (Q) or histidine at codon 171 results in the prion protein being susceptible to the structural change. The Animal Production Unit is currently developing a test for identification of scrapie resistance/susceptibility based on the use of TaqMan technology. The study is aiming at finding an approximate indication of allele frequency of individual breeds, identifying susceptible or resistant flocks. It is expected to find a tool that can help improve our ability to predict disease resistant/susceptibility status and also which can be used in scrapie disease mechanism studies.

Training in the APU

Mr. Traoré Abdallah finished his training at the Animal Production Unit end of April and returned to his institute, Laboratoire Central Vétérinaire at Bamako, Mali.

Technical Coorporation Projects

Operational Projects and Technical Officers responsible for implementation

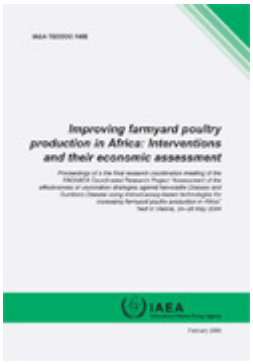
ANG/5/002	Upgrading Laboratory Services for Diagnosis of Animal Diseases	Crowther Viljoen
ANG/5/003	Veterinary Drug Residues Monitoring Programme	Cannavan Byron
ANG/5/004	Monitoring and Control of Transboundary Animal Diseases	Crowther
BEN/5/002	Diagnosis and Control of Animal Diseases	Crowther Viljoen
BEN/5/003	Veterinary Drug Residue Monitoring Programme	Cannavan Byron
BKF/5/002	Development of a Veterinary Medicine to Combat the Fowl Pox Virus	Viljoen
BOL/5/016	Diagnosis and Molecular Characterization of the Foot-and-Mouth Disease Virus	Crowther
BYE/9/006	Rehabilitation of the Chernobyl-Affected Territories	Crowther
CHI/5/046	Certification of Exported Animal Products Using Nuclear and Other Analytical Techniques	Cannavan Byron
CMR/5/011	Nuclear Techniques for Improving Local Ruminant Productivity	Boettcher
CMR/5/012	Diagnosis and Surveillance of Major Animal Diseases Using Molecular Biology Techniques	Crowther
COL/5/020	Use of Protein Banks for Improving Pork Production	Vercoe
CPR/5/014	Increasing the Productivity of Crop/Livestock Production System	Vercoe
CYP/5/018	Improving Artificial Insemination Efficiency and Cattle Fertility	Boettcher
ELS/5/010	Improving Nutrition Practices and Reproductive Efficiency in Cattle	Vercoe
ERI/5/003	Monitoring and Control of Transboundary Animal Diseases	Viljoen
ETH/5/012	Integrating Sterile Insect Techniques for Tsetse Eradication	Feldmann Viljoen
ETH/5/013	Veterinary Drug Residues Monitoring Programme	Cannavan
HON/5/002	Improvement in the Nutritional and Sanitary Conditions of Cattle to Enhance their Productivity through Nuclear Methods	Vercoe
INS/5/029	Supplementary Feeding and Reproduction Management of Cattle	Vercoe Boettcher
INS/5/032	Improving Beef and Dairy Cattle Production in Yogyakarta	Vercoe Boettcher
INT/5/148	Establishing Quality Systems in Veterinary Testing Laboratories	Viljoen Crowther
IRA/5/012	Preparation of ELISA Kits for Diagnosis of Foot-and-Mouth Disease	Crowther
IVC/5/028	Surveillance and control of African Swine Fever	Diallo Unger
KEN/5/025	Development of Diagnostic Tests and Vaccines for Livestock Diseases	Unger
MAG/05/12	Increasing Self-sufficiency in Domestic Meat and Milk Production	Vercoe
MAL/5/025	Food Safety Monitoring Programme for Livestock Products	Cannavan
MLI/5/019	Improving Pneumopathies Diagnosis in Ruminants Using PCR	Viljoen
MON/5/012	Monitoring of Residues in Livestock Products and Surveillance of Animal Diseases	Cannavan Crowther

