

DEVELOPMENT OF A VACCINE FOR CONTAGIOUS BOVINE PLEUROPNEUMONIA IN AFRICA

COMMERCIAL PRODUCTION TO BEGIN SOON ON GAME-CHANGING VACCINE FOR LIVESTOCK LUNG DISEASE

WHAT CANADIAN AND KENYAN COLLABORATORS DISCOVERED:

- ✓ A more effective and affordable vaccine for Contagious Bovine Pleuropneumonia (CBPP)
- ✓ A vaccine that can be rapidly produced by manufacturers and easily used by farmers
- ✓ Licensing agreements for commercial production and marketing

BY THE NUMBERS

- 1 vaccine patented and licensed for commercial production, following rigorous testing on 3 vaccine prototypes
- On station trials showed new vaccine to be 81% effected versus 22% conferred by the existing vaccine
- Tests on 5 immune-system boosting antigens identified 1 (Montanide ISA 61 VG) that, when added to the vaccine, provided the most effective protection at the lowest production cost
- 11 presentations at scientific meetings, and 2 stakeholder 2 stakeholder meetings with key partners

THE IMPACT:

Researchers in Kenya and Canada collaborated with vaccine manufacturers, government regulators, and pan-African organizations to clear the way for mass production of a practical and affordable vaccine for small-scale livestock keepers in Kenya and other African countries, the majority of whom are poor and women. In a global first, the project team developed a CBPP vaccine that is safe, highly effective, prolongs immunity, reduces side effects, and can be easily stored and transported, with no cooling required. The vaccine is expected to have a positive impact on food productivity: fewer cattle becoming infected; more stable market prices; lower intervention costs to control the spread of the disease; and less reliance on antibiotics which saves money and reduces the risk of increased antibiotic resistance. Cost-benefit analyses provide sound business rational for poor farmers to purchase the vaccine, and the use of public funds to control the disease. Commercial production is on schedule to begin in 2019.

THE CHALLENGE:

CBPP is a highly contagious respiratory disease of cattle that has serious economic and trade consequences across Africa. The bacterial infection affects the livestock of about 24 million African farmers each year, primarily low-income farming families, causing at least US\$60 million in losses annually. An existing CBPP vaccine on the market is effective for only about 22% of cattle. It can also have severe side effects, is short-lived, and requires refrigeration, making it impractical in many parts of Africa. In a previous CIFS RF project, Canadian and Kenyan researchers developed three promising vaccine candidates. Further studies were then needed to determine which vaccine and which formulation offered the greatest protection against CBPP and could be affordably mass produced. There was also a need to identify the socio-economic factors that would increase the likelihood of farmers using the new vaccine.

TRANSLATING RESEARCH INTO ACTION

Developing an effective vaccine that can be manufactured at scale



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“We believe vaccination is the best way to control CBPP and to improve food security for the small-scale cattle farmers disproportionately affected by this disease. Our objective is to get this vaccine to farmers in Africa as quickly as possible.”

Jane Wachira, CEO, Kenya Veterinary Vaccines Production Institute (KEVEVAPI)

- ✓ Finalized licensing agreement between KEVEVAPI for commercial production and marketing and 3 intellectual property-holder institutions: Kenya Agricultural and Livestock Research Organization (KALRO), International Livestock Research Institute (ILRI), and Vaccine and Infectious Disease Organization – International Vaccine Centre (VIDO-InterVac).
- ✓ Expanded manufacturing partnerships to include additional African and European companies.
- ✓ Developed and tested formulations of the experimental vaccine, tested and selected vaccine adjuvants, constructed vectors and strains for industrial production, and compared the new vaccine formulation to the existing vaccine using animal trials.
- ✓ Engineered proteins (called protein chimeras or fusion proteins) to reduce the number of antigen components (and thus the cost per dose) in the new vaccine.
- ✓ Montanide ISA 61 VG was selected as adjuvant for the final vaccine formulation, based on its safety, value, availability and ease of use, and acceptance by manufacturers and registration authorities.
- ✓ Developed laboratory-scale processes to harvest, isolate, and purify antigen. Limited large-scale process was under development at the end of the project, and Merck is providing funding and technical support for this activity to continue between KALRO and KEVEVAPI.
- ✓ Acquired a high throughput processing machine, the first of its kind of sub-Saharan Africa. The machine can test 9,600 samples from animals in 45 minutes (as opposed to days or weeks with existing methods), which will speed up diagnoses, reduce the number of false positives, lower treatment costs, and improve surveillance and control programs.
- ✓ A product development centre was launched in Kenya and equipped to produce recombinant antigens and analytical reagents for the vaccine. Staff were trained to produce the antigens in-country.

Overcoming the social and economic barriers to widespread vaccine adoption

“I gave some of my animals that vaccine once (the current commercial vaccine that has been on the market for 20 years). And you know what happened? The tail fell off.”

Lesinko Koriata, Farmer, Oloorien Lelemek, County of Narok

- ✓ Determined that most livestock owners perceive vaccination as the only effective control measure for CBPP. Yet vaccination coverage in endemic areas has been low.
- ✓ Socio-economic and gender studies suggest that uptake of the vaccine will be strong, but dependent on cost.
- ✓ Farmer use of current vaccine was influenced by: number of cattle owned, age of the livestock owner, household income and size, and previous experience of CBPP in the herd. Willingness-to-pay studies showed that livestock keepers are generally willing to pay for CBPP vaccines.
- ✓ Strengthened the business case for a new vaccine; e.g., one outbreak in a single county costs \$125,000 in cattle losses, surveillance, and control measures.
- ✓ The highest national and sub-national authorities in Laikipia were involved in communicating the risk of CBPP to farmers in a high-impact awareness campaign that received national media coverage.

