The role of FAO in the eradication of rinderpest

Introduction
In 1945, when the United Nations was established to succeed the League of Nations, the Food and Agriculture Organization of the United Nations (FAO) was one of the first specialized agencies to be set up. During its first Conference, held in Quebec (Canada) in the autumn of 1945, both the assets and mandate of the International Institute of Agriculture (IIA), created in May 1908, were handed over to FAO. In line with the IIA vision, FAO convened the first international meeting (1946) on animal health in London (United Kingdom). This aimed to explore how the Organization could best assist the harmonization of efforts to contain high-impact livestock diseases, particularly those that were transboundary in nature and were seriously affecting human nutrition, following the global war that had just ended. Rinderpest was at the top of the list, and continued to dominate the animal health agenda ever since. The first role of FAO was to help develop improved vaccines that were sufficiently low in cost for extensive rinderpest control operations. For the first time there was hope of eradicating the disease (Hambidge, 1955). As there was little international collaboration in rinderpest control and research during that period, FAO took a coordination role, which would lead – after almost 65 years – to the global eradication of rinderpest in June 2011.

The role in the production and use of vaccines
In April 1947, the Sub-committee on Animal Health of the FAO Standing Committee on Agriculture recommended that FAO should assist in the distribution and establishment of the then novel attenuated avianized rinderpest virus vaccines developed by a team of United States and Canadian scientists at the Grosse Isle Laboratory in Lower St. Lawrence River, Canada. Towards the end of 1947 two veterinarians were assigned to the FAO special advisory group in China, to assist the Chinese in the future development of avianized and lapinized rinderpest vaccines. At the end of April 1948 a veterinarian, K.V.L. Kesteven, was appointed to join FAO’s staff in Washington, DC (the United States of America), and was assigned primarily to work on the problem of rinderpest (United Nations Interim Commission on Food and Agriculture, 1945; Hambidge, 1955).

In the following years, the eminent Japanese virologist Junji Nakamura advised the Governments of Egypt and Nigeria on the production of rinderpest vaccine, while S.A. Evans advised the Sudanese Government. An important international workshop organized by FAO was held at Izatnagar, India, early in 1953, under the direction of S. Datta, and was concerned with the manufacture of live virus vaccines, particularly the rinderpest vaccine. Two years later, R. Daubney ran a similar international training workshop in Cairo (Egypt). This was followed in 1959 by another workshop in Pakistan under the direction of G.G. Alton (FAO, 1955).
In the 1950s, FAO supported the use of lapinized and lapinized-avianized attenuated vaccines developed by Nakamura. Meanwhile, Walter Plowright and colleagues at the East Africa Veterinary Research Organization were developing an attenuated tissue culture vaccine, intended to replace the goat-adapted vaccines that had been used extensively in Asia and Africa throughout the 1940s and 1950s – and to good effect, despite their residual virulence and demanding production procedures. The new safe and effective vaccine was evaluated extensively in the early 1960s in Africa. As a result, from 1970 onwards, FAO was able to recommend that this tissue culture vaccine should be used in all affected and at-risk countries (FAO, 1993; WHO/FAO/OIE, 1968). One challenge to its use was the necessity of keeping the vaccine cold (in hot climates), to prevent the rapid loss of viral infectivity, rendering the vaccine useless. This cold chain problem was ameliorated to an extent by the use of freeze-drying, first applied to goat-adapted rinderpest vaccines in Kenya. Subsequently, in the 1980s, adaptation of the virus to VERO cells and an improved freeze-drying process to reduce residual moisture enabled Jeffrey Mariner, funded by the United States Agency for International Development (USAID), to produce a vaccine formulation with enhanced thermo-stability. This new formulation allowed the tissue culture vaccine to retain its potency for a month or more (as long as it was not reconstituted), even in the extremely hot conditions encountered in many of the countries where it was needed. Production of the vaccine, called Thermovax, was successfully transferred to a number of vaccine manufacturers and proved key to rinderpest control in remote pastoral areas, using community-based animal health workers.

