# Animal Production and Health Newsletter

JOINT FAO/IAEA DIVISION OF NUCLEAR TECHNIQUES IN FOOD AND AGRICULTURE
AND FAO/IAEA AGRICULTURE AND BIOTECHNOLOGY LABORATORY, SEIBERSDORF
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA

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## CONTENTS

## *Dear Colleague,*

You will recall that in mid-1996 the Animal Production and Health Sub-programme was subject to an extensive external review covering the past 10 years and what was proposed for the medium term (next 5 - 7 years). Following this review and as we start the 1997/98 biennium, we therefore are assured in the knowledge that we have a fully mandated programme with the appropriate focus. If you had an opportunity to read the last Newsletter detailing the outcome of the review, you will be aware that there will be no major changes of direction but more a shift towards problem-orientated research and support, with immunoassay technologies (RIA and ELISA) remaining firmly part of the programme.

Thus we are continuing our FAO/IAEA Co-ordinated Research Projects (CRPs) on using the ELISA; for monitoring trypanosomosis and rinderpest control and eradication programmes in Africa; foot-and-mouth disease (FMD) control in Asia; and international validation of assays for brucellosis and foot-and-mouth disease in Latin America. In 1997, whilst we will complete this latter CRP on assay validation, we will commence support for a new CRP on monitoring contagious bovine pleuro-pneumonia (CBPP) control programmes in Africa.

In terms of RIA, the focus here remains on using the RIA progesterone assay to monitor reproductive activity in livestock as an indication of productivity levels. As was recognised by much of the work supported in developing countries during the past ten years, the main problems are the ones of poor nutrition and inappropriate management. We have CRPs therefore dealing with looking at alternative feed resources and management practices relating to national artificial insemination services and utilising changes in reproductive performance as criteria for improved productivity.

Our review also identified the need to look at alternative technologies and new support areas. We will continue the CRP looking at the use of measuring purine derivatives in urine as a measure of rumen microbial digestion and we have commenced support for a new CRP on the use of the polymerase chain reaction (PCR) in animal disease diagnosis (principally rinderpest and CBPP). In entering new activity areas, we have commenced a support programme for assisting national laboratories to conduct screening for veterinary drug residues in livestock and livestock products, and we are seeking support for a CRP in aquaculture concerned with progeny testing using DNA microsatellite technology.

You will find more detailed accounts of all these activities in this Newsletter but I hope that from this brief overview you will get a feel for the extent and the concepts behind our 1997/98 Sub-programme.

In April of this year, we held an International Symposium at the Vienna International Centre entitled "Towards animal disease diagnosis and control in the 21$^{st}$ Century". Some 165 delegates attended this Symposium and I would like to take this opportunity to thank all those who attended this meeting and made it the success that it clearly was! From the many presentations we learned a great deal about the technologies and approaches that are likely to be used in the future. It is clear that a whole range of biosensors are becoming available that can provide the

diagnostician and research worker with assays of unique sensitivity and specificity although perhaps at a cost that may prohibit their use in developing countries for some time to come! Equally important though, several speakers highlighted the need to retain proven and tested methodologies and that, in the final analysis no amount of "cutting-edge" technology will sustainably control or eradicate animal disease without a functioning veterinary field service!

No-one can surely be unaware of the enormous impact of the computer and the "Internet" on information exchange and communication and we are certainly actively involved in trying to improve links with you using such approaches. In this context, I would like to draw your attention to the "Home Pages" of both FAO and IAEA on the World Wide Web which provide you with access to information on the Joint FAO/IAEA Division and the Animal Production and Health Sub-programme. We are increasingly adding information to this site and eventually you should be able to get information on every aspects of our programme. Indeed, it is envisaged that in the not too distant future this Newsletter will be made available on our Home Page along with all the necessary applications forms for support programmes.

Equally important for many of our counterparts has been the use of the E-mail which is enabling us to contact you rapidly and deal with matters that would previously have taken several letters or faxes.

Having said all this, please rest assured that those of you who do not have access to either E-mail or Internet will not be neglected. We are only too well aware of the difficulties of establishing and funding such communication links and that many of you will not be able to make use of such technologies for some time. We will certainly continue to communicate in exactly the same way as before to ensure that ALL of you are kept informed of our programmes and our support activities .

Whilst at the beginning of this introduction I mentioned that we have only just started a new biennium (1997/98) of support activities, I need to draw your attention to the need to submit **now** proposals for support under the 1999/2000 programme of IAEA Technical Co-operation (TC). As in previous years, proposals need to be submitted at the latest, one year in advance of a biennium. Thus, if you feel that you would benefit from support through our Department of Technical Co-operation by the establishment of an IAEA TC Project, you will need to submit proposals by the end of this year **at the very latest**.

Proposal forms for an IAEA TC Project can be obtained directly from us, national authority dealing with IAEA, or from your local UNDP office. You will need to submit such proposals through the appropriate national authority in your country designated to deal with IAEA and this is usually your national Atomic Energy Commission (AEC) or Ministry of Energy. You will need to be aware of any IAEA Country Programming Framework that has been established at the national level and the priority that your Government will set for the submission of project proposals to the IAEA. For our part, we are happy to review any proposals in areas that we are currently involved (and these are detailed throughout this Newsletter) but be aware that resources are limited and that both your Government and IAEA will need to set priorities.

With reference to submission of FAO/IAEA Research Contract proposals, I have already mentioned the commencement of a new CRP in CBPP,

but there will also be the commencement of new CRPs in poultry disease diagnosis, on validation of assays for separating FMD vaccinated from naturally infected animals, on the use of tannin assays for identifying alternative feed resources, on the use of body conditioning scoring and on veterinary drug residue analysis. Full details of these are contained in this Newsletter and whilst many of these CRPs will not commence until 1999, it is not too early at this stage to submit applications for these.

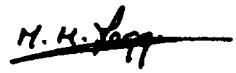
Finally, I need to turn your attention to staff changes. Fortunately, there have only been two of these since the last Newsletter, although the second half of 1997 will see many more changes. In April, Barbara Van der Eerden completed her two-year cycle with us as an FAO Associate Professional Officer. In these two years, Barbara had significantly contributed to the Sub-programme through the further development and operation of our External Quality Assurance Programme (EQAP). We had set her an enormous task and by the end of the two years we cannot thank her enough. Fortunately, her contribution has demonstrated the indispensable need for such support and we will shortly be appointing a full time EQAP officer (although because of limited funds initially for only one year). An old friend of the Sub-programme, Dr. Camille Ooijen, will join us for three months to provide backstopping for EQAP prior to this appointment.

Dr. Yeshay Folman also returned to Israel after a one-year sabbatical with us. Dr. Folman contributed significantly to our many deliberations prior to the external review and was the driving force behind the establishment of the new CRP on tannins. Many thanks, Yeshay, for all your support and enthusiasm.

Fortunately, we have been able to continue the sabbatical post and in May we have been joined by Dr. Ray Till. Ray has a wealth of experience in crop/livestock systems and how best to maximise feed resources. I am confident that he will contribute significantly to the Sub-programme activities in the coming 12 months and we greatly look forward to working with him.

I hope by now I have whetted your appetite for what follows in this Newsletter. Once again, may I reiterate our commitment to work with you in developing ideas, in finding solutions to the many problems facing animal production in the developing world and, where possible, in helping you get these solutions used in the field.

With best wishes,



Martyn Jeggo
Head, Animal Production and
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## B. FORTHCOMING EVENTS

### Meeting of TC Regional Project RAW/5/004 "Support for Rinderpest Surveillance in West Asia", Amman, Jordan, 22 - 26 June 1997

This IAEA TC "model" project is aimed at helping efforts to control and eradicate rinderpest in the region through the supply of equipment, expertise, training and quality assurance services. Participants will attend from Jordan, Afghanistan, Iran, Iraq, Kazakstan, Kuwait, Lebanon, Saudi Arabia, Syria, Turkey, UAE, Uzbekistan and Yemen. Country reports on the disease situation and current efforts in vaccination and testing will be given.

Experts from France, UK, Pakistan and FAO (Rome), will deal with the serological aspects of monitoring vaccination and the surveillance of disease using ELISA; the latest molecular biological methods for the diagnosis and differentiation of rinderpest and peste des petits ruminants (PPR), in particular, the Polymerase Chain Reaction (PCR) techniques; the current situation of rinderpest eradication and contingency planning. Aspects of Internal Quality Control (IQC) and External Quality Assurance Programmes (EQAP) will be covered by FAO/IAEA staff.

The overall aim is to cease rinderpest vaccination in all countries in the region as soon as possible and provide laboratory-based tests to aid field staff in their role of active surveillance for any remaining pockets of rinderpest.

### Regional Workshop on "The Use and Applications of the FAO/IAEA Self-Coating RIA Kit and the ARCAL Kit for Progesterone Determinations", Veracruz, Mexico, 8 - 12 September 1997

**Deadline for nominations:** 15 July 1997

**Organizers:** International Atomic Energy Agency and Food and Agriculture Organization of the United Nations in co-operation with the Government of Mexico through the Universidad Veracruzana and the Instituto Nacional de Investigaciones Nucleares (ININ).

**Language:** Spanish

**Participation:** The Workshop is open to 14 radioimmunoassay technicians from ARCAL Member States participating in the activities of ARCAL XXVIII Project "RIA Techniques in Animal Production Research".

**Background to the workshop:** The progesterone radioimmunoassay (RIA) has successfully been used in research and extension activities for improving production and animal productivity. The RIA as a laboratory technique has provided useful information on the reproductive performance of livestock and has served to build up groups of researchers and extension workers who have conducted numerous surveys and experiments at the farm level. However, a major problem has been the routine supply of RIA kits.