MON/5/013	Diagnosis and Surveillance of Transboundary Animal Diseases and Production of Diagnostic Reagents	Crowther Viljoen
MYA/0/006	Human Resource Development and Nuclear Technology Support	Crowther
MYA/5/011	Development of Supplementary Feeding Strategies Based on Local Feed Sources	Vercoe
MYA/5/012	Diagnosis and Control of Swine Vesicular Disease and Swine Brucellosis	Crowther
MYA/5/013	Integrated Approach for Enhancing Cattle Productivity	Vercoe
NAM/5/007	Control of Animal diseases in Northern Namibia	Viljoen
NER/5/011	Upgrading Laboratory Services for Diagnosis of Animal Diseases	Diallo Unger
NIC/5/007	Determining Drug Residues in Bovine Meat Exports	Cannavan Byron
NIR/5/032	Control and Eradication of African Swine Fever	Crowther
PAN/5/014	Improving Cattle Production and Quality Control for Monitoring of Animal Diseases	Crowther Viljoen
PER/5/027	Use of Nuclear Techniques to Improve Alpacas Productive and Reproductive Methods	Boettcher
RAF/0/013	ICT-Based Training to Strengthen LDC Capacity	Crowther Boettcher
RAF/5/046	Increasing and Improving Milk and Meat Production (AFRA III-2)	Boettcher
RAF/5/053	Assistance to OAU/IBAR PACE Programme for the Control and Eradication of Major Diseases Affecting Livestock	Viljoen Lelenta
RAF/5/054	Improvement of Livestock Productivity through an Integrated Application of Technologies (AFRA III-4)	Boettcher
RAF/5/055	Support to African Union's Regional Programmes for Control and Eradication of Major Epizootics	Viljoen
RAS/5/035	Improving Animal Productivity and Reproductive Efficiency (RCA)	Vercoe Boettcher
RAS/5/041	Production of Foot-and-Mouth Disease Antigen and Antibody ELISA Reagent Kit (RCA)	Crowther
RAS/5/044	Integrated Approach for Improving Livestock Production Utilizing Indigenous Resources and Conserving the Environment (RCA)	Garcia Boettcher
RER/5/012	Regional Control of Brucellosis in Sheep and Goats (core 2003–2007)	Crowther
SAF/7/002	Development of Veterinary Vaccines and Strengthening Drug Residue Laboratory Capabilities	Crowther Viljoen
SIL/5/006	Improving the Productivity of N'dama Cattle	Boettcher Vercoe
SRL/5/039	Monitoring of Chemical Residues and Food-borne Pathogens	Cannavan
SUD/5/027	Control of Ticks and Tick-Borne Diseases Using ELISA	Unger
SUD/5/028	Epidemiology and Control of Snail-borne Diseases in Irrigated Areas	Crowther
SUD/5/029	The Characterization and Quality Assured Production of an Attenuated Theileria Annulata vaccine	Crowther
TUN/5/021	Fodder Shrubs as Feed Resources to Improve Livestock Productivity	Vercoe
UGA/5/026	Monitoring and Control of Foot-and-Mouth Disease	Crowther
URT/5021	Livestock Development in Zanzibar After Tsetse Eradication	Boettcher Vercoe Viljoen
UZB/5/003	National Livestock Feed Quality database	Vercoe
YEM/5/004	Improving the Diagnosis of Animal Diseases	Crowther
YEM/5/005	Monitoring of Veterinary Drug Residues	Cannavan
YEM/5/006	Quality Management for Upgrading Animal Disease Control	Crowther Viljoen
ZAI/5/014	Upgrading Laboratory Services for Diagnosis of Animal Diseases	Crowther
ZIM/5/010	Improvement of Veterinary Diagnostic Laboratory Services	Unger

Publications

Recent Publications

Improving Farmyard Poultry Production in Africa: Interventions and their Economic Assessment



IAEA-TECDOC-1489

ISBN 92-0-101206-3

Date of publication: February 2006

This TECDOC is the product of the final meeting of the Coordinated Research Project on Assessment of the effectiveness of vaccination strategies against Newcastle disease and Gumboro disease using immunoassay-based technologies for increasing farmyard poultry production in Africa, initiated and supported by the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture.