**The role in establishment of veterinary services**

In the early days, FAO experts and consultants carried out assignments in most countries where rinderpest was endemic, with a focus on setting up veterinary services to control diseases. R. Daubney was one of the pioneers at the Kenya Veterinary Services, and later he was tasked with advising the Governments of Egypt and India on the control of rinderpest by national mass vaccination campaigns, which were spectacularly successful when they were implemented in the 1950s. Concurrently, in Cambodia, K. Fukusho, T. Furutani and H.L. Stoddart established a production plant for a lapinized-avianized rinderpest vaccine, and used the vaccine in the field to control the disease. J.R. Hudson was similarly occupied in Thailand. For nearly two decades, V.G. Hinds was a consultant in Bangladesh, India and Pakistan, designing, constructing and operating biological plants producing lyophilized rinderpest vaccine. In the late 1950s, H.B. Shaki established a veterinary service in Nepal to combat rinderpest (United Nations Interim Commission on Food and Agriculture, 1945). As rinderpest was suppressed, FAO assisted countries’ veterinary services with the final stages of rinderpest elimination, halting vaccination and providing evidence of the absence of the virus through application of different surveillance tools. The Organization also contributed to the standard-setting activities of OIE. In addition, FAO supported the training of epidemiologists and laboratory staff and the procurement of laboratory equipment for almost all the countries infected by rinderpest.
The role in creating regional institutions

In 1948, FAO and the British Colonial Office organized a pan-African meeting in Nairobi (Kenya) specifically to discuss methods of controlling rinderpest. Participants from 32 countries unanimously concluded that the eradication of rinderpest was a practical possibility and should be carried out without delay. The African Rinderpest Conference, examining the question of eradication in Africa, drew attention to the special problems that existed in certain territories and envisaged that assistance might be required in the spheres of finance, provision of personnel and provision of vaccines. The conference also warned that overstocking could become accentuated as control of rinderpest progressed, and stressed that attention to the marketing and utilization of surplus stock was imperative. The conference considered that FAO would be the most suitable global organization to undertake solution of the problems (FAO, 1955). Accordingly, it asked for FAO’s assistance with the creation of an African Rinderpest Bureau (a precursor of the present-day African Union’s Inter-African Bureau for Animal Resources [AU-IBAR]), which was to play a key role in supporting rinderpest eradication from Africa. It was proposed that its creation should be initiated and established in 1950, by the Commission for Technical Cooperation in Africa South of the Sahara (CCTA) and the Foundation for Mutual Assistance in Africa South of the Sahara (FAMA). A working party of these two bodies studied the proposal for the creation of the bureau and widened its functions to include all African epizootic diseases of livestock. Thus, in 1952, the bureau was established at Muguga, Kenya, as the Inter-African Bureau of Epizootic Diseases (IBED) with W.G. Beaton as its first director. Accepting morbid conditions in addition to epizootic ones, IBED became the Inter-African Bureau of Animal Health (IBAH), which in 1970

Figure 1: Regional programmes/projects
broadened its responsibilities to include animal production and was renamed IBAR (FAO, 1993).

The first Joint FAO/OIE Far East Meeting on Animal Health was held in Karachi (Pakistan) in 1952, the second in Bangkok (Thailand) in 1954, and the third in Tokyo (Japan) in 1956. Since January 1959, responsibility for work in the field of animal health was taken up by the Animal Production and Health Division of FAO. Later, in 1976, as outcomes of these meetings, the FAO Animal Production and Health Commission for Asia, the Far East and the Southwest Pacific (APHCA) was established. When the first session of APHCA opened, in Bangkok (Thailand) from 7 to 11 June 1976, Bangladesh, India, Malaysia, Nepal, the Philippines, Sri Lanka and Thailand were members. In setting its operational guidelines, the commission categorically decided that its operational thrusts would be aimed at action-oriented programmes in livestock and poultry development, which would include such activities as disease control. Animal production and health would be covered on both a national and a regional basis (APHCA, 1976).

In the late 1950s, FAO accelerated the foundation of the Near East Animal Health Institute at several sites, overseen by Yoshihiro Ozawa. The rinderpest unit was established in Cairo (Egypt) and was equipped to diagnose rinderpest and produce rinderpest tissue culture vaccines (United Nations Interim Commission on Food and Agriculture, 1945).