The national co-ordinators of the ARCAL XXVIII Project at a meeting on 3-7 March 1997 in Temuco, Chile, agreed to submit to the IAEA a work plan for the establishment of a Latin American Network of RIA Laboratories in Animal Production for the development, validation, standardization and commercial production of RIA kits for progesterone determination. The IAEA will initially co-ordinate the network, composed of 34 laboratories in 14 countries.

The FAO/IAEA self-coating solid-phase RIA kit will provide the basis for the development and production of the future ARCAL RIA kit.

**Purpose of the workshop:** The workshop will provide training to laboratory personnel on the use of progesterone RIA in research. Emphasis will be given on the standardization of the method, quality control of the technique and co-ordination work in the future development and validation of the FAO/IAEA/ARCAL progesterone kit.

**Participants' qualifications:** The workshop is aimed at RIA laboratory personnel in Latin America participating in the ARCAL XXVIII Project. Candidates should have a degree in veterinary science, animal science, biology or equivalent and at least 3 years' post qualification experience in research in livestock production. Basic knowledge of radioimmunoassay principles is required.

**Nature of the workshop:** The workshop will allow for discussion on procedures and work methodology for the FAO/IAEA self-coating RIA kit and the development and validation of the FAO/IAEA/ARCAL progesterone kit. Participants will carry out laboratory training on the use and practical applications of progesterone RIA. Lectures on quality control of RIA and adequate use of laboratory equipment will be given. Working sessions using computer programs for the analysis of RIA results will also be organized. Laboratory results, as "case studies" from RIA laboratories within the region will be discussed.

**Regional Workshop under FAO/IAEA Co-ordinated Research Project on "The Application of Antigen and Antibody Detection ELISA to Diagnose Trypanosomes in Domestic Livestock", Onderstepoort, South Africa, 6 - 9 October 1997**

A workshop on "The application of antigen- and antibody detection ELISA to diagnose trypanosomes in domestic livestock" will be organized from 6-9 October at the Onderstepoort Veterinary Institute situated near Johannesburg, South-Africa. The 15 Research Contract holders participating in the FAO/IAEA (Government of Netherlands-funded) CRP on the "Use of immunoassay methods for improved diagnosis of trypanosomosis and monitoring tsetse and trypanosomosis control programmes" will be provided training in:

* Theoretical aspects of indirect and competitive ELISA.
* Application of a competitive ELISA to detect *T. congolense* antigens/antibodies.
* Improved methods of sample collection.
* Discussion of results and future aspects of the FAO/IAEA External Quality Assurance Programme.
* Collection and analysis of geo-referenced data sets.
* Practical demonstration of geo-referenced data in a Geographic Information System (GIS).
* Appropriate presentation of research results.

**FAO/IAEA Interregional Training Course on "The Use of Nuclear-based Techniques for the Determination of Veterinary Residues in Livestock Products", Central Veterinary Laboratory, Nicosia, Cyprus, 3 - 29 November 1997**

**Deadline for nominations:** 1 August 1997

**Participation:** The training course is open to 20 participants from developing Member States of FAO and IAEA.

**Language:** English

**Background of the course:** An increase in the use of veterinary drugs, including growth promoters, is a predictable consequence of expanded animal production efforts in developing countries. Unfortunately, many of the least developed countries suffer from a lack of effective regulatory control of their use. In order to ensure a safe and saleable food product for both local consumption and international trade, developing countries require the capacity to provide large-scale testing programmes for detection of the regulated residues in food animals and their products.

While assays for food contaminants (veterinary drug and pesticide residues, microbial pathogens, etc.) can be performed using a number of techniques at different stages of production, the ante-mortem testing of livestock sera or milk with RIA and/or ELISA provides one of the more practical avenues for large scale testing using immunoassay technologies based on relatively simple and robust kits. This approach should allow public health authorities to determine if a problem exists (whether related to home consumption or an export market) to put in place remedial action and subsequently to monitor the success of such efforts. Linked to this approach will be the need to develop effective and acceptable sampling strategies that will result in a manageable level of testing whilst ensuring that any abuses will be detected.

**Purpose of the course:** To train laboratory personnel in the use of RIA, ELISA and HPLC technologies for determining levels of antibiotics and specific hormones in livestock and livestock products.

**Participants' qualifications:** Applicants should be laboratory personnel involved at the national level with carrying out veterinary drug residue analysis.

**Nature of the course:** The course will be of a practical nature supplemented with theoretical lectures. The lectures will deal with the basic immunoassay and HPLC whilst the practical course will focus on the use of these technologies for determining levels of drug residues. Lectures and practicals will also be given on sampling strategies to determine the situation within defined populations of livestock.

**Regional Workshop held under the IAEA TC Model Project RAF/5/043 on "The Surveillance of Rinderpest to Achieve the Final OIE Declaration of Freedom from Rinderpest", Laboratoire National d'Elevage et de Recherches Vétérinaires, Dakar, Senegal, 1 - 5 December 1997**

**Deadline for nominations:** 30 September 1997

**Language:** English/French

**Participation:** The workshop is open to candidates from developing Member States of IAEA participating in the TC Model Project RAF/5/043 ("Assistance to complete the eradication of rinderpest from Africa") as well as to FAO-funded participants from West and Central Africa who are involved in the co-ordination of the Pan African Rinderpest Campaign (PARC).

**Background to the workshop:** The main objective of PARC is to eradicate rinderpest from Africa. The different stages of this process are defined through a number of OIE declarations culminating in a final OIE declaration of freedom from rinderpest. Rinderpest now appears eradicated from West and Central Africa and the phase of mass vaccination is now over. A phase of intensive and active disease surveillance to detect any remaining foci of infection is now commencing.

**Purpose of the workshop:** The workshop will provide training in the surveillance of rinderpest and on the OIE pathway to enable national Governments to proceed towards the final international declaration of freedom from rinderpest. The epidemiological and statistical background of the sampling and surveillance strategies will be explained together with various aspects of the ELISA-based surveillance. Performance indicators to assess the operation of existing disease control and surveillance programmes will be covered and applied to the national PARC programmes of the participants.

**Nature of the workshop:** The workshop will be a combination of lectures, practicals and simulation exercises. For the practical and simulation exercises, the participants will be asked to provide the relevant data on their national disease control and eradication programmes.

## General Information Applicable to All Training Courses

### Application Procedure

Nominations should be submitted in duplicate on the standard IAEA nomination forms for training courses. Completed forms should be endorsed by, and returned through the official channels established. Nominations received after that date or applications sent directly by individuals cannot be considered. It is suggested that advance information of the nominations be submitted by facsimile/telex with the following information: name, age, academic background, present position, and working address (including telex, facsimile and telephone numbers), to enable the Secretariat to make preliminary evaluation of the candidates.

### Language Qualification

Nearly all Courses are held in English and in the case of countries in which English is not an official or working language, nominations must be accompanied by a separate certificate of the candidate's proficiency in English. This certificate must be issued by a language school, cultural institution or an embassy of a country in which English is spoken.

### Administrative and financial arrangements

Nominating Governments will be informed in due course of the names of selected candidates and at that time, full

details will be given of procedures to be followed with regard to administrative and financial arrangements. The IAEA will pay the full cost of the participants' air travel from their home countries and return. During their attendance at the course, participants will receive from the IAEA a stipend sufficient to cover the cost of their accommodation, food and incidental expenses.

The organizers of the course do not accept liability for the payment of any costs or compensation that may arise from damage to or loss of personal property, or from illness, injury, disability or death of a participant while he/she is attending the course, and it is clearly understood that each government, in nominating candidates, undertakes responsibility for such coverage. Governments would be well advised to take out insurance against these risks.

## C. PAST EVENTS

### Planning and Co-ordination Seminar "Surveillance Needs for the Final Eradication of Rinderpest from Africa", IAEA, Vienna, Austria, 13 - 16 January 1996

This seminar was attended by key donors and the main countries involved in the Pan African Rinderpest Campaign (PARC). The recommendations and conclusions are outlined below. This seminar underlined the importance for further support to PARC to give "assistance to achieve the final eradication of rinderpest from Africa", the title of the Regional African TC Model Project RAF/5/043. A result of one of the main recommendations to IAEA is to hold a workshop on the OIE pathway for the PARC Co-ordinators in West and Central Africa and you will find details of such a workshop elsewhere in this Newsletter.

**Conclusions and Recommendations:**

- This meeting provided a timely forum:
  - ⇒ to assess the current situation of rinderpest in PARC;
  - ⇒ to obtain information on the PARC strategy for ensuring a time-bound achievement of the elimination of rinderpest and its causative virus from Africa;
  - ⇒ to detail 'current and future rinderpest surveillance activities in selected PARC countries;
  - ⇒ to identify how best the IAEA through the Joint FAO/IAEA Division, can support PARC in achieving final eradication;
  - ⇒ to up-date two key international donors (EU and US AID) on future needs.

- The eradication of rinderpest from Africa is achievable within the next 3 - 5 years.

- Good communications at the national, regional and inter-regional level is essential during this final eradication phase.

It was recommended that efforts are put into improving levels of communication particularly at the regional and international level.

- The Official OIE Pathway for all practical purposes is not now being used and has been replaced at the national level with the IAEA-TECDOC-747 providing guidelines on the OIE Pathway.

  It was recommended that the OIE guidelines should be up-dated in line with the IAEA-TECDOC 747 information, to remove identified ambiguities and to take into account new technologies and approaches relevant to specific phases of the campaign. GREP should co-ordinate the up-date and submit the final document to the OIE Code Commission by August 1997.

- Some form of recognition of a country's disease status should be endorsed by PARC during the declaration phases of the OIE Pathway.

