Animal health: Supporting Africa's campaign against rinderpest

IAEA and FAO scientists have played catalytic roles in helping African countries save their livestock from a life-threatening disease

by Martyn H. Jeggo, Roland Geiger, and James D. Dargie

Rinderpest, or cattle plague, is a devastating viral disease of cattle and wildlife. It can affect all animals in a herd and kill up to 90% of them. When exposed to infection, susceptible animals develop an eye discharge followed by the formation of ulcerative necrotic lesions in the mouth and nose. Within a few days these lesions spread to the intestines resulting in severe diarrhoea and frequently death. Although mild strains of the rinderpest virus exist, most infected animals die and the only effective protection is through vaccination. Fortunately, today's vaccines protect animals against all known strains of rinderpest virus and one inoculation protects them for life.

At the turn of the 20th century, the application of basic zoo-sanitary measures eradicated the disease from Europe. In Africa and Asia, however, rinderpest has continued to cause the death of millions of animals. Between 1979 and 1983, more than 100 million head of cattle were affected in Africa. In Nigeria alone during this period, 500 000 cattle died, at an overall economic cost to the country of an estimated US $1.9 billion.

Over the past 8 years, the IAEA and the Food and Agriculture Organization (FAO) have worked together through their Joint Division in Vienna to help African countries protect their livestock — and by extension their agricultural economies — from the severe consequences of rinderpest. They have supported an extensive African campaign to eradicate rinderpest. Since 1987, when the campaign began, the disease was found in 14 African countries. Today, rinderpest is restricted to relatively isolated pockets in just two African countries — an indication of just how effective efforts have been. This article reports on this campaign, specifically looking at the impact of projects carried out by the IAEA and its Joint FAO/IAEA Division. It further addresses key aspects of this work that may provide valuable lessons for the future.

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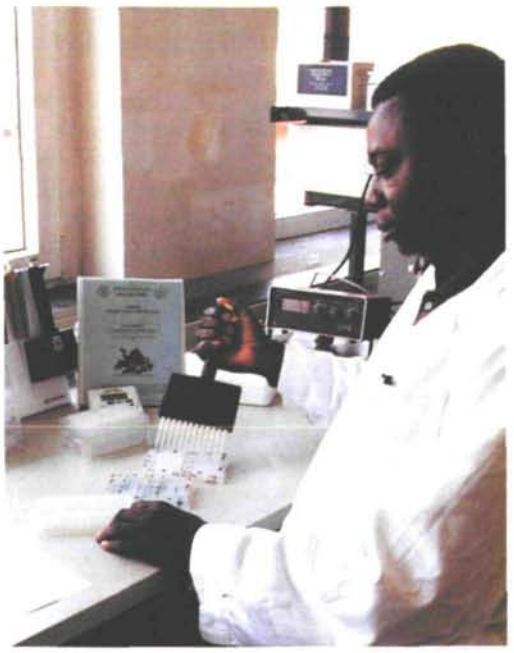
Strategy of control and eradication

Under the first major effort to eliminate rinderpest from the region (the so-called JP 15 Campaign in the mid-1960s), millions of cattle in 22 African countries were vaccinated at a cost of US $51 million. The disease all but died out. Cattle owners and veterinary authorities, no longer fearing the disease, became complacent, however. They ceased vaccination and national cattle populations again became susceptible. Unfortunately, residual pockets of virus activity remained in some countries and the movements of infected cattle by nomads and commercial operators consequently led to the devastating epidemics of the late 1970s and early 1980s.

Since then, it has been recognized that the rinderpest virus cannot survive if 85% or more of the cattle are effectively vaccinated. With this in mind, and realizing that success in eradicating the disease would require substantial strengthening of veterinary services in Africa, the Organization of African Unity (OAU) took action. In 1986, through its Inter-African Bureau of Animal Resources (IBAR), it embarked on the largest ever eradication programme for animal disease, the Pan African Rinderpest Campaign (PARC). This programme is funded primarily by the European Economic Community (EEC) but a consortium of other international and bilateral donors is also involved. *(See figure.)*

This new campaign incorporated several elements so as to be certain that countries achieved adequate levels of vaccination to ensure eradication. In addition to mass annual vaccination cam-



Scenes from campaigns to eradicate rinderpest, a life-threatening disease for cattle and wildlife.