Improving the quality of rinderpest vaccines for use in African vaccination programmes was a challenge, which FAO met by establishing the Pan African Veterinary Vaccine Centre (PANVAC) based in Senegal and Ethiopia for the quality assurance of vaccines, under the management of Daouda Sylla and Mark Rweyemamu. Established as a service for AU-IBAR for the Pan African Rinderpest Campaign (PARC), PANVAC benefited from funding provided by the FAO Technical Cooperation Programme (TCP) supplemented later with inputs from the United Nations Development Programme (UNDP), the European Commission and Japan. It made an invaluable contribution to rinderpest control and is now institutionalized within the AU.

Role in coordination

Energized by the second great African rinderpest pandemic, which hit sub-Saharan Africa in the early 1980s, FAO and partners lobbied strongly for a concerted effort to eradicate rinderpest from the continent; the Pan-African Rinderpest Eradication Campaign was the result. For more than 50 years, FAO was crucial in establishing and coordinating other regional rinderpest control campaigns (Figure 1): the African Joint Programme 15 (JP15); the Near East Animal Health Institute’s regional project; the Middle and Near East Regional Animal Production and Health Project (MINE- ADEP); PARC; and the West Asia Rinderpest Eradication Campaign (WAREC). A South Asia Rinderpest Eradication Campaign (SAREC) was energetically promoted, but did not materialize and was replaced by individual country livestock development pro-
grammes funded by the European Commission (APHCA, 1976) with coordination by the GREP Secretariat. After it came to an end, PARC was followed by the Pan African Programme for the Control of Epizootics (PACE). This generated the Somali Ecosystem Rinderpest Coordination Unit (SERECU), which played a key role in coordinating activities and continued until the three countries (Ethiopia, Kenya and Somalia) could be accredited as rinderpest-free. During PARC and PACE, FAO maintained a unit within AU-IBAR in Nairobi (Kenya) focused on studying the epidemiology of rinderpest across the African continent. This oversaw the success of the various emergency campaigns against rinderpest in West Africa in the period immediately after the discovery of the second African epizootic (1980s), and was active in strategy setting.

In 1994, the FAO Council approved the establishment of EMPRES. Salient under EMPRES is GREP, which was designed as a time-bound programme aimed at ensuring the evidence-based global eradication of rinderpest virus by 2010. In addition, the GREP Secretariat contributed to the standard-setting activities of OIE by being involved in production of the Terrestrial Animal Health Code – Rinderpest Chapter, the Manual – Rinderpest Chapter and surveillance guidelines and in the rinderpest ad hoc group, overseeing the accreditation of countries as rinderpest-free. Through this programme, GREP assumed the responsibility for assisting the veterinary services of rinderpest-affected countries to eliminate the infection, develop or assess their evidence relating to the demise of the infection (clinical searches, sero-surveillance, contingency planning), and express this in accordance with the rules for accreditation through dossier presentation, developed by OIE. In just 17 years, it has provided technical assistance and guidance to many countries and regions in their rinderpest control, as well as providing technical guidance to international organizations and donors.

**Consultative meetings**

From the late 1940s onwards, FAO (Headquarters and in the field) convened a series of consultative meetings. The objectives were to find ways of producing suitable vaccines for controlling the disease, formulating strategies for control, guiding countries, and monitoring progress in disease control/eradication. Latterly, it was
recognized that regional coordination of campaigns against rinderpest would be the only realistic approach to controlling the disease, as isolated national actions would lead only to sporadic and unsustainable improvements. FAO sent an observer to the first international meeting convened for the inauguration of JP15 in 1961 (in Kano, Nigeria). When the campaign was extended to eastern Africa, using funds from UNDP, FAO ran training schemes in Ethiopia and Somalia. A few years later, a similar rinderpest conference was convened by FAO for Asia and the Far East, in Bangkok (Thailand), at which several governments agreed to take all possible steps to control the widespread outbreaks of rinderpest by coordinating their programmes with those of neighbouring countries, with the objective of ultimate eradication. In 1968, the World Health Organization (WHO), FAO and OIE jointly organized a meeting in Paris to draw up standards for the production of avianized, caprinized and lapinized rinderpest vaccines. A further meeting in 1971 drew up the standards for rinderpest cell culture virus vaccine (APHCA, 1976; FAO, 1955, 1993; United Nations Interim Commission on Food and Agriculture, 1945). Several expert meetings or training courses/workshops reviewed the technical progress on FAO-GREP and advised accordingly. The technical consultations held during GREP emphasized the need for epidemiologically determined strategies and encouraged adoption of the concepts of performance indicators, bench-marking and risk management, and discouraged prolonged mass vaccination programmes. The GREP strategy that led to global eradication was guided by two underlying thrusts: i) time-bound milestones as set out in the GREP Blueprint; and ii) basic risk analysis principles.

