

Test heartwater attenuated Welgevonden stock vaccine in cattle

Researcher: Dr Helena Steyn D Tech
Ms A.I. Josemans Nat. Dipl. Vet. Tech.
Dr E. Zwegarth PhD
Dr A. Latif PhD
Mr C. Troskie Nat. Dipl. Vet. Tech.

Research Institute: Agricultural Research Council Onderstepoort Veterinary Institute (ARC-OVI)

Industry Sector: Cattle and Small Stock

Focus Area: Animal Health and Welfare (3)

Testing of various formulations of an attenuated heartwater vaccine in Friesian cattle

Aims of the project:

1. To formulate an effective attenuated heartwater vaccine for cattle which is easy to administer
2. To determine the optimum dose and route of attenuated Welgevonden vaccine in Holstein cattle
3. To determine duration of immunity
4. To field challenge the immunized cattle in a heartwater endemic region

Heartwater is caused by the organism *Ehrlichia ruminantium* which is transmitted by ticks of the *Amblyomma* species. It affects mainly domestic and wild ruminants and it is controlled by use of a live blood vaccine. Alternative vaccines are required due to the limitations associated with the current vaccine. At ARC-OVI research towards alternative vaccines has been ongoing and one example is the use of DNA vaccines. Previous studies have shown that the DNA vaccines could offer protection in the laboratory but failed in the field where the disease is transmitted by ticks. In this project we investigated the use of a multi-epitope DNA vaccine which is made up of short sequences from different antigens that were shown to be immunogenic. After three inoculations with the multi-epitope DNA vaccine delivered by i.m. injection and the gene gun, none of the sheep survived challenge with *E. ruminantium* infected ticks. However, when the same multi-epitope DNA vaccine was formulated with an adjuvant, it protected three of the five sheep against tick transmitted *E. ruminantium* infection. From this project we learnt that when using subunit vaccines like DNA vaccines, it is very important to include appropriate adjuvants in the vaccine formulation in order to improve the immunogenicity of the DNA vaccine. *Ehrlichia ruminantium* is the causative agent of heartwater and it is transmitted to ruminants by the *Amblyomma hebraeum* tick. An experimental cell-derived attenuated *E.*

ruminantium (Welgevonden) vaccine was developed at ARC-OVI. This attenuated Welgevonden does not cause heartwater in sheep and goats but induces complete protection when administered either intravenously (IV) or intramuscularly (IM) (subcutaneous route was less effective) against a lethal needle challenge dose with the homologous stock. Previously a preliminary experiment indicated that when the attenuated Welgevonden vaccine was tested in Friesian cattle with the IV route only one animal required treatment after challenge with the Gardel stock. Further optimisation of the attenuated vaccine regarding dose, route and challenge was thus required for use in cattle. This project showed that a dose of 1×10^6 CFU/2ml of the attenuated vaccine via the IM route can induced 100 % protection when administered to cattle (n=5) challenged with ten ticks infected with the Welgevonden strain. Accurate, reproducible and immediate determination of the attenuated vaccine dose after thawing and before administration is however required before this vaccine can be taken to the next level.