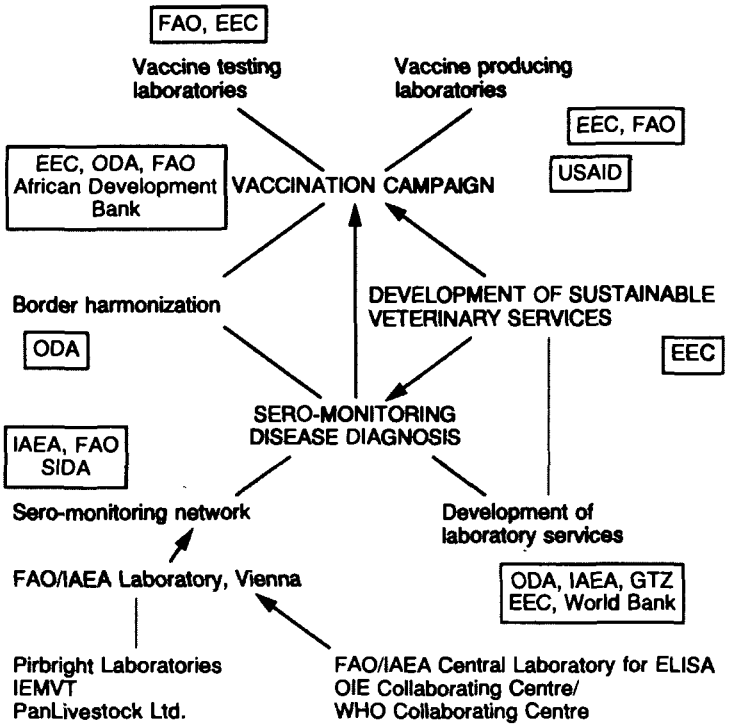
paigns, each country would need to establish a system to determine the effectiveness of their national vaccination programmes and ascertain that 85% or more of their cattle populations were immune. Once this had been attained, countries could cease vaccination but would then continue to monitor animals carefully to identify any remaining pockets of virus infection. The Office International des Epizooties (OIE) — the veterinary analogue to the World Health Organization — would officially register countries free of rinderpest, once surveillance procedures had shown this to be true. The OIE registration would thus place a seal of international acceptance of eradication for each country and pave the way for freer livestock movements and trade.

Yet how would the required level of seromonitoring and disease surveillance be established and maintained on a routine basis in each country? Until PARC started, the only recognized approach for determining whether animals were successfully vaccinated against rinderpest was to collect blood samples for examination. They would be examined for the presence of anti-rinderpest antibodies using a method called virus neutralization. This is a lengthy procedure requiring considerable expertise, equipment, and logistic support — well outside the means of most African laboratories. Moreover, the procedure cannot be standardized between countries. Therefore, some other kind of test was needed. After much discussion, a panel convened by the FAO and IAEA decided that an immunoassay-based method called the ELISA (enzyme-linked immunosorbent assay) offered the ideal solution to the problem.

ELISAs can be used to diagnose a wide range of different diseases. They identify the causative organism and detect the antibody response to different organisms. They are therefore in principle suited to measuring both the response to rinderpest vaccination and to detecting any remaining foci of virus activity following a cessation of vaccination. ELISAs are relatively simple and, because the reagents are used in minute amounts, also very inexpensive. Another major advantage is that the procedure is fast. Many samples can be tested in a short time, which means that analysis of test results can be computerized. The assays can be easily checked through internal and external quality control procedures, removing all subjectivity and providing assurance of results. Finally, ELISAs can be produced in a "kit" with the reagents prepared in such a way that they can withstand the rigours of prolonged travel.