Networking in epidemiology and laboratory diagnostics
The world has been placed at the point of worldwide rinderpest eradication by the concerted efforts of national authorities, with investment in regional programmes from the international community. Research institutes and reference laboratories operating within regional laboratory networks provided the vaccines, diagnostic, surveillance and epidemiological tools to make this possible. Very active in this field was the World Reference Laboratory (WRL) established by FAO at the United Kingdom’s Institute for Animal Health (IAH) Pirbright Laboratory, which conducted seminal work on diagnostics and molecular epidemiology, and the Joint FAO/International Atomic Energy Agency (IAEA) Division based in Vienna (Austria). Networks established in Africa and Asia provided fora for regional experts to extend their understanding within an environment that supported the validation of assays and technology transfer to key countries, through FAO- and IAEA-funded projects.

Partnership and donor support
Rinderpest eradication would not have been achieved during the last 30 years were it not for the strong partnerships developed among FAO, national authorities, OIE, regional organizations such as the AU, and numerous donor agencies. Substantial and enduring financial support underwrote the resources and resolve needed to achieve eradication. For the most part, donor assistance to FAO came from the European Development Fund
(EDF), UNDP and organizations such as USAID, the United Kingdom’s Department for International Development (DFID), the Government of the Republic of Ireland and the Italian Development Cooperation (Cooperazione Italiana). FAO’s TCP project funding was used to control rinderpest outbreaks rapidly and to undertake activities to strengthen laboratory diagnostics, emergency preparedness planning, surveillance and capacity building. This FAO function was highly appreciated by recipient countries.

Declaration of the Joint FAO/OIE Committee on Global Rinderpest Eradication
The agreement between FAO and OIE establishing the Joint FAO/OIE Committee on Global Rinderpest Eradication (the Joint Committee) was concluded in June 2009. The main function of the Joint Committee was to provide a report of its findings to the Directors-General of FAO and OIE, stating whether it was confident that the world could be declared free from rinderpest, and/or recommending the actions to be taken for this achievement to be attained. More concretely, the Joint Committee was to: i) advise the Directors-General of FAO and OIE on potential gaps and risks regarding the proof of freedom from rinderpest, to allow a firm statement declaring the end of rinderpest virus circulation in the world; ii) draft a joint FAO-OIE text for the global declaration of freedom from rinderpest in mid-2011; and iii) draft an international agreement outlining the principles and responsibilities for oversight, and regulatory actions to ensure freedom from rinderpest in the post-eradication era. The Joint Committee also produced draft guidelines for the global sequestration of rinderpest virus and virus-containing material in biosecure laboratories. Its final report indicated that it concurred with the conclusions of OIE’s Scientific Commission that rinderpest had been eradicated.

Conclusion
With FAO-GREPs field objectives realized, focus needs now to be directed to maintaining worldwide freedom from rinderpest in the post-eradication era, through the destruction or safe custodianship of remaining stocks of vaccines for emergency use or of virus samples that may be held at research or diagnostic facilities. Actions are also needed to develop a post-eradication strategy, which will include safeguarding against rinderpest resurgence through emergency planning, to assure public confidence in the reality of eradication and to ensure that the benefits of the achievement are reflected in cost savings from the cessation of vaccination and in improved trade prospects. Above all, the remarkable achievement should be reflected in a renewed impetus to manage effectively the remaining transboundary animal diseases. Rinderpest eradication has arguably changed the way countries approach transboundary animal disease burdens, with a growing number of countries today exploring progressive control pathways for other high-impact diseases, such as foot-and-mouth disease, peste des petits ruminants and brucellosis. Lessons learned from rinderpest eradication, although not universally applicable, can usefully inform policy and strategy setting for other diseases.

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