- Concern was expressed over the lack of understanding of the implementation of the OIE Pathway and in particular the surveillance activities during the three phases.
  It was recommended that a workshop be convened in West Africa as soon as possible to provide clarification and training in rinderpest surveillance.

- It was recognised that there are several anomalies concerning the use of vaccines within the OIE Pathway. Whilst these would be dealt with during the update of the OIE Pathway described under (4) of specific concern was the use of CBPP vaccines with a rinderpest component but not certified for use as BISEC.
  It was recommended that, if a dual vaccine is used, it must contain certification for both components.

- National Veterinary laboratories should be supported to ensure their role in the diagnosis of rinderpest.

- The formation of networks such as the FAO/IAEA sero-monitoring network presents many advantages. Information networks should be created and include Directors of Veterinary Services. The introduction of modern communication technologies such as E-mail should be supported.

- Mild strains of rinderpest might be difficult to detect clinically and the recognition of the 3 D's will not always be sufficient to identify infection. Serology and antibody detection, not only in cattle, are therefore essential in the surveillance of rinderpest. Other sentinel groups of animals like small ruminants and game should be included in surveillance.

- Delays in submitting suspect rinderpest samples to Regional Laboratories and to the World Reference Laboratory, Pirbright, UK, are regarded as a problem. For the submission of samples, systems must be established. It is essential that adequate funding is provided for this.

- The FAO/IAEA rinderpest laboratory network provides an excellent structure to field validate new diagnostic assays. This should be used to validate the N-recombinant based RP ELISA for separating recombinant vaccinated animals from naturally-infected animals.

**Second FAO/IAEA Research Co-ordination Meeting on "Improvement of Ruminant Livestock Productivity through the Use of Progesterone RIA to Increase Efficiency and Quality of Artificial Insemination Services", Melbourne, Australia, 17 - 21 February 1997**

This CRP started in late 1994 and aims to identify major factors affecting Artificial Insemination (AI) Services in cattle in order to adopt remedial measures. The programme includes seven Contract Holders in Asia and seven in Latin America plus the participation of five Agreement Holders on RIA procedures, male fertility, AI, reproductive physiology and statistics. A computer application "AIDA" specifically developed for this project is being used to store and analyze data and to provide reports related to the AI Services.

The School of Veterinary Science, University of Melbourne, Australia, was the venue for the event. All CRP participants attended the meeting with the exception of the representative of Myanmar. The assistance and dedication of Prof. David Galloway in the organization of the meeting is greatly appreciated. Research Contract Holders presented the results of the field survey on AI services. Technical interventions to solve the identified problems on individual basis were fully discussed and work plans were prepared for the second phase of the programme. A workshop on data management and analysis was held to instruct Research Co-ordination Meeting (RCM) participants on the use of suitable statistical procedures applicable to their data.

Preliminary results indicated that the interval to first service was fairly adequate in dairy herds of Argentina, Chile and Peru. However, this interval is excessively long in countries such as Bangladesh, Cuba, Indonesia, Pakistan and Sri Lanka (150-205 days) denoting long post-partum anoestrus periods and deficiencies in oestrus detection. Conception rates were in general lower than expected. The main reasons identified through the survey are incorrect AI timing in Costa Rica, Cuba, Indonesia, Uruguay and Sri Lanka and poor semen quality due to inappropriate handling in Cuba and Pakistan. The high conception rate in Vietnam was also unexpected and it is probably due to the selection of the best AI inseminators to facilitate data collection.

Three major problems have been identified through a combination of progesterone data and clinical information:

(a) 17.7% of AI services were performed in animals while not in oestrus, e.g. during luteal phase or in anoestrus period (Cuba 39.2%, Indonesia 37.3%, Sri Lanka 28.7% and Costa Rica 28.4%). 5% of services occurred in pregnant cows in Argentina, Costa Rica and Uruguay.

(b) 14.6% of AI services were probably performed at the correct time but the cow either failed to conceive or lost the embryo at an early stage. These animals would have shown oestrus signs and been re-inseminated 21 days later under normal situations.

(c) 7.8% of AI services resulted in abnormally extended luteal activity or in pregnancies which failed to be maintained. Subsequent oestrusses were missed and cows remained un-inseminated for long periods (>45 days after-last failed AI).

These problems indicate that 35% of AI services fail in these countries and efforts must focus on improving farm management and oestrus detection.

**The conclusions of the meeting were**:

- The CRP has generated a unique international data set for the understanding of AI constraints in developing countries.
- The AIDA computer software (developed by the Animal Production and Health Section) for data storage and analysis is proving critical to the success of this CRP.
- Progesterone RIA has proved again to be a powerful tool, this time to monitor constraints on AI in developing countries.
- The quality of the semen just prior to insemination has not been fully assessed under this CRP.

**The recommendations were:**

- There is a general agreement that quality of AI services is low and needs to be improved.
- Milk (and plasma) samples must be run in duplicate to ensure the credibility of the progesterone data.
- There is a concern that the inseminators in each project should be monitored continuously. The procedures used by the inseminator should be documented periodically.
- Interventions should have well-defined hypotheses in order to set up the experimental design properly. Appropriate statistical methodology should be used to analyze data before making conclusions.

## Second FAO/IAEA Research Co-ordination Meeting on "Improving the Diagnosis and Control of Foot-and-Mouth Disease in South East Asia Using ELISA-based Technologies", Manila and Subic Bay, The Philippines, 24 - 28 February 1997

This CRP involves support to 10 national veterinary laboratories responsible for the diagnosis and monitoring of foot-and-mouth disease (FMD) as part of the Organisation International des Epizooties (OIE) programme aimed at eradicating FMD from the region. From the outset it was envisaged that this CRP would link intimately with the OIE eradication programme and provide the programme the necessary skills at the national level to diagnose the disease, characterize FMD virus types causing outbreaks and monitor the success of national control/eradication activities.

It was agreed that, whenever possible, meetings of FAO/IAEA Research Contract

Holders would be combined with those of the OIE FMD Sub-commission in the region. In 1995, a joint meeting was therefore held of the first RCM with the OIE Sub-commission in Thailand and in 1996, through an IAEA Regional Training Course in Vietnam. In 1997, the 2nd RCM of this CRP was again held in conjunction with the OIE Sub-commission in Manila.

During day one and two of the meeting, the participating countries (Philippines, Thailand, Malaysia, Laos, Cambodia, Vietnam, Singapore, Hong Kong, Sri Lanka, Bangladesh, Thailand and Myanmar) presented a detailed account on the occurrence of FMD in their countries. Presentations were also made by the national veterinary laboratories and the work conducted under the CRP. These presentations were of very high quality and contrasted sharply with similar reports given three years ago. Discussions were held on the FMD sub-types circulating in the region and the need for quality controlled vaccine. A number of commercial vaccine producers discussed how best they could assist the programme and the need to match vaccine types with the virus sub-type causing the outbreak was highlighted. It was clear that although changes in sub-types were occurring in the region, these were minor, except in the case of Hong Kong, where a new Type O virus had been isolated. It was postulated that the new virus had originated in China and had been brought into Hong Kong through infected live pigs.

On days three and four of the meeting, in conjunction with the two Agreement Holders who attended the meeting, discussions were held with individual Research Contract Holders on their current work and work plans for the coming 18 months, and the inputs, in term of equipment and reagents needed, to achieve these. In summary, in Laos, Cambodia, Vietnam and Myanmar the focus will be on prevalence studies, in Thailand and Malaysia on the status of regions within the country and on the effectiveness of control strategies, particularly vaccination programmes; in the Philippines on the progress towards eradication on an island-by-island basis, in Sri Lanka and Bangladesh on the effectiveness of vaccination programmes; and in Hong Kong on an understanding of the endemic situation in pigs.

As part of the CRP, to ensure that results emanating from these diagnostic laboratories are reliable, an FAO/IAEA External Quality Assurance Programme was developed for the FMD ELISA kits. This consists of three components, viz. a questionnaire on laboratory management, an evaluation of the internal controls included on every ELISA plate tested and the testing of an external panel of five unknown samples. All Research Contract Holders in the CRP have participated in this programme, with one external test panel being sent out in 1996. Analysis of the information is not yet completed, but provisional results indicate that 8/10 of the laboratories can reliably type FMD virus although the antibody detection ELISA is dealt with less consistently. The results were discussed with the group and with individual Contract Holders. It was universally agreed that this procedure was highly successful in meeting its objectives, trouble-shooting problems in individual laboratories and essential to building external confidence in results being reported.

On the last day of the meeting, various aspects of communication were discussed as an essential component of such an eradication campaign. The need to involve the farmer at all stages of the programme, and in effect, to have a "bottom up" (from the farmer) as opposed to a "top down" (from central Government) approach, was highlighted.

A set of 28 conclusions and recommendations was produced by the Joint FAO/IAEA/OIE Meeting but the key ones relating to the CRP are detailed below.

- ELISA technology has now been transferred to most national veterinary laboratories in the region and is being routinely used to assess progress in the regional OIE/FAO/IAEA FMD control and eradication programme.
  ⇒ Support should continue to complete the process of ELISA technology transfer and routine use within national laboratories in this region.

- Many of the national laboratories are involved in evaluating the use of FMD vaccines in their countries. Critical to that process is assurance of vaccine potency.
  ⇒ A regional vaccine testing capability should be established as a matter of urgency to provide assurance of vaccine quality prior to purchase or national use.

- Examination of FMD viruses isolated from outbreaks provides invaluable information on the epidemiology of FMD in the region. A virus typing capability is now available in most countries but further studies require more detailed examination of isolates.
  ⇒ Every effort be made to ensure that material from outbreaks of FMD are sent to the WRL for further virus characterisation.