Developing the approach

IAEA has the task of promoting the peaceful uses of nuclear energy and in agriculture its programme is developed and technically implemented by the Joint FAO/IAEA Division. In the early days of immunoassays, radioisotopes were the labels of choice and today these are still used extensively in radioimmunoassays (RIA) for



OAU = Organization of African Unity; IBAR = Inter-African Bureau for Animal Resources; ODA = Overseas Development Adminsitration (UK); EEC = European Economic Community; GTZ = Deutsche Gesellschaft für Technische Zusammenarbeit; SIDA = Swedish International Development Authority; OIE = Office International des Epizooties; IEMVT = Institut d'Elevage et de Medicine Veterinaire des Pays Tropicaux; WHO = World Health Organization; USAID = United States Agency for International Development

Structural organization of PARC

measuring reproductive hormones and as labels for other diagnostic procedures involving molecular methods.

However, in the 1980s, enzymes became recognized as more appropriate labels for diagnostic tests based on immunoassay where the need was for high throughput and a "yes/no" answer. Nevertheless, in the process of developing and purifying reagents for ELISA tests and for validating their specificity and sensitivity, isotopes are extensively used. While the final test does not contain an isotope, ELISAs would be difficult to develop without isotopes, and they are clearly nuclear-based techniques. Indeed the very first immunoassay-based serological test for rinderpest was an RIA using antibodies labelled with iodine-125.

Against this background, it was logical for the IAEA to expand its programme to encompass ELISA for diagnosing livestock diseases. It was also logical, in view of the critical food security situation in Africa, that the first target of such a programme would be to develop a cheap and reliable test for rinderpest — a disease which is capable of killing large numbers of animals which provide a basic source of food and traction for millions of Africans.

At the outset, some key decisions had to be made on how to implement the task — in particular whether to provide veterinary centres with the capability to produce their own kits for particular diseases, whether to supply kits from a commercial source, or whether the IAEA itself should produce them. Although it may have been politically desirable to provide each diagnostic centre with the capability to develop and produce its own ELISA test, this was considered technically and economically unrealistic. Commerical kits also posed problems. While the supply appeared to be a simple solution, the kits are prohibitively expensive and are seldom designed for use in developing countries. Moreover, they are not available for rinderpest or many of the diseases which exist in developing countries. A further important consideration was that commercial companies do not provide training or technical backstopping on the use of their diagnostic products in developing countries. Consequently, the validity of the obtained results is often suspect.

Having weighed the pros and cons of each option, the IAEA and FAO decided to establish the FAO/IAEA Central Laboratory for ELISA and Molecular Techniques for Animal Disease Diagnosis, located at the IAEA's Seibersdorf Laboratories. Within this Central Laboratory, tests for a variety of diseases affecting livestock could be developed and refined and quality assurance programmes for the various tests could be co-ordinated. Its establishment and subsequent recognition by OIE and WHO as official collaborating centres for ELISA were critical — not only from the standpoint of providing the springboard for the development of the IAEA's programme but also for promoting international standardization of reagents and test protocols for diagnostic tests. As far as PARC was concerned, this approach satisfied the requirement for all PARC countries to use a standardized system of sero-monitoring. In that way, results could be compared from country to country, validation data could be produced which would meet stringent OIE requirements, and adequate internal and external control procedures could be introduced to assure all parties that the results being reported were indeed correct.

In providing support for the introduction and use of ELISA-based technology for sero-monitoring into PARC countries, two basic types of IAEA support programmes were utilized: the Research Contract Programme and the Technical Co-operation Programme. But crucial to the success of the IAEA's assistance was the

overall integration and co-ordination of these resources by the Joint FAO/IAEA Division.

Setting up the network

Co-ordinated research programmes. FAO/IAEA research contracts are awarded on an annual basis (for up to 5 years) to institutes in developing countries for the purpose of using nuclear-based methods to study or solve a problem in a particular field of activity or region. These contracts can be grouped to form a Co-ordinated Research Programme (CRP), under which a number of research agreements are also awarded to institutes in developed countries that have established expertise in the problem being tackled. CRPs, which are funded by the IAEA's regular budget or by external donors, also involve holding Research Co-ordination Meetings (RCMs) at regular intervals.