Informing policy

“The vaccine will help restore both milk and meat production which were affected by the disease. (There will be) scaling up once the vaccine passes the field test so that it can be available to farmers at the shortest time and at lowest cost possible.”

Dr. Salome Kairu Wanyoike, Veterinary Epidemiologist and Economist, Ministry of Agriculture, Livestock and Fisheries, Kenya

- ✓ Regulatory framework established which will be useful for a variety of products.
- ✓ Study indicated that CBPP rates have been increasing and are predicted to increase from 14% to 18% by 2030 at the current rate of control with the current vaccine.
- ✓ Two policy briefs were prepared: one analyzing the problem the project is addressing, and a second on who can be involved in CBPP control and eradication.
- ✓ Identified a need for greater coordination and regulation in CBPP vaccination between national government and counties, as well as greater awareness of national, regional, and international CBPP control strategies.
- ✓ Prepared a CBPP control strategy and contingency plan in Kenya.

- ✓ Provided national training on CBPP surveillance in collaboration with the African Union Inter-African Bureau for Animal Resources.
- ✓ 2 stakeholder meetings informed key partners: Pharmacy and Poisons Board, Department of Veterinary Services, National Biosafety Board, Kenya Veterinary Board, National Council for Science and Technology, Directorate of Veterinary Medicines, Food and Agriculture Organization of the United Nations, Global Alliance for Livestock Veterinary Medicines, and Kenya's Veterinary Medicines Directorate.
- ✓ KALRO scientists received a public service excellence award from the Kenya Government in recognition of their outstanding commitment to developing the vaccine.

WHAT'S NEXT?

KALRO has committed half the funding needed (CAD\$2.5million) for a large-scale field trial in commercial cattle to assess safety, efficacy, and duration of immunity of the vaccine. Funds still need to be sourced for laboratory activities, including producing the vaccine for more cattle and testing the efficacy of the vaccine under field conditions, as well as evaluating a business model using an electronic voucher system. A committee to oversee the animal trials includes the local project's principal investigators, institutional animal welfare organization, Directorate of Veterinary Services, and Pharmacy and Poisons Board. Merck has provided funding that will allow KALRO and KEVEVAPI to continue limited large-scale production of antigens. Consultations are ongoing with Merck for further scale-up.

LEARN MORE ABOUT THIS PROJECT:

Project abstract: <https://www.idrc.ca/en/project/development-subunit-vaccine-contagious-bovine-pleuropneumonia-africa-cifrsf-phase-2>

KEY OUTPUTS

ACADEMIC ARTICLES

Analysis of immune responses to recombinant proteins from strains of Mycoplasma mycoides subsp. mycoides, the causative agent of contagious bovine pleuropneumonia. Perez-Casal J, Prysliak T, Maina T, Wang Y, Townsend H, Berberov E, Nkando I, Wesonga H, Liljander A, Jores J, Naessens J, Gerdts V, Potter A. Vet Immunol Immunopathol. 2015 Nov 15;168(1-2):103-10. doi: 10.1016/j.vetimm.2015.08.013. Epub 2015 Sep 9.

Capsular polysaccharide from Mycoplasma mycoides subsp. mycoides shows potential for protection against contagious bovine pleuropneumonia bovine pleuropneumonia. Veterinary Immunology and Immunopathology 04/07/2016 Martin Mwirigi, Isabel Nkando, Moses Olum, Samuel Attah-Poku, Horace Ochanda, Emil Berberov, Andrew Potter, Volker Gerdts, Jose Perez-Casal, Hezron Wesonga, Reuben Soi, Jan Naessens Volker Gerdts, Jose Perez-Casal, Hezron Wesonga, Reuben Soi, Jan Naessens <http://dx.doi.org/10.1016/j.vetimm.2016.07.002>

Experimental evaluation of inactivated and live attenuated vaccines against Mycoplasma mycoides subsp. Mycoides. Veterinary Immunology and Immunopathology 17/12/2015 Martin Mwirigi, Isabel Nkando, Racheal Aye, Reuben Soi, Horace Ochanda, Emil Berberov, Andrew Potter, Volker Gerdts, Jose Perez-Casal, Jan Naessens, Hezron Wesonga Gerdts, Jose Perez-Casal, Jan Naessens, Hezron Wesonga <https://doi.org/10.1016/j.vetimm.2015.12.006>

Recombinant Mycoplasma mycoides proteins elicit protective immune responses against contagious bovine pleuropneumonia. Veterinary Immunology and Immunopathology 23/02/2016 Nkando I., Perez-Casal J., Mwirigi M., Prysliak T., Townsend H., Berberov E., Kuria J., Mugambi J., Soi R., Liljander A., Jores J., Gerdts V., Potter A., Naessens J., Wesonga H. <https://doi.org/10.1016/j.vetimm.2016.02.010>

IN THE MEDIA

How a new vaccine could save cattle herds -- and livelihoods. National Post. September 28 2018. Jose Perez Casal
<https://nationalpost.com/pmnl/news-pmnl/how-a-new-vaccine-could-save-cattle-herds-and-livelihoods>

NTV Kenya: *Food Friday: New vaccine for Livestock Lung Disease set to be introduced* (22-Jul-2016)
<https://www.youtube.com/watch?v=ZJrJvxP03Vo>

VIEW ALL RELATED PROJECT OUTPUTS IN THE IDRC DIGITAL LIBRARY [HTTPS://IDL-BNC-IDRC.DSPACEDIRECT.ORG/BROWSE?TYPE=PROJECT&VALUE=107849](https://idl-bnc-idrc.dspacedirect.org/browse?type=project&value=107849)

QUICK FACTS

Project location(s): Kenya

Institutions: University of Saskatchewan (Canada); Kenya Agriculture and Livestock Research Organization (KALRO) (Kenya)

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