- In some countries in the region, capabilities in the field to diagnose and monitor FMD have fallen behind developments in national laboratories.
  ⇒ Every effort be made to strengthen national FMD diagnostic and surveillance capabilities at the field level.

- In a number of countries, areas within the country are considered free from FMD.
  ⇒ Verification of FMD freedom in such areas or zones should be undertaken using the agreed OIE procedure involving statistically acceptable sampling procedures and by clinical examination and laboratory testing of appropriate samples. Verification will need to be an on-going activity where there is a risk of FMD re-invasion.

- The introduction of an EQAP for the FMD laboratories in the region is providing valuable information and will assist in providing confidence during the FMD control and eradication process.
  ⇒ An EQAP should continue to be introduced and established as routine in FMD diagnostic laboratories in the region.

We are extremely grateful to the Government of the Philippines for hosting this course, and to Dr. Bicbic Verin and her colleagues for the excellent organisation and hospitality shown throughout the meeting.

**First Co-ordination Meeting of Project Co-ordinators of AFRA TC Project II-17 "Development and Field Evaluation of Animal Feed Supplementation Packages" (RAF/5/041), Dar-es-Salaam, Tanzania, 24 - 28 February 1997**

The above meeting was held in Dar-es-Salaam, Tanzania, to discuss and prepare detailed work plans for activities to be undertaken during 1997 and 1998 under the new AFRA TC Project II-17 - "Development and field evaluation of animal feed supplementation packages". It was attended by AFRA Project Co-ordinators from Algeria, Cameroon, Côte d'Ivoire, Egypt, Ghana, Kenya, Madagascar, Mauritius, Namibia, Nigeria, Sudan, Tanzania, Tunisia, Zaire and Zambia. All participants were actively involved in the preparation of a logical framework for the two components of the new AFRA project namely, (a). development and field evaluation of a feed supplementation package for ruminant livestock; and (b) introduction of the bulk-based reagent methodology for the local production of RIA kits for animal reproduction studies. On the basis of the logical frameworks, individual work plans were prepared for each of the participating country with a time schedule and operational strategy.

Participation at this meeting was limited to the designated national project co-ordinator for each country participating in AFRA Project II-17.

**First Meeting of National Co-ordinators of ARCAL TC Project XXVIII "RIA Techniques in Animal Production Research", Temuco, Chile, 3 - 7 March 1997**

Support for the Regional TC Project RLA/5/041 was in response to Member States' requests for the establishment of a regional network of RIA laboratories in animal production to supply non-locally available chemicals/biologicals and provide standards, IQC and EQC samples to ensure the sustained availability of low-cost progesterone RIA kits from within the region.

At present, there are 48 RIA laboratories involved in livestock activities in Latin America, 34 out of them have been supported through FAO/IAEA programmes and the other 14 by other programmes. All 48 laboratories have facilities for progesterone RIA assay using $^{125}I$-progesterone as a tracer. However, several laboratories can also determine $T_3$, $T_4$, testosterone, cortisol and LH, and a few of them can additionally work on insulin, oestradiol, zeranol, trembolone, specific proteins, oestrone sulphate, prolactin and FSH.

The purpose of the meeting, held at the Universidad de La Frontera, was to define the plan of activities and commitment of individual countries for the implementation of the project and, in particular, for the establishment of the Latin American Network of Radioimmunoassay Laboratories for Livestock Development.

The meeting was attended by 14 National Co-ordinators from the Latin American region. Local arrangements by Dr. Néstor Sepúlveda are gratefully acknowledged.

Meeting participants presented in the first two days, a description of the many research and extension activities supported by the FAO/IAEA programme in animal production during the past 10 years. The third day was dedicated to discussions on the future application of RIA as a tool for improving animal productivity, and the importance and possible structure of the new Latin American Network of Radioimmunoassay Laboratories for Livestock Development. Participants were split into groups to formulate the structure, *modus operandi* and work plan for the regional project.

The basic structure of the network was defined as follows: (a) The RIA laboratory of the Animal Production Unit of the FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf, will be the Reference Laboratory and will provide the technical support required for the local production of kits and it will conduct quality assurance under the FAO/IAEA External Quality Control Programme; (b) five laboratories will initially be in charge of the development and validation of the 'ARCAL' progesterone RIA kit and at a later stage of the production and distribution of kits. One of these laboratories will lead the network after it is fully established; (c) one National Laboratory per participating country will be the link between other local RIA laboratories and the Main Laboratory, and they will be responsible for the co-ordination, dissemination of information and training within their countries; and (d) six collaborative laboratories from Sweden and USA within the animal production sector and from the region involved in the human endocrine sector will provide technical advice to the network.

The work plan of the regional project developed during the meeting contains 17 activities over the four years of the programme.

**The main conclusions of the meeting were:**

- The implementation of the Animal Production Programme in Latin America using the RIA technique for monitoring reproductive functions has resulted in a series of important improvements in livestock productivity benefiting smallholder farms and peasants; it has enriched scientific knowledge in the reproductive physiology of livestock allowing formulation of low cost improved and sustainable nutritional and management practices. The programme has also improved the scientific level of project counterparts, resulting in hundreds of scientific publications in national and international journals.

- There is a continuing need for RIA technology and reagents. The know-how and laboratory facilities are available but the high cost of commercial kits is a major constraining factor. The implementation of the Latin American Network of Radioimmunoassay Laboratories for Livestock Development should produce standardized kits at an affordable cost.

**The main recommendations were:**

- FAO/IAEA should facilitate technical and economical support for the establishment of the Latin American Network of Radioimmunoassay Laboratories for Livestock Development. The transfer of the progesterone RIA kit production technology and the monitoring of laboratory efficiency through the FAO/IAEA Quality Control Assurance Programme are important components to the success of the project.

- FAO/IAEA and the participating Governments should encourage all RIA laboratories involved in livestock development to participate in the programme. This will strengthen the performance of the laboratories and reduce the operating costs of the network and progesterone RIA kit production.

- The establishment of a regional database for scientific publications, initially implemented by the Animal Production and Health Section, and subsequently transferred to the region will provide up-to-date information to scientists in the region.

## FAO/IAEA Regional Training Workshop on "Guidelines for Developing Feed Supplementation Packages" under AFRA TC Project II-17 - "Development and Field Evaluation of Animal Feed Supplementation Packages" (RAF/5/041), Rabat, Morocco, 10 - 14 March 1997

This training workshop was organized under the framework of the African Regional Co-operative Agreement for Research, Development and Training related to Nuclear Science and Technology (AFRA).

The objective of the workshop was to provide guidelines for the development of feed supplementation packages using locally-available feed resources in developing countries. The workshop covered the following topics: introduction to feeds and feed evaluation; rumen and its environment; principles of ration formulation for ruminant livestock; feed supplements and supplementation including the manufacture of urea-molasses multinutrient blocks; designing and conducting nutrition experiments for field evaluation of supplementation packages; analysis and interpretation of field data.

The workshop was attended by 16 participants from 12 AFRA Member States: Algeria, Cameroon, Egypt, Ghana, Kenya, Mauritius, Morocco, Namibia, Tanzania, Tunisia, Zambia and Zaire. It was held at the Institut Agronomique et Vétérinaire Hassan II and opened by Dr. Ahmed Bentouhami of the Direction de l'Elevage Ministère de l'Agriculture et de la Mise en Valeur.

Local arrangements were handled by the Workshop Director, Dr. Samira Mannar, the AFRA Project Co-ordinator for Morocco. Both accommodation and training facilities provided by the Institut Agronomique et Vétérinaire Hassan II were excellent. We would like to thank the host institute and its staff, the local and outside lecturers and staff, and Dr. Samira Mannar, for their assistance in conducting this workshop.

**Final FAO/IAEA Research Co-ordination Meeting on "Development of Supplementation Strategies for Milk-Producing Animals in Tropical and Sub-tropical Environments", Malang, Indonesia, 24 - 28 March 1997**

Contracts under the CRP were awarded in 13 countries - Brazil, Chile, China, Indonesia, Mexico, Paraguay, Philippines, Sri Lanka, Thailand, Turkey, Uruguay, Venezuela and Vietnam. The aim of the programme was to identify and remedy major nutritional constraints through devising cost-effective and sustainable feeding and management strategies. The use of progesterone RIA to monitor reproductive performance and the measurement of selected metabolites to highlight nutritional imbalances were the key elements in the programme. Field observations/measurements such as body weight, body condition score, milk production, sexual behaviour, feed resources and quality were also monitored.

The RCM was attended by the 13 FAO/IAEA Research Contract Holders, the five Agreement Holders, and one Consultant from the UK. The excellent local arrangements organized by Dr. Hendrawan Soetanto and his group are greatly acknowledged.

It is planned to publish the final reports in a special edition of the Preventive Veterinary Medicine journal. We expect to get nine scientific papers from Research Contract Holders and five from the Agreement Holders.

**The most relevant results were:**

- The use of selected metabolites proved invaluable in indicating potential nutritional constraints provided that sampling is rigorously done according to the CRP methodology and that feed resources do not fluctuate over short periods of time. The methodology applied in this CRP, therefore, can be usefully applied in small-holder farms in tropical and subtropical environments as part of a multi-disciplinary approach.

- Poor feeding management in terms of availability of feedstuffs during the year, low quantity and quality of feeds supplied to corralled or tied animals and deficient pasture management for grazing animals were the common factors limiting productivity in all countries. In general, scientists know what is needed for higher production but the technology to achieve this has not reached the farmers resulting in poor animal performance.