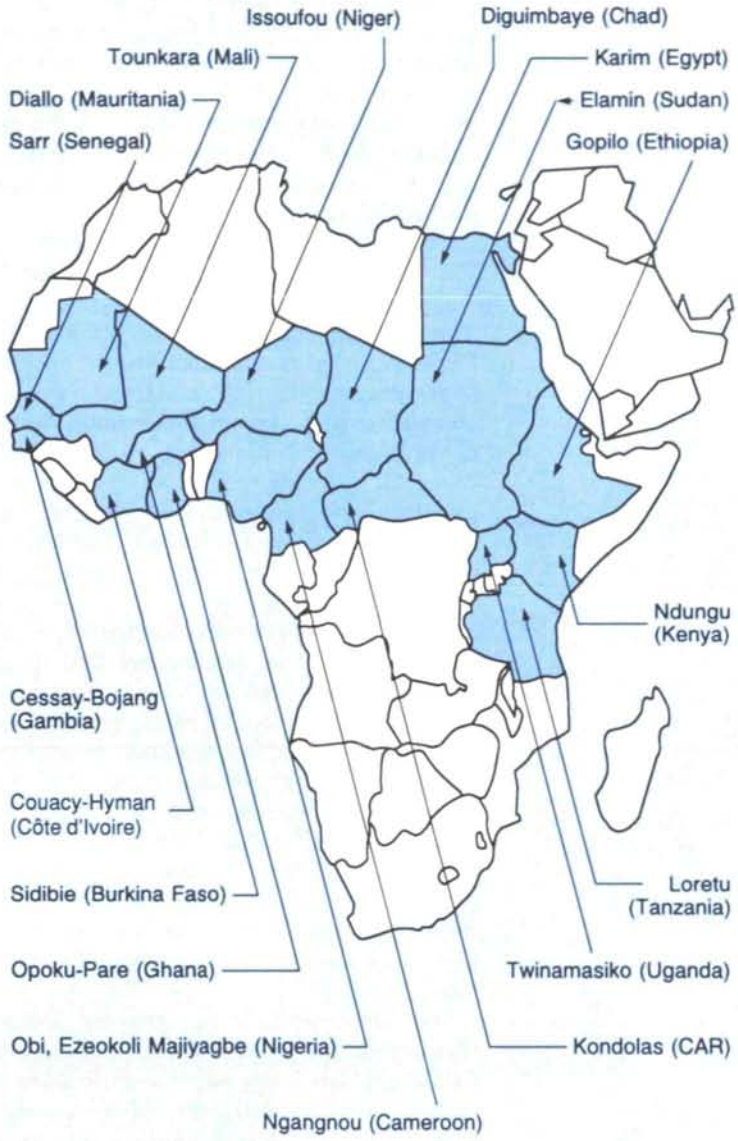
CRPs were an ideal mechanism for establishing a "network approach" for introducing an ELISA test for rinderpest sero-monitoring. They responded to the need for a simple, cheap, and reliable system to monitor and if necessary improve the effectiveness of the expensive national vaccination programmes envisaged under PARC, and to the need for a system which could be easily run in a standardized fashion throughout the region. CRPs further would allow validation of the ELISA under a wide variety of conditions and localities in Africa; "fine tuning" of the ultimate test to be used; and field testing of the computer software programs necessary for quick analysis of the many thousands of sera that would be tested.

Against this background, the IAEA approached the Swedish International Development Authority (SIDA) for funding. In 1986, it agreed to provide funds to the Joint FAO/IAEA Division for a 5-year programme to introduce an ELISA test (developed by the Pirbright Laboratories in the United Kingdom in collaboration with the FAO/IAEA Central Laboratory) into 21 national veterinary laboratories in 19 African countries charged with the task of sero-monitoring rinderpest.