It contains the results of the interactive collaboration of the chief scientific investigators, research agreement holders, research contract holders and IAEA experts to assess, improve and finally economically analyse the impact of avaccination and management strategies against Newcastle Disease, Gumboro Disease and Fowlpox. Its use is intended for poultry specialists involved in the diagnosis and control of infectious diseases, field veterinarians confronted with poultry production problems and veterinary authorities planning such control programmes. This TECDOC contains a wealth of data useful for teachers and students of veterinary universities and colleges.

Guidelines and Recommendations for Improving Artificial Breeding of Cattle in Asia

IAEA-TECDOC-1480

ISBN 92-0-112005-2

Date of publication: November 2005

This manual of protocols, procedures, guidelines and recommendations was produced under an IAEA Technical Cooperation Project entitled Improving Animal Productivity and Reproductive Efficiency that was implemented within the framework of the RCA programme, with technical support of the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture. It is the result of interactive collaboration between the national Project Coordinators of the project, several experts in AI in the participating Member States, IAEA experts who assisted with the project and the Technical Officer from the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture. The manual is intended for livestock specialists involved in the provision of artificial insemination (AI) services to cattle farmers in Asia, including those in Ministries of Agriculture/Livestock, Departments of Livestock and Veterinary Services, AI centres, semen distribution centres and field level AI Service points. It is also a useful resource for teachers and students in faculties of Veterinary and Animal Sciences, and those involved in the training of AI technicians.

In Press

Improving Animal Productivity by Supplementary Feeding of Multinutrient Blocks, Controlling Internal Parasites, and Enhancing Utilization of Alternate Feed Resources

IAEA-TECDOC-1495

ISBN 92-0-104506-9

This publication is a comprehensive overview of the practical aspects of developing and using urea–molasses multinutrient blocks in different parts of the world. Livestock farming is important for provision of animal protein for human consumption, and as a source of income for many poor farmers in developing countries. With the increase in human population and economic growth of many Asian countries, the demand for livestock products will increase considerably in the coming years. However, the main constraint to livestock development in these countries is the scarcity and fluctuation of the quality and quantity of the year-around animal feed supply. Increased population and industrialization are making the arable land scarce and in addition a large area of arable land is being degraded due to human activities. For sustainable development of the livestock sector it is essential to secure sufficient supply of balanced feeds from resources, which do not compete with human food. The conventional feeds such as soya bean, groundnut, rapeseed meals etc., are either not available or are available at a very high cost. Therefore, there is an urgent need to efficiently utilize locally available feed resources such as tree and shrub leaves, agroindustrial by-products and other lesser known and new plants

adapted to harsh conditions and capable of growing in poor, marginal and degraded soils. Another important limiting factor for enhancing animal productivity in the tropical countries is heavy internal parasitic load in livestock. Results from the regional IAEA TC project entitled Improving Animal Productivity and Reproductive Efficiency RAS/5/035 are presented in this publication. It is hoped that this publication will be of great practical value to extension workers, students and researchers, and to those thinking of using such feed supplementation technology or of starting commercial production.

In Preparation

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

A document 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 document 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 DOCUMENT 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

FAO/IAEA Working Manual on Measurement of Methane from Ruminants

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.

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 envi-

ronmental 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 for writing 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 The Use of Non-structural Protein of Foot-and-Mouth Disease Virus (FMDV) to Differentiate between Vaccinated and Infected Animals.

The 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 have been written and will be submitted for publication in June.

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 DOCUMENT has been completed and will be submitted for publication in June.

Publications in Scientific Journals and Conference Proceedings

A paper entitled Tests used for diagnosis and surveillance of livestock diseases — aspects of kit validation, producer and end-user responsibilities by AP&H staff - J.R. Crowther, H. Unger and G.J. Viljoen, has been accepted for publication in the Rev. sci. tech. Off. Int. Epiz.