- Incorrect breeding management seriously affected reproductive performance. Poor conception rates were not usually a problem but long intervals to the onset of post-partum ovarian activity, low oestrus detection efficiency and sub-utilized Artificial Insemination services were commonly found.

- Inadequate nutrition, ineffective preventive health care and deficient reproductive management have contributed to poor performance of young-stock in small-holder production systems, with clear long-term effects on productivity. Calf rearing practices in such production systems were identified as an area in urgent need of on-farm multi-

disciplinary research. Strategies for improved calf rearing need to be developed and their impact on farm performance and profitability needs to be assessed.

**The overall conclusions were:**

- This CRP protocol was invaluable for identifying nutritional and management constraints in dairy and dual-purpose cattle production systems. The sampling strategy and data recording were appropriate (with minor modification) for prevalent conditions under different environments, and can be used both to identify problems and to monitor remedial measures.

- The use of (a) progesterone RIA for evaluating reproductive status and identifying breeding management problems; (b) selected nutritional metabolite determinations for identifying nutritional constraints; and (c) body conditioning at key times around calving for estimating nutritional status and predicting cow performance, proved to be useful and practical tools for evaluating and monitoring production systems.

- The importance of a quality control programme for laboratory techniques was highlighted. The RIA EQAP undoubtedly prevented erroneous results and misinterpretations.

- A five-year CRP greatly improves the ability of Research Contract Holders to do applied research through adherence to sound experimental protocols, reliable laboratory tools and in this case the use of an appropriate computer database. Project counterparts gain confidence and enhance their abilities to interact with farmers.

## FAO/IAEA International Symposium on Diagnosis and Control of Livestock Diseases Using Nuclear and Related Techniques "Towards Disease Control in the 21st Century", Vienna, 7 - 11 April 1997

The Symposium attracted approximately 120 participants, 60 of which came from developing countries. Thirty-four invited papers and 37 posters were presented. The aim of the Symposium was to review existing techniques utilized in disease control and diagnosis and to carefully put them in context for use in developing countries. In doing this it was hoped to provide answers to the following questions: What are the Global problems in Livestock development? How may advances be harnessed to solve such problems? What are the unique features of advances which will drive them into the "market-place"?

The ultimate aim of science in livestock is to increase food security, this Symposium considered science as part of a complex socio/economic problem and not in isolation. Thus, the Symposium addressed some of the wider issues dealing with not only with serology and molecular biology (which might be expected in their direct relevance to methods for diagnosing diseases) but also, epidemiology, vaccines, information networks, GIS and socio-economic factors. The Proceedings will be published later this year.

The people presenting the papers, with subject areas specified, are listed below, but many of the papers had co-authors.

| List of Speakers | Subject Area |
|---|---|
| M.P. Salema | Opening Statement |
| M.H. Jeggo | Overview of technologies exploited in animal disease diagnosis |
| J. R. Crowther | Biotechnology today |
| R. Jacobson | Overview on ELISA |
| J. Anderson | ELISA and rinderpest |
| K. Nielsen | ELISA and brucellosis |
| A.G. Luckins | ELISA and trypanosomosis |
| N. Ferris | ELISA and foot-and-mouth disease |
| R. Jackman | Homogeneous assays |
| I. Tothill | Biosensors |
| J. J. Reddington | Penside tests |
| A. Jungbaur | Monoclonal antibodies |
| A. Diallo | Overview of molecular methods |
| K. E. Johansson | Diagnosis of Contagious Caprine and Contagious Bovine Pleuropneumonia by PCR and Restriction Enzyme Analysis |
| S. Belak | Application of the PCR and molecular epizootology in Veterinary Diagnostic Medicine |
| P. Majiwa | Application of PCR in trypanosomiasis |
| N. Knowles | Molecular techniques in foot-and-mouth disease epidemiology |
| T. Barrett | Molecular techniques in rinderpest epidemiology |
| G. Uilenberg | Tick-borne disease control |
| J. Crampton | Vaccine delivery in the 21st Century |
| G. Viljoen | DNA vaccines |
| M. Thrusfield | Epidemiological prospects in the 21st Century |
| J. A. Kramps | Monitoring assays |
| M. Jeggo | Monitoring control programmes |
| B. van der Eerden | External Quality Assurance Programmes |
| J.A. W. Coetzer | Training for developing countries |
| J. Hilton | Information technologies - perspective for the 21st Century |
| G. Gettinby | Mathematical modelling |
| T. Ndegwa | GIS - overview |
| D. Rogers | Satellites, their uses |
| T. Robinson | Practical applications of GIS in the management of livestock disease |
| P. Mellor | Climatic change |
| A. Dyjkhuizen | Cost/benefit analysis |
| D. Zwart | Sustainability |
| S. Edwards | Role of OIE in disease control |
| P. Roeder | Summing up technology impact on disease diagnosis and control |

**First FAO/IAEA Research Co-ordination Meeting on "Application of Molecular Techniques in Animal Disease Diagnosis in Developing Countries", Vienna, 14 - 18 April 1997**

The meeting was attended by six Research Contract Holders from Turkey, Mali, Côte d'Ivoire, Namibia, Ethiopia and Kenya and four Research Agreement Holders from South Africa, UK, Sweden and France. The purpose of the meeting was to:

* Establish logical framework for each Research Contract Holder.
* Formulate detailed work plans for the next 12 months.
* Discuss practical details for implementation of work plans.
* Review present status of molecular techniques in laboratories of Research Contract Holders.

During the meeting, each Research Contract Holder presented a report on laboratory activities involving molecular techniques. The findings of the Consultant Report on "Application of Molecular Techniques in Animal Disease Diagnosis in Developing Countries" were distributed and discussed. New guidelines for the presentation of the Agency's Research Contract Programme were presented. The Logical Framework prepared from the Agency's perspective was presented and distributed. Each Research Contract Holder prepared a Logical Framework and work plan in the required format. Equipment and reagent needs were agreed. Various practical details involving the use of molecular techniques were highlighted and discussed.

**Final FAO/IAEA Research Co-ordination Meeting on "The Use of ELISA for Epidemiology and Control of Foot-and-Mouth Disease and Bovine Brucellosis in Latin America", Vienna, Austria, 14 - 18 April 1997**

This meeting was held at the Joint FAO/IAEA Division, Vienna, Austria, and was attended by 9 Research Contract Holders from 7 Latin American countries (Argentina 2, Brazil 1, Chile 1, Colombia 2, Costa Rica 1, Paraguay 1, Venezuela 1); 5 Agreement Holders (Brazil, Canada, Italy, United Kingdom, USA) and 5 observers (Argentina 1, Brazil 1, Paraguay 1, Sweden 1, Uruguay 2). The main purpose of this meeting was to present results from a 3 year field validation of a competitive brucellosis ELISA and a Foot-and Mouth Disease (FMD) Antibody Liquid Phase Blocking ELISA (LPBE) in Latin America, and to complete editing of reports for publication as an IAEA-TECDOC.

The RCM started with the presentation of results by the brucellosis group, followed by the FMD group. Days 4 and 5 were spent in two separate groups to work on individual reports and on the conclusions and recommendations to be included in the IAEA-TECDOC.

During the week prior to this RCM, an FAO/IAEA International Symposium on Diagnosis and Control of Livestock Diseases Using Nuclear and Related Techniques "Towards the 21$^{st}$ Century"

was held in Vienna. All participants of the RCM took the advantage to participate at the Symposium (see separate report elsewhere in the Newsletter).

**Brucellosis**

Results were presented by individual Research Contract Holders, comparing classical diagnostic tests, e.g. Buffered Plate Agglutination, Rose Bengal, Complement Fixation, 2 Mercaptoethanol, Radialimmunodiffusion with different ELISAs, e.g. indirect ELISA and competitive ELISA using different Antigens and Mabs. Three different groups of cattle were tested: (1) 1,000 brucella free cattle; (2) 1,000 brucella vaccinated but uninfected cattle; and (3) 1,000 cattle from brucellosis infected herds.

***Conclusions:***

- All ELISAs performed well. This study included 30,000 individual samples from 5 countries in Latin America and a variety of cattle breeds that were tested in seven different assays. The total number of individual tests performed was more than 200,000. This study represents the largest serological validation exercise undertaken for brucellosis. Competitive ELISA II (which uses LPS as antigen and monoclonal antibody Mab 84 as a competing reagent) emerged as the preferred assay because the LPS antigen is relatively simpler to prepare, and the antibody is directed against a defined epitope and possesses high affinity. In addition, the test has high sensitivity and specificity, is useful for differentiating infected from vaccinated cattle and resolves cross-reactions due to infections with *Yersinia enterocolitica*. Even though the competitive ELISA I (O-chain antigen) also performed well, it has the disadvantage that the antigen and conjugate preparation are more difficult.

- One of the major potentials of the competitive ELISA is that it can be used for diagnostic purposes in species other than bovines , including humans.

- One of the limitations of all the current ELISA techniques is that they are not suitable for testing in the field (so-called penside test) since they require laboratory facilities and trained personnel.

- Although the indirect brucella ELISAs possess good sensitivity and specificity, they are only useful for testing a limited number of species and they do not distinguish vaccinal antibody from that due to infection.

- Cut-off values for each ELISA must be established for different countries and regions, and will depend on factors such as prevalence and vaccination status.

- Buffer Plate Antigen and Rose Bengal are useful diagnostic tests for screening sera, especially in laboratories where the conditions for performing the ELISA have not been established.

***Recommendations:***

- That ADRI/ELISA, CELISA I and CELISA II be designated as "preferred assays" for brucellosis by the Office International des Epizooties (OIE).

- That IAEA take the necessary steps to ensure the availability of competitive ELISA II for all countries. Any such arrangements should positively favour all parties involved in the validation of the assays.