By the early 1990s, the initial objective of having a fully validated and standardized ELISA test running routinely in Africa was achieved. The stage was then set to train staff in the veterinary centres supporting PARC's activities to use the test as a monitoring tool within the framework of their national campaigns and to establish systems of feedback of results to national PARC co-ordinators and to officials responsible for regional co-ordination at OAU/IBAR. During these follow-up activities, which were also generously funded by SIDA, the ELISA kit for rinderpest was modified to give the higher levels of sensitivity and specificity needed to identify residual areas of virus activity. An external quality assurance (QA) programme also became operational under which each participating laboratory was required to test 40 sera each year to assure that the results obtained were valid. Standardized systems for designing sampling strategies for each country were written and two FAO/IAEA computer software programs were developed to assist in data generation, storage, and manipulation.

Throughout the entire period of SIDA support (from 1986-1993), RCMs were held annual-

FAO/IAEA Sero-monitoring Network of National Veterinary Laboratories in Africa



ly at which research contract holders presented details of their national sero-monitoring programmes, the results obtained, and their plans for the next 12 months. These co-ordination meetings proved vital in maintaining the programme's impetus. During the past 3 years, national sero-monitoring results from the entire region have been published by IAEA on an annual basis to provide national authorities, OAU, and all donors with an up-to-date account of PARC progress, and to provide individual countries with the basis for declaring freedom from rinderpest.

Technical co-operation projects. The IAEA's Department of Technical Co-operation was another important avenue of support. Through national and regional projects, the Department helps countries to develop their human resources and infrastructures so that they are better able to use nuclear methods for the development of different sectors of the economy, including agriculture. These projects usually involve a partnership between the IAEA and relevant national institutes. The institute provides basic infrastructural resources and the Agency provides appropriate equipment, training in the technology for counterpart staff, and outside experts who periodically visit the institute and assist with the technology transfer. Such projects may last for 3 to 5 years.

For PARC, IAEA-supported national and regional projects provided intensive training in technical skills and knowledge to national staff belonging to the testing laboratories (through regional courses and individual fellowships), the equipment and rinderpest kits needed to do the testing, and the services of both short-term experts and a regional expert to technically support the activities.

For technical officers, primary concerns typically include ensuring that recommended activities are technically viable, contribute to the socio-economic development of the countries (that is, have "impact"), and are able to run independently of donor support. Administrators are also interested in these aspects, but they additionally want information on costs and cost-effectiveness, including justification for the way in which technical officers utilize the financial resources. A number of questions therefore inevitably arise when a particular Agency activity is evaluated: What did it achieve? Has it had impact? What did it cost? Can it now run on its own without further external inputs?

Achievements, costs, and impacts

Before the IAEA's rinderpest programme was initiated, national vaccination programmes against the disease in sub-Saharan Africa could not be monitored effectively by the veterinary services. This was because they lacked an appropriate test, an appropriate and reliable animal sampling framework for using the test, and systems for reporting and feedback of results. They also lacked the equipment and know-how to conduct sampling and testing in a way which was acceptable to OAU/IBAR, to the OIE and to the donors supporting PARC. These countries, therefore, were unable to show that they were free of rinderpest or the virus which causes it. As a result, there were restrictions on animal movements and trade. The veterinary services were also locked into costly and indefinite annual vaccination programmes to avoid adverse economic and agricultural consequences arising from the cattle deaths, reduced meat and milk production, and loss of traction animals caused by outbreaks of rinderpest.

The Agency's programme has helped to introduce a new scenario — one in which an internationally accepted test has been developed, validated, and made available with quality assurance to the majority of African countries involved in PARC. The test works well and national veterinary authorities and all major donors and organizations involved in the PARC programme firmly believe and trust its reliability. It can now be used for other national and regional programmes being developed by FAO in concert with major donors.

But developing the test and providing the internationally accepted FAO/IAEA test kits and the equipment to conduct the assays were perhaps the least of the challenges. Having developed this powerful test, the first challenge was to decide how it should be used to assist in "decision making" — both within the national testing laboratories and by those supervising field staff responsible for cattle vaccinations and for collecting blood samples for testing. The next challenge was to develop the linkages needed to make the strategy work.