The Joint FAO/IAEA Programme of the IAEA in Vienna, Austria, has a long experience in helping to develop and validate assays and has provided strong support in developing OIE norms. This paper will focus on ELISA and PCR as the major technologies exploited in diagnosis and surveillance. Problems involving the terminology and factors in kit production, supply and validation are examined, in particular emphasizing the importance of robustness and ruggedness of tests. The responsibilities for achieving quality controlled data to solve diagnostic and surveillance of producers, distributors, users and national and international organizations are discussed. The roles of internal quality control (internal proficiency testing) and external quality assurance (external proficiency testing) as well as aids to solving problems with kits are examined.

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

Information on New FAO titles:

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 Strenghten 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.

Questionnaire for Participants in APHS Projects (CRP and TC), Meetings, Workshops, Fellowships, Scientific Visits and Training Courses

An evaluation of the Animal Production and Health subprogramme is currently being performed. In order to assist us in this process we would appreciate your cooperation in filling out the attached questionnaire and return it by mail, facsimile or email:

Animal Production and Health Section
Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture,
Vienna International Centre, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria;

Fax (43-1) 26007 26052
email: aph-webcontact@iaea.org

Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Animal Production and Health subprogramme (APHS)

Questionnaire for Participants in APHS Projects (CRP and TC), Meetings, Workshops, Fellowships, Scientific Visits and Training Courses

1) What is the nature of your association with the APHS projects?

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2) What is your assessment of the scientific merit of the APHS project that you are/were associated with?

☐ Very good ☐ Good ☐ Satisfactory ☐ Unsatisfactory

3) Please give any comments on the scientific merit of the APHS project.

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4) Are you satisfied with your interactions with the APHS technical staff in regard to project planning?

☐ Very good ☐ Good ☐ Satisfactory ☐ Unsatisfactory

5) Are you satisfied with your interactions with the APHS technical staff in regard to project implementation?

☐ Very good ☐ Good ☐ Satisfactory ☐ Unsatisfactory

6) Are you satisfied with your interactions with the APHS technical staff in regard to project backstopping (e.g. provision of technical advice and material inputs)?

☐ Very good ☐ Good ☐ Satisfactory ☐ Unsatisfactory

7) As a result of your participation in an APHS project have you increased your capacity to improve animal nutrition/reproduction/health?

☐ Yes ☐ No ☐ Not applicable

8) If you marked “yes” for the question above, please give a description of the increase in capacity

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9) As a result of your participation in an APHS project has the production and health of livestock in your country or in the region of the project improved?

☐ Yes ☐ No ☐ Do not know

10) If you marked “yes” for the question above, please give a description of the type of change and an estimate of the percentage change.

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11) How would you describe the usefulness or applicability of the results that have been produced during the APHS project to other end-users?

☐ Very good ☐ Good ☐ Satisfactory ☐ Unsatisfactory

12) If you marked "Very good" "Good" or "Satisfactory" for the question above, please give a description of the uses or applications of the results

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13) Please give any additional comments on ways we could improve the APHS project and uptake of its results or outputs by end-users.

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14) What is your perception about the overall services provided by the APHS with regard to technical guidance and support?

☐ Very good ☐ Good ☐ Satisfactory ☐ Unsatisfactory

15) What is your perception about the overall services provided by the APHS with regard to publications?

☐ Very good ☐ Good ☐ Satisfactory ☐ Unsatisfactory

16) What is your perception about the information provided by the APHS on their website and newsletters?

☐ Very good ☐ Good ☐ Satisfactory ☐ Unsatisfactory

17) Could the APHS make more use of the website? If yes, how?

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18) What is your perception about the relevance of the overall APHS to the priorities and needs of your country?

☐ Very good ☐ Good ☐ Satisfactory ☐ Unsatisfactory

19) If you clicked "Not Satisfactory" for the question above, please describe how the subprogramme could be made more relevant.

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20) Any other comments or suggestions?

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21) Please identify the country and institution you are associated with (optional)

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International Atomic Energy Agency

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