- That the compiled validation data generated by all the participating countries be published in a refereed scientific journal.

- Internal and external quality assurance procedures for these ELISAs should be continued to be undertaken by the Joint FAO/IAEA Division.

- Evaluation of the Fluorescence Polarization Assay (FPA) and Radial Immunodifusion (RID) test for field diagnosis of brucellosis and comparison of the performance, characteristics of these assays with the standardised ELISAs, in particular the C-ELISA, should be undertaken.

- Evaluation of the competitive ELISA II and other assays in calfhood, adult and re-vaccinated herds, should be undertaken.

- Validation of the I-ELISA(ADRI) for the detection of antibodies (anti Brucella LPS) in milk should be undertaken.

**Foot-and-Mouth Disease**

The FMD group tested two groups of sera using a new Liquid Phase Blocking ELISA (LPBE): 120 sera from FMD-free, non-vaccinated cattle and 120 sera from FMD-vaccinated cattle. Sera from FMD-free, non-vaccinated cattle were tested in a screening assay (1:32) and doubtful results were re-tested 1:32, 1:64, 1:128, 1:256. Sera from vaccinated cattle were tested in a titration assay 1:10, 1:50, 1:250 and 1:1250.

One of the central observations was that the intra- and inter-laboratory variation of the test was too high and that the range for the C++ and Antigen control was too narrow. In Brazil and Venezuela, the values for the C++ (= strong positive control serum) sometimes exceeded the Upper Control Limit (UCL) (too high) or were below the Lower Control Limit (LCL) (too low). In Argentina and Colombia, only too high C++ values were observed in some cases. In Paraguay, the general tendency was towards too low C++ values with the exception for the A-antigen where both too low and too high C++ values were observed. The reason for these differences may be due to different pipetting techniques which become crucial when glycerinized antigen is used. Nevertheless, the predictive value of the test remained good. Taking into consideration all data produced by the 5 Research Contract holders and by PANAFTOSA, a new mean value for the antigen control and C++ was established. This value plus 2 SDs was agreed to be the new reference value for a re-test of the different groups of sera.

***Conclusions:***

- The evaluation of reproducibility of the Liquid Phase ELISA for FMD revealed that the C++, C+, and C- controls were reasonably consistent between laboratories.

- The predetermined UCL and LCL values for the C++ PI were too narrow to be useful in making decisions about this parameter. These limits were re-calculated using data from all laboratories.

- The Ca (antigen control) was too variable between laboratories. The accuracy of the assay (Ca values falling within control values) was lacking in some laboratories; either the data exceeded the UCL or were less than the lower LCL. The precision of the assay within a laboratory was also variable for some laboratories.

- Accuracy for the Ca was assessed in relation to the UCL and LCL as originally defined by PANAFTOSA. These limits were too narrow. The UCL and LCL were thus re-defined based on the data collected for the Ca control from all laboratories.

- Because of the general consistency of Ca samples within and between plates during a single run, it was concluded that the probable cause of the problem was pipetting of the glycerinated antigen stock solution.

- Application of the assay for field use will require resolution of this problem.

***Recommendations:***

- The laboratories involved should re-test the serum panels with the use of a more explicitly defined procedure for pipetting the glycerinated Ca antigen. It is essential that this reagent give uniform, reproducible, and accurate results since it is used for calculation of the PI values for all control and test sera.

- The new UCL and LCL, as defined during the RCM, will be used to assess performance of the re-tested sera.

- All biologicals to conduct this re-test are still available at the participating laboratories. The chemicals, however, would need to be supplied for this study.

- After re-testing, the anticipated data would be used to re-calculate the UCL and LCL values for the Ca OD data and the C++ PI data.

- An External Quality Assurance Programme will be needed to assess proficiency in conducting the FMD ELISAs within and between laboratories.

- A mechanism is needed to "accredit" laboratories that are proficient in conducting this assay.

- The reproducibility and repeatability of this new data should be compared with the same data from the Asian FMD CRP. The reagent and protocols for these two FMD assays

differ: the current study was done with PANAFTOSA-specific reagents while the reagents for the Asian study are from the World Reference Laboratory (UK).

- Validation of the FMD ELISA for detection of antibodies of non-structural proteins to separate vaccinated from infected animals should be undertaken.

**FAO/IAEA Regional Training Workshop on "Production of Self-coating RIA Kits for Measuring Progesterone in Livestock", under AFRA Project II-17 - "Development and Field Evaluation of Animal Feed Supplementation Packages" (RAF/5/041), Tunis, Tunisia, 5 - 16 May 1997**

This training workshop was organized under the framework of the IAEA African Regional Co-operative Agreement for Research, Development and Training related to Nuclear Science and Technology (AFRA).

The main objective of the workshop was to train staff from analytical laboratories in charge of animal reproduction studies, in developing AFRA Member States, on the preparation and use of the FAO/IAEA self-coating RIA system for measuring progesterone in milk and plasma. The workshop covered the following topics: collection and processing of milk and blood samples for progesterone analysis; reagent and sample preparation, including standards and IQC; principles of monoclonal and polyclonal antibody production; coating of tubes with antibody followed by solid phase RIA; analysis and interpretation of RIA data and External Quality Control.

The course was attended by 18 participants from 16 AFRA Member States: Algeria, Cameroon, Egypt, Ghana, Kenya, Libya, Madagascar, Mauritius, Morocco, Namibia, Nigeria, Sudan, Tanzania, Tunisia, Zambia and Zaire and was held at the Ecole Nationale de Medecine Vétérinaire, Sidi Thabet, Tunis. The Workshop was opened by Dr. Malek Ateff, the Acting Director, Ecole Nationale de Medecine Vétérinaire. The keynote address was delivered by the Director General, Ministry of Scientific Research, Dr. A. Rihi.

Local arrangements were handled by the AFRA Project Co-ordinator, Dr. Jamel Rekhis, who was also the Workshop Director. The accommodation and training facilities provided by the Institute were excellent. We would like to thank the host institute, the local and outside lecturers, and the Workshop Director and his organizing committee for their assistance in conducting this workshop.

## D. STATUS OF EXISTING CO-ORDINATED RESEARCH PROJECTS

- **Surveillance of Rinderpest in Africa, Phase III**

  Support for the surveillance of rinderpest is still limited to that available through the IAEA TC Programme and for equipment and reagents. It is, however, hoped that EU funds for the FAO/IAEA CRP and the Research Contracts will be available in the near future.

- **Improvement of Ruminant Livestock Productivity Through the Use of Progesterone RIA to Increase Efficiency and Quality of Artificial Insemination Services**

  The programme has 14 Research Contracts, 1 Technical Contract and 4 Research Agreements and no further awards can be considered. The Second RCM was held at the University of Melbourne, Melbourne, Australia, from 17 - 21 February 1997.

- **Use of Immunoassay Methods for Improved Diagnosis of Trypanosomosis and Monitoring of Tsetse and Trypanosomosis Control Programmes in Africa**

  The CRP is aimed at using an antigen-detection immunoassay (ELISA) for improved diagnosis of trypanosomosis and to use this serological technique together with standard parasitological techniques, such as the buffy coat technique (BCT) for monitoring the effectiveness of tsetse and trypanosomosis control programmes.

  All fifteen Research Contract holders of the CRP have been invited to attend the 24th meeting of the International Scientific Council for Trypanosomosis Research and Control (ISCTRC) to be held from 29 September to 3 October 1997 in Maputo, Mozambique. Following the meeting, it is intended to organize a workshop on "The Application of Antigen- and Antibody Detection ELISA to Diagnose Trypanosomes in Domestic Livestock" from 6 - 9 October 1997 at the Onderstepoort Veterinary Institute situated near Johannesburg, South Africa.

- **Development of Feed Supplementation Strategies for Improving the Productivity of Dairy Cattle on Smallholder Farms in Africa**

  The programme has 12 Research Contracts and 5 Research Agreements and no further awards can be considered. The Second RCM was held in Rabat, Morocco, from 1 - 5 April 1996 and the final RCM is planned for August/September 1998. Notification of the exact venue and date of the meeting will be given as soon as it has been finalized.

- **Development, Standardization and Validation of Nuclear-based Technologies for Measuring Microbial Protein Supply in Ruminant Livestock for Improving Productivity**

  This programme has 5 Research Contracts and 4 Research Agreements and no further awards can be considered. The first RCM was held at Gadjah Mada University, Yogyakarta, Indonesia, from 5 - 9 August 1996. The final RCM for Phase I of the programme is planned for August/September 1998. Notification of the exact venue and date of the meeting will be given as soon as possible.

- **Improved Diagnosis of Foot-and-Mouth Disease in South East Asia Using ELISA-based Technologies**

  This programme has 10 Research Contracts and 3 Research Agreements and no further awards can be considered. The 2nd RCM took place in The Philippines, from 24 - 28 February 1997, and it is intended to hold the final RCM in early 1999.

- **Application of Molecular Techniques in Animal Disease Diagnosis in Developing Countries**

  This programme currently has 6 Research Contracts and 4 Research Agreements. The first RCM was held in April 1997 in Vienna, and the next meeting will be held in early 1999. It is possible to consider 2-3 more Research Contract proposals from laboratories relatively competent in the use of molecular technologies (PCR) and working in the field of rinderpest or CBPP diagnosis and surveillance.

## E. NEW CO-ORDINATED RESEARCH PROJECTS

**"Use of Nuclear-based Technologies to Increase Farm-yard Poultry Production in Africa by Improving Vaccination Strategies against Newcastle Disease and Gumboro Disease"**

Full details of this new CRP were given in the previous Newsletter. 25 Research Project proposals have been received. These will be assessed for scientific merit and practical application prior to the award of Research Contracts.