Two further major achievements of the programme were that it served to catalyze discussion and eventual agreement between all those with a stake in PARC on the steps that countries would take in the process of moving along a pathway which would culminate in a declaration of freedom from rinderpest. It also put into place within 19 countries a verifiable and transparent system for doing this. Thus, apart from developing and providing the essential "tool" for verification, the IAEA's programme introduced the quality assurance and epidemiological systems necessary to ensure international acceptability and reporting of data obtained by national testing laboratories. Impor-

tantly, the programme also helped to ensure that a constant flow of information took place between these centres and the people making the decisions in the field so that vaccinations were targeted at susceptible cattle populations. Such a comprehensive and standardized system of national and regional testing and reporting has never been achieved before — either in the developed or developing world.

Behind all this lies considerable human endeavour and commitment. Many development projects provide training abroad for national counterparts and the services of full-time consultants in recipient countries to assist project activities. All too often these activities collapse because the counterparts leave their posts following training or the consultant leaves the country.

During this programme, only three of the several dozen people trained through FAO/IAEA-sponsored courses, workshops, fellowships, and other mechanisms (which were conducted almost exclusively within Africa) moved to other positions and were replaced. National counterparts were supported initially by consultants from outside Africa who made only short visits to the countries concerned (typically for 1 to 2 weeks), but always with a clear objective in mind — for example, to check assay results or help with data analysis. Accountability for doing the testing and for interpreting and reporting results was always with the national counterparts, and the reagents for running the external quality assurance of assay results were prepared and distributed from an African centre.

Without doubt, therefore, and in addition to the technical and conceptual developments which underpinned the Agency's assistance, the major achievement (and critical factor in making this support effective) was the high levels of technical ability, knowledge, and motivation attained by the national counterpart staff. This was made possible by using the comparative advantages of the different IAEA support mechanisms. One spin-off from this is that counterparts who started off as IAEA trainees are now providing the bulk of the technical support for rinderpest sero-monitoring in Africa and are being hired as consultants by the IAEA and FAO in support of rinderpest eradication activities elsewhere in the world.

Economic impacts. The impact of PARC and of the IAEA's programme is already evident at a number of levels. The first of these is economic. Here it must be emphasised that while the funds provided by the Agency were critical to the success of PARC, they were complementary to other inputs and would have been ineffective without the mobile veterinary force and laboratory personnel or the vehicles, fuel, spare parts, etc., needed in each country to vaccinate cattle and collect blood samples.

The cost of carrying out the original basic research to develop the reagents for use in the standardized FAO/IAEA kit were covered by the United Kingdom through its support to the Pirbright Laboratories. Additionally, the reagents and the consultancy services needed to help establish the technical capability to produce the kits at the FAO/IAEA Central Laboratory were provided by the UK's Department of Energy. Thus, essentially all the original research and development costs were met from sources outside the IAEA.

The programme then moved progressively through the stages of technology transfer (equipping and training of staff in counterpart laboratories), applied research to validate the rinderpest test (including further training and technical backstopping by IAEA experts and the holding of co-ordination meetings), and ultimately to the final stage of routine use of the test within national vaccination programmes and reporting of results to regional PARC co-ordinators and donors. During these stages, SIDA provided US $1 million for applied research in Africa and at Seibersdorf, while the IAEA's Technical Assistance and Co-operation Fund (TACF) provided US $2.7 million primarily for training, equipment and kits, and technical backstopping. When considered in relation to the number of countries involved and the timescale of the programme (1986-1994), these outlays represent annual expenditures of less than US $20 000 per country over the period covered. In fact, due to the extremely high level of sustainability which now exists in this programme, the Agency's contribution to the entire PARC sero-monitoring in 1994 fell to US $80 000, or about US $4500 per country. In 1995, no further inputs are foreseen from the TACF.

