ILRI Media Briefing

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Towards better control of the cattle-killing disease East Coast fever

Concerted effort over 50 years by a large multi-disciplinary and multi-national team has successfully developed a vaccine that could prevent one million cattle deaths and save Africa's cattle keepers over US$ 300 million a year. Meanwhile, on-going research aims to take advantage of cutting-edge science to develop an improved vaccine that will be cheaper, safer and more convenient to use - overcoming the major drawbacks of the rather crude, though effective first vaccine.

What is East Coast fever?

East Coast fever (ECF) is a devastating disease of cattle caused by a single-celled parasite known to science as *Theileria parva*, and carried by ticks feeding on the cattle. The disease occurs in 11 countries in east, central and southern Africa where the brown-ear tick, which spreads the disease, is found.

ECF kills at least and probably more than one million cattle each year and affects both improved types of dairy cattle and African zebu cattle. It is widely regarded as being amongst the most serious constraints to increasing the productivity of dairy and beef cattle in the region. In 2005, an ILRI-led study estimated that ECF caused annual economic losses totalling more than US$ 300 million: more than 45 million of the region's 75 million cattle are at risk of ECF. The disease also hinders the widespread use of more productive, but also more susceptible, European cattle breeds.

For the past century ECF has been partially controlled by limiting tick infestation by use of chemical sprays, dips and, more recently, oil-based pour-ons. This approach has a number of disadvantages including development of pesticide resistance in the tick population, while few if any new chemical products are expected to be released on the market. Another disadvantage is the exposure of farmers to potential health risks, which are exacerbated by lack of protective clothing amongst the poor. Environmental contamination is another disadvantage arising from the frequent use of pesticides – in high-risk ECF areas application might be needed every five or so days.

Some drugs are available for treatment of ECF. To be effective, they need to be used at an early stage of the disease. However, the cost per animal is relatively high, making this less affordable for the owners of African zebu cattle, which are less productive.

It was with this background that a form of vaccination, known as the ECF Infection and Treatment Method (ECF ITM) was developed.

What is the ECF infection and treatment method?

The ECF ITM is an immunisation procedure involving inoculation of cattle with live ECF parasites combined with simultaneous treatment with an antibiotic. Without this treatment the parasites would kill the cattle, but the antibiotic suppresses the infection. The result is a mild ECF reaction followed by life-long immunity to the disease.

Although rather crude – differing little from the first-ever live vaccine developed by Edward Jenner more than 200 years ago - the ECF ITM vaccine is effective if appropriate care is taken in its manufacture, storage and use.
However, the vaccine has disadvantages. One important one is that the live parasites used for the vaccine have to be stored at very low temperatures. This is achieved by keeping them in liquid nitrogen, but maintaining supplies of this ultra-low temperature liquid in remote parts of Africa is logistically challenging.

Another problem is that a small number of animals might react to the vaccination and get clinical disease, especially if proper care is not taken to give the correct amount of the antibiotic.
Calves as young as one month of age can be vaccinated. A low dose of laboratory-prepared live parasites is thawed out and injected under the skin close to the ear (to mimic natural feeding by the brown ear tick), while the antibiotic is injected into the muscle. Vaccinated cattle are fitted with a unique numbered and colour-coded ear tag, which shows they have received the vaccine and also identifies the supplier of the vaccine. Vaccinated animals develop immunity to ECF that will last all of their lives.

ILRI's role in the ITM vaccine

Work to develop an ECF vaccine began at the East African Veterinary Research Organisation, Muguga, Kenya in the 1960s and was continued at the National Veterinary Research Centre in Kenya. This culminated in the introduction of a version of the ECF ITM vaccine, known as the 'Muguga cocktail', on a commercial basis in various eastern African countries for various classes of cattle between 1998 (Tanzania pastoral sector) and 2012 (Kenya dairy sector), using vaccine produced by ILRI.

For close to 50 years, many partners have been involved in the testing, refinement, re-testing, production, registration and commercialisation of the vaccine, enabled by financial support over more than four decades provided by a large number of donors.

ILRI has and continues to work with this wide range of partners playing various roles. This collaborative work has had a significant impact on the development and refinement of the ECF ITM approach, helping to ensure continuous supply of quality-assured vaccine at critical times and providing the answers to some key questions. ILRI's contributions fall into three main categories:

- Development and application of molecular tools - critical to production of quality-assured vaccine and to tracking performance of the vaccine in the field.
- Ensuring continued supply of quality-assured vaccine – stepping in to demonstrate the feasibility of manufacture of the Muguga cocktail at a commercial level when no other organization was able and willing to do so, and capacity-building and supporting a Malawi-based lab to take over long-term production.
- On-going technical support and backstopping as needed.

Together these contributions have enabled the ECF ITM vaccine to be used to immunise hundreds of thousands of cattle in both the extensive (pastoralist and ranch) and dairy sectors. They have also helped pave the way for commercial production, distribution and large-scale deployment of the vaccine throughout the region.

Impact of the vaccine

The impact of the ECF ITM vaccine has been considerable. For example, in one pastoralist area in northern Tanzania, before the vaccine was introduced overall calf mortality was shown to be 40-80%, with 75% of deaths due to ECF.

Following adoption of the vaccine, calf mortality rates have been dramatically reduced to as low as 2%. Pastoralists also report that cattle with the distinctive ECF ear tag attract higher prices at markets.

Vaccination also allows the amount of anti-tick spray used to be reduced, with environmental and human health benefits. In both smallholder dairy and pastoralist areas of northern Tanzania, spraying is now often done only once a month rather than once a week. Pastoralists also report that when their animals are vaccinated they no longer have to avoid areas which they know are high ECF risk, enabling them to make better use of the grazing resources available to them.

The next step – a new vaccine

ILRI researchers and their partners are now building on decades of research in cattle immunology and the molecular biology of the parasite to exploit the very latest advances in biotechnology, with the aim of developing a sub-unit vaccine – one that is based on carefully chosen protective biological molecules rather than live parasites. If ILRI's research is successful, the resulting vaccine will be cheaper, safer and much more convenient to use than the current ECF ITM vaccine.

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