**"The Monitoring of Contagious Bovine Pleuropneumonia Control Programmes in Africa"**

The overall objective of this new CRP is to assist national veterinary laboratories in the diagnosis of CBPP and in the monitoring of national and regional CBPP control programmes. Central to the programme will be the use of a competitive ELISA for serologically evaluating animals for CBPP although this will also be linked to the use of the Polymerase Chain Reaction alongside conventional assays for determining infected animals.

Nine Research Contracts have been positively evaluated and along with three Agreement Holders, will be submitted to the IAEA Contractual Committee for final approval this month. It is proposed to hold the first Research Co-ordination Meeting under this project in early 1998.

**"Increasing Dairy Cattle Productivity by Strategic Feeding According to Body Condition Scoring Evaluated Using Radioimmunoassay Technologies"**

The lactation yield in dairy cows is determined primarily by their genetic potential and the availability of nutrients. The nutrient requirement of post-partum cows is substantially higher than their ability to consume feed and their body tissues are utilized to supply the udder. Only cows with adequate body reserves at calving are able to attain their potential milk yield. Cows with poor body condition at calving have sub-optimal lactation yield and poor reproductive efficiency. Equally though, the over-weight low-yielding cow is also at higher risk of calving difficulties and metabolic disease. It is imperative that cows have optimal body condition at calving.

The body condition is best measured by way of Body Condition Scoring (BCS). This assesses body fat reserves and is a common management tool on dairy farms in developed countries. Studies in the developed world revealed that cows calving below a BCS of 2.0 on the 1 to 4 scale, have a lower milk production and poorer post-partum reproductive efficiency than cows calved with a higher BCS. Feeding of cows is therefore planned strategically to obtain optimal BCS throughout lactation and to prepare the cows for calving in an appropriate body condition.

There is little information on dairy cattle being strategically fed on the basis of BCS in developing countries. Insufficient nutrition, especially during critical stages of the lactation, remains a major constraint to increased milk production. It is clearly necessary to develop feeding strategies that will increase milk production by more efficient use of the available animal and feed resources. Optimizing feeding on the basis of BCS at the critical levels during lactation should have beneficial effects on the entire lactation period increasing production of milk and improving profitability for farmers. It is important to discern the relationship between BCS at calving and milk production at various stages of lactation in various breeds of cows and their crosses in these countries. The effect of post-partum feeding of energy and protein on peak milk yield needs also to be studied.

We propose to start a new CRP on this topic with the overall objective to increase milk production in developing countries through the judicial use of available feed resources providing dairy cow with sufficient nutrients at critical stages of the lactation cycle, basing these decisions on BCS. It is anticipated that this CRP will start at the beginning of 1999 and further details, including how to apply, will be published in our next Newsletter.

## "Use of an Antibody ELISA to Non-structural FMD Protein for Control and Eradication of Foot-and-Mouth Disease in Developing Countries"

Based on the encouraging results obtained in the past, e.g. North, Central and parts of South America (Chile and Uruguay) are FMD free without vaccination and Argentina, Paraguay and Southern Brazil have been declared free of FMD with vaccination. In June 1996, in Brasilia the countries in Latin America committed themselves to the eradication of the Foot-and-Mouth virus from the continent by the year 2009. Based on the experience of FMD eradication in Uruguay, OIE recently accepted a new category "FMD free with vaccination". The need of a test that accurately separates vaccinated from FMD infected animals became critical.

### Overall Objective

To improve the effectiveness of national and international FMD control and eradication campaigns through the application of an assay that is able to distinguish antibodies due to vaccination from infection.

### Specific Research Objective

To validate an antibody ELISA to non-structural proteins of FMD virus under different epidemiological conditions:

(1) to select an appropriate Ag (3ABC, 2A), Ag expression system (baculovirus, E. coli) and ELISA system (competitive, indirect);

(2) to compare different diagnostic methods (ELISA, EITB, PCR) suitable for screening and confirmation and to determine cut-off values;

(3) to collect sera and analyse results from three critical epidemiological regions
- FMD free without vaccination
- FMD free with vaccination
- FMD infected with vaccination

### Research Contracts

For the most part, these Research Contracts will be awarded to institutes which already have a capacity to conduct the ELISA and have been involved in diagnosis of FMD.

### Research Agreements

Four Research Agreements will be awarded to institutes/scientists with internationally-recognized expertise in FMD diagnosis, control and epidemiology.

### Research Co-ordination Meetings

The first Research Co-ordination Meeting will be held in 1999. The main purpose is to establish a detailed work plan for the following year. It is expected to have a training course on diagnosis and epidemiology of FMD at the same time.

Future RCMs are expected to be held every 12 - 18 months.

**Co-ordination of Technical Input**

This will be achieved through agreement on research protocols and work plans and provision of defined reagents and protocols.

## "Decreasing the Risk of Feeding Tanniniferous Plants by Optimizing their Harvesting, Diet-Mixing and Polymer Binding"

We introduced this new CRP in the AP&H Newsletter, in January 1997. It has undergone some fairly close scrutiny and it is hoped that it will now proceed with essentially the same objectives but be somewhat more focused.

The changes suggested are to develop the CRP in two stages, with a more tightly controlled animal production system.

Stage 1 (2 - 3 years )

At a small number of sites (6 to 8 ), compare and develop 2 or 3 analytical methods for the specified tannin fractions (based on the recommendations from a consultants meeting) in relation to production from dairy cattle under rigorously controlled situations. These methods must be simple, robust and suitable for use in developing countries

Stage 2 (2 - 3 years )

Select 8 to 10 sites in developing countries, and 3 to 4 in developed countries, to establish collaborative Research Contracts/Agreements to evaluate the use of tanniniferous plants based on the recommended analytical procedures and already proven RIA assessment of animal nutritional status. The overall objectives of the second stage being the application of the recently established tannins assays, and the validation of the relationships to animal production in a variety of environments in developing countries.

To make sure that the most appropriate analytical and management techniques are used, it is intended that a consultants meeting will be held from 25 - 27 August 1997 in Vienna, on **Development, Validation and Standardization of Simple and Reliable Tannin Assays Through the Use of Nuclear and Related Techniques for Better Utilization of Tanniniferous Fodder to Improve Production from Dairy Cattle in Small-holder Farms.** This meeting will answer the following questions:

1. What are the relative proportions of tannins and other potentially toxic/beneficial substances in the major plants used for animal feeds?

2. Considering the relative proportions of tannins and other polyphenols or toxic/beneficial agents in the plants, what are the dominant components in terms of animal production?

3. If, as has been suggested, the tannins are the most important in relation to animal production, what particular fractions should we focus attention on?

4. What analytical methods should be considered in the development of simple and robust assay procedures suitable for use in developing countries?

This then should provide the focus for the development and validation of simple, robust, analytical methods and their evaluation in terms of animal production as the first stage of a well defined CRP on the use of tanniniferous materials in animal production.

**Research Contract Proposals**

As a background to the submission of Research Contract proposals, institutions can obtain a copy of the recommendations from the consultants meeting, available mid-September, by contacting Ray Till at the address given at the top of the staff list. In view of the refined objectives of the CRP, previous proposals for Research Contracts should be revised and re-submitted. On the basis of technically-sound proposals from institutions, Research Contracts will be awarded for an initial period of 1 year. The deadline for receipt of such proposals is **1 December 1997**. Selection of the participants will be based on the relevance to Member States of feeding tanniniferous plants, on the qualification of counterparts, the quality of the proposals submitted and the availability of appropriate research facilities and equipment at the counterpart's laboratory. Research proposals must include experiments in which tanniniferous plants and mixtures are screened *in vitro*, and subsequently used in studies where they are fed to dairy cattle whose productivity is measured. Contracts would be renewable every year up to 3 years subject to the satisfactory progress of each annual Contract. There is modest financial support for each Contract (around US$ 5,000 - 12,000 per year with an initial higher input in the first year to provide equipment). The Contracts require an agreed work plan and are awarded on a cost-sharing basis, i.e. institutes concerned would be expected to provide support to achieve the project's objectives. It is anticipated that 6 to 8 Contracts / Agreements will be awarded for Stage 1, and 10 to 14 for Stage 2 of the CRP. It is envisaged that countries could also integrate their requirements for equipment through application to relevant National and Regional projects supported through IAEA or FAO.

**Research Agreements**

Four Research Agreements will be awarded to institutes/scientists with internationally-recognized expertise in tannin chemistry and animal nutrition and production.

**Research Co-ordination Meetings**

A RCM will be held as soon as practicable after setting up the CRP. If appropriate, a short training course in tannin assay techniques will be held during the first RCM.

**Co-ordination of Technical Input**

This will be achieved through agreement on work plans and research protocols, as well as the collection, analysis and reporting of data. Agreed analytical procedures for tannin determinations, characterization of diets and monitoring of animal production will be adhered to.

**General Information Applicable to All Co-ordinated Research Projects**

**Submission of Proposals**

Research Contract Proposal forms can be obtained from IAEA, and national Atomic Energy Commissions and UNDP offices. Such proposals will need to be countersigned by the Head of the Institution 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 IAEA Technical Co-operation Projects (TCP). These are concerned with aspects of animal production and diagnosis of animal diseases. Through such projects additional support may be provided for the activities planned under the individual Research Contracts. This would provide further equipment, specialized training through IAEA training fellowships and the provision of technical back-stopping through visits by IAEA experts for periods of up to 1 month. Such support would be available to IAEA Member States.