The costs of vaccination and blood collection and testing vary considerably from country to country. Figures from a number of Member States indicate average costs of US $0.8 per head and US $3 per sample, respectively. Thus in Egypt, for example, where 4.2 million cattle were vaccinated in 1992-93, the cost of vaccination was US $3.3 million. Based on the sero-monitoring and disease surveillance results which cost US $30 000 to obtain, this country was able to stop vaccinating and therefore saved more than US $3 million. However, to meet OIE recommendations, countries must continue to sero-monitor for 5 years following cessation of vaccination, which in Egypt's case will cost about US $150 000; nevertheless, savings on vaccinations over that period will exceed US $16 million. The Gambia has also stopped vaccinat-

ing and a further six West African countries (Mali, Senegal, Ghana, Burkina Faso, Côte d'-Ivoire and Mauritania) will do so by the end of 1994 with annual savings totalling US $6 million. Sero-monitoring in these countries costs US $60 000 per year, or US $300 000 during the 5 years following vaccination. For this group of countries, total savings over 5 years after accounting for the costs of sero-monitoring will therefore be just under US $30 million. Even in a rinderpest-infected country like Ethiopia with a cattle population of 35 million, vaccination has now stopped in large areas and the scarce resources are used to focus on the endemic areas. The confidence of the veterinary authorities to cease vaccination in these countries is largely based on the sero-monitoring results.

These figures go some way towards illustrating the enormity of the economic resources expanded on PARC and they also demonstrate the great cost-effectiveness of the IAEA's support. Yet they do not give the total picture. Eight years ago rinderpest was present in 14 African countries. It is now restricted to relatively isolated pockets in only two countries. Major outbreaks of rinderpest such as those which occurred before PARC normally last for about 5 years and result in an average mortality of 30%. With a total cattle population of 120 million in sub-Saharan Africa, this represents about 8 million cattle per year. At an estimated value per-head of US $120, the total cost of another rinderpest pandemic would be US $960 million per annum. Under PARC, approximately 45 million cattle are vaccinated annually at a cost of US $36 million. This gives an annual cost-benefit ratio for the vaccination campaign of around 25 to 1. The net annual economic benefit to sub-Saharan Africa of the campaign is therefore in the region of US $920 million, excluding other benefits, such as the value of animal traction. By analogy, the cost of renewed epidemics of rinderpest would be around US $1 billion per year. There can therefore be no doubt that PARC is economically justifiable and that the Agency's assistance has contributed substantially to the economic impact of the campaign by putting into place the technology and decision-making apparatus to enable countries to appropriately target and monitor their vaccination programmes, and then to eventually stop vaccination .

The second major impact is political. Rinderpest eradication is given top priority by the OAU for livestock development in Africa and this organization has campaigned vigorously to secure donor and national support for both vaccination and sero-monitoring. The undoubted success of both activities in terms of economic benefits to individual farmers and countries, and in establishing effective linkages between farmers and field and laboratory personnel has given the veterinary services a high profile in PARC countries. This in turn has opened up opportunities for improved control or eradication of other diseases and enhanced prospects for privatization and sustainability — a point underlined at the 4th OAU Council of Ministers meeting held recently in Addis Ababa where the principles developed and strategies undertaken in implementing the IAEA's support for PARC were considered as a model for other diseases.

The major impact of the IAEA's programme is still to come. The resources established for rinderpest can now be used to encourage flow of animal disease data from the herd level to veterinary investigation centres and from there to national authorities. In that way, appropriate policies and cost-effective campaigns may be developed to control or eradicate other diseases affecting livestock and food security in Africa. A start to this has already been made through national technical co-operation projects under which assistance is being provided to support control programmes on African Horse Sickness in Morocco, brucellosis in Zambia, Mali, Côte d'Ivoire and Ghana, and contagious bovine pleuropneumonia in Namibia, Uganda, Cameroon and Côte d'Ivoire. Also, a network similar to that in operation for rinderpest was recently established to monitor trypanosomiasis control programmes in 14 African countries. With the rapid move towards liberalization of trade and internationally standardized approaches to establishment of disease status as agreed under the General Agreement on Tariffs and Trade (GATT), the approach that has evolved through the IAEA's assistance to PARC will prove crucial in the long term to improving African livestock productivity and giving producers a better chance in the international market place.