## F. QUALITY ASSURANCE PROGRAMMES

*External Quality Assurance Programme (EQAP)*

The FAO/IAEA EQAP for Animal Disease Diagnosis is a programme which provides counterpart laboratories, as well as the staff of the Animal Production and Health Sub-programme with a tool to measure the efficiency and effectiveness of research or technical co-operation programme implementation. Briefly, the components of the EQAP include (1) a questionnaire to provide information about the participating laboratory; (2) evaluation of internal quality control (IQC) data from the participating laboratory; and (3) an external quality control (EQC) test panel of unknown samples which are interpreted by the participating laboratory. In counterpart national veterinary testing laboratories, participation in the EQAP provides a mechanism for the implementation of improved Good Laboratory Practices (GLP) while providing external documentation of a laboratory's proficiency in conducting a specific diagnostic assay. For the Sub-programme, the EQAP provides a means to identify laboratories which are performing specific assays well, and a vehicle to help others solve problems that they may be experiencing.

Due to a number of factors, the progress in implementing and maintaining the EQAP has not been as good as had been anticipated. However, progress has been made, and it is expected that several rounds of the EQAP will be conducted in the remainder of this year.

* *The EQAP Round for the FAO/IAEA Competitive Rinderpest ELISA*

The second round was initiated in September 1996, with a total of 31 laboratories initially scheduled to participate. In fact, 29 laboratories (20 PARC, 8 WAREC, and the World Reference Laboratory at Pirbright, UK) were eventually included in this round. Seventeen laboratories responded by returning one or more of the following: (1) a new or up-dated questionnaire; (2) the IQC data from the last 12-70 rinderpest competitive ELISA plates run in the laboratory; and/or (3) the qualitative interpretations and quantitative data from the EQC panel. The results of this round have been compiled, and a report (EQAP/RP/1996A) will be distributed to participating laboratories in early summer, 1997. EQC panels and associated materials will be distributed to participating laboratories for the third round (EQAP/RP/1997A) during July 1997.

* *The EQAP Round for the FAO/IAEA Indirect Brucella ELISA*

The second round was initiated in September 1996, with a total of 35 laboratories in Asia, Africa, and Latin America participating. The results of this round are being compiled, and a report (EQAP/BR/1996A) will be distributed in mid-summer 1997. The EQC panels for the third round (EQAP/BR/1997A) will be distributed during August 1997.

* *The EQAP Round for the FAO/IAEA Trypanosomosis Antigen-capture ELISA*

The first round was initiated in September 1996, with 16 laboratories from Africa participating. A report has been compiled (EQAP/TRYP/1996A) and distributed to participating laboratories. Future EQAP efforts supporting trypanosomosis diagnosis will concentrate on proficiency testing of the new assays being developed for implementation late in 1997. No further EQAP rounds for the antigen-capture ELISA will be conducted.

* *The EQAP Round for the FAO/IAEA Foot-and-Mouth Disease ELISAs*

The first round for both the indirect sandwich (antigen detection) and liquid phase blocking (antibody detection) ELISAs was initiated in September 1996, with 10 laboratories participating in Asia. Analysis of laboratory proficiency for the indirect sandwich ELISA has been completed, and results are being distributed individually to participating laboratories. However, due to the complexity of analyzing laboratory performance with the various serotypes of FMD in the liquid phase blocking ELISA, the results for this part of the first round will not be available until late summer 1997. We anticipate initiating a second EQAP round for both assays during the fall 1997. The second round will be designed to include laboratories from Latin America as well as Asia.

As you can see, much has been done and much remains to be done in the FAO/IAEA EQAP during the rest of this year. We would like to take this opportunity to thank all of the laboratories which have participated to this point, and assure you that we will try to provide more timely "feedback" to you in the future. For copies of the reports mentioned above, or for further information on the FAO/IAEA EQAP for Animal Disease Diagnosis, please contact

the EQAP Co-ordinator or your Technical Officer through the Animal Production and Health Sub-programme.

## G. COMPUTER SOFTWARE PROGRAMS

### EDI

ELISA Data Interchange (EDI)

As announced in the last Newsletter, we have been preparing a new version of EDI in order to add some features and solve some of the problems that counterparts have experienced in the field. EDI, Version 2.2 has been beta-tested by staff of the Sub-programme and will be distributed on a limited basis for field-testing during early summer. The User Manual for EDI has been revised to incorporate information on the latest additions and changes in the programme. Briefly, the additions and changes to the newest version include:

* Addition of four new options for the type of plate reader used.
* Addition of assay modules for the competitive brucellosis ELISA and the rinderpest immuno-capture ELISA.
* Addition of a new "linker" to enable satisfactory use of EDI with MS-DOS 6.22.
* Changes to the plate 'RECALCULATION' function and storage of more complete internal quality control data from each assay plate run.

We anticipate that field-testing of EDI 2.2 will be completed soon, and the software program and new manual will be made available in late summer as a replacement to earlier versions of EDI for all laboratories using FAO/IAEA-supported ELISAs.

### SID

The first release of the new version of SID (SID III), a database program to assist in the management of data from the surveillance of disease control programmes in particular rinderpest, brucellosis and trypanosomosis was distributed at the end of last year. Counterparts were asked to give their comments and to report back on errors in the program to enable us to correct them. So far, very little response has been received.

### AIDA

The "Artificial Insemination Database Application" AIDA version 4.3 has successfully been tested by 14 Research Contract holders in 14 Asian and Latin American countries. This projects are part of the FAO/IAEA CRP on "Improvement of Ruminant Livestock Productivity through the Use of Progesterone RIA to Increase Efficiency and Quality of Artificial Insemination Services".

The database has been valuable in assisting in the identification of artificial insemination constraints under a variety of production systems, geographical situations and

cultural conditions world-wide. Up to December 1996, data from 10,104 artificial insemination services in 6,553 cows from 1,327 farms have been collected and analyzed. Data collected included information related to farms, AI technicians, semen, cow/heifer, and oestrus characteristics, and progesterone concentrations of a set of milk (or plasma) samples collected on three occasions with relation to the AI service (at day 0, 10-12 and 22-24 after service).

The database is a user-friendly application that can be used at any time in any place, independently of the current CRP framework to monitor and follow-up AI services (e.g. AI co-operatives or AI Centres, selected AI units, group of AI technicians, etc.) or to evaluate the effect of season of the year, type of semen, etc.

A new version of this stand-alone application, with some enhancements on reports and data analysis will be released by October 1997. A free distribution of the database, offered in the previous Newsletter, was in fact very limited for a number of reasons. We will re-distribute in September to those who request it provided that requesters are significantly involved in AI activities.

## H. GEOGRAPHICAL INFORMATION SYSTEMS - UPDATE

GIS has been applied in mapping the parasite and red blood cell levels of cattle monitored as part of a tsetse eradication project on Unguja Island, Zanzibar, and United Republic of Tanzania. Further analysis was conducted using statistical software (SPSS) to compare disease distribution characteristics in the island. A land use map has been compiled incorporating the livestock geography of the island. The GIS database that was thus created has been linked to a serological data base (SID3). A system that will integrate the SID3 database system with an integrated tsetse and trypanosomosis database system is currently under development by a research group from the University of Oxford. The system will incorporate multivariate analytical and spatial display capabilities in a novel way currently lacking in most GIS software.

A logical data framework has been created to accommodate animal disease data for analysis and mapping purposes for various countries. Using the framework, a database on Cameroon is being created based on the sero-monitoring data submitted to the AP&H Section.

A paper on the application of GIS in livestock disease control and eradication programmes was presented at a Symposium held in Vienna between 7 - 11 April 1997, on Diagnosis and Control of Livestock Disease Using Nuclear and Related Techniques.

A GIS training module that introduces field staff to applying GIS in data referencing, analysis, display and layout-output preparation, has been created. The module uses some of the parasitological and disease vector data and geographical data obtained from Unguja Island. Three participants have been trained using the module. It is anticipated that the module will be presented to a number of African scientists during a workshop at the Onderstepoort Veterinary Institute, South Africa, from 6 - 9 October 1997.

# I. PUBLICATIONS

**Printed**

Application of an Immunoassay Method to Improve the Diagnosis and Control of African Trypanosomosis, IAEA-TECDOC-925, 1997, 116 pp.

The Programme to Clarify and Solve the Problem of African Trypanosomosis, Programme Memorandum, 1996, 16 pp.

Programme Destiné à Clarifier et Resoudre le problème des Trypanosomoses Africaines, Exposé du Programme, 1997, 16 pp.

"Estimation of rumen microbial protein production from purine derivatives in urine", a Laboratory Manual for the FAO/IAEA Co-ordinated Research Programme on "Development, Standardization and Validation of Nuclear-based Technologies for Measuring Microbial Protein Supply in Ruminant Livestock for Improving Productivity". IAEA-TECDOC-945, 1997. 49 pp

**In Press**

Proceedings of the Final Research Co-ordination Meeting of the SIDA-funded CRP on "Immunoassay Methods for the Diagnosis and Epidemiology of Animal Diseases in Latin America", Guadeloupe, May 1994, in conjunction with the Proceedings of the Final RCM of the CRP on "The Use of ELISA for Epidemiology and Control of Foot-and-Mouth Disease and Bovine Brucellosis in Latin America", Vienna, Austria, April 1997.

**In Preparation**

Special edition of the Preventive Veterinary Medicine journal. This publication will contain most of the reports of the Final Research Co-ordination Meeting of the FAO/IAEA Co-ordinated Research Programme on "Development of Supplementation Strategies for Milk-Producing Animals in Tropical and Subtropical Environments" held in Malang, Indonesia, from 24 - 28 March 1997.

Proceedings of the International Symposium on "Towards Disease Control in the 21st Century", held in Vienna, 7 - 11 April 1997.

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