Sustainability

Throughout the developed world, governments have embarked on the progressive privatization of industries and even of essential services like health, public transport, and education. In these countries, most aspects of animal welfare are in the hands of private veterinary practioners who are licensed to undertake routine vaccinations, on-farm testing, and clinical inspections. Nevertheless, national governments and government veterinary officers retain control over significant parts of disease reporting and control programmes including the running of essential support services, such as veterinary

investigation and animal disease research centres. These continue to be funded from taxes generated from agriculture, but much more significantly from the industrial and service sectors simply because they are considered as politically and economically essential to the countries concerned.

In Africa, agriculture is the backbone of the economy and livestock are both essential and substantial components. At present the veterinary services are almost exclusively government-run. Current moves to liberalize their involvement, through new policy and financial frameworks being prepared and implemented through PARC, will reduce but not eliminate government responsibility for planning and monitoring control or eradication programmes for many diseases and for running support services.

The IAEA's assistance to PARC has covered a period of 8 years and the activities of the network which was established will continue to be supported technically by the Joint FAO/IAEA Division, OAU/IBAR, and FAO using funds now being made available by the EEC.

The need to maintain external funding for this activity will probably be seen by some as a sign of failure because it implies "non-sustainability". Yet the financial resources required to maintain the rinderpest sero-monitoring network now amount to less than US $5000 per country, primarily to supply FAO/IAEA kits (which cost US $2000 to test 10 000 samples in duplicate), some consumables and *ad hoc* consultancy services.

These inputs are small when considered in relation to the initial investments made in research, development, equipment, and training; they are minimal in comparison to the investment being made by the countries themselves; and they represent a fraction of the benefits accruing to the African livestock and agricultural sectors. But small as these inputs may be, external funding must be maintained either until the job is completed (in which case there will be no further need for kits), or the policies now being put in place produce comprehensive customer-client relationships. As pointed out earlier, in no country in the world are any of the facets which society considers vital to its well-being and development truly self-sustainable if defined in purely narrow sectorial terms. The African veterinary services are no exception.

The future

In all the countries covered by the IAEA's programme, the capacity now has been developed to use immunoassay technology to monitor rinderpest vaccination. As immunity levels in national cattle herds reach 85% and countries cease vaccination, they will continue to carry out intense serological and disease surveillance to identify and remove any remaining pockets of disease or virus activity which were not detected because of vaccination programmes. The funds now earmarked by the EEC will be used to cover the requirements of countries which have not yet benefitted from Agency support and to establish in all national laboratories a second ELISA test which will enable actual diagnosis of rinderpest as opposed to detecting antibodies to the virus. This kind of test is essential for countries that stop vaccinating so that appropriate remedial action can be taken in the event of a suspected outbreak of the disease.

Eradication programmes similar to PARC are being planned by FAO and the EEC for other parts of the world infected with rinderpest, most notably in the Arabia peninsula under a West Asian Rinderpest Eradication Campaign (WAREC), and in Asia through a South Asia Rinderpest Eradication Campaign (SAREC). Also, FAO recently launched its Global Rinderpest Eradication Programme (GREP) to provide a co-ordinated approach to global rinderpest eradication — a target which it is believed can be achieved by the year 2010.

These programmes will attempt to emulate the undoubted success of PARC. In all cases, rinderpest sero-monitoring and surveillance using the test and strategies developed and introduced by the IAEA for PARC have been pinpointed by FAO and the EEC as crucial to the success of this global effort. The funds required for the testing programme to support SAREC have already been earmarked for establishing an FAO/IAEA co-ordinated research programme operated by the Joint Division, and in many WAREC countries a number of national IAEA technical co-operation projects are now providing support for rinderpest sero-surveillance along the lines provided to PARC.

The ultimate goal of global eradication will take time, but with increasing realization of the benefits to be attained and a commitment on the part of the countries affected to face up to the seriousness of the problem, the goal that has been set is a realistic one. When rinderpest is finally eradicated the IAEA's contribution to this unique effort will have been considerable. ❐