

Cutting-edge technology for diagnosing cattle abortions

By Susan Marais (Photographs: University of Pretoria)

Researchers at the University of Pretoria (UP) are optimistic about their breakthrough to help solve one of the livestock sector's most pressing issues, namely abortions in heifers and cows. The study in question was funded by Red Meat Research and Development South Africa (RMRD SA).

Abortions that occur as a result of pathogen infections lead to economic losses and create public health risks. According to Dr Mirinda van Kleef, working group chairperson at the RMRD SA, only 25% of abortion cases are successfully diagnosed. This is because diagnostic tests can only detect one pathogen at a time. In addition, these tests are also time-consuming and costly.

As a result, RMRD SA decided to support research conducted at UP to develop a multiplex test for possible abortions.

A global concern

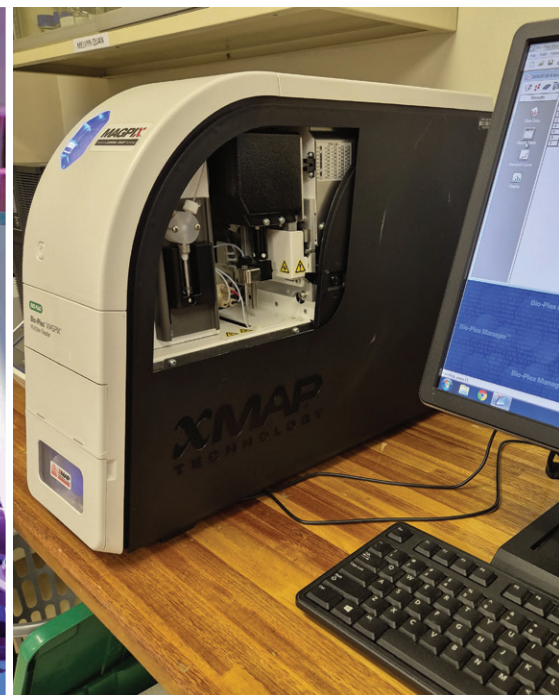
Dr Angelika Loots and Prof Melvyn Quan of the Faculty of Veterinary Science undertook the study. Dr Loots holds a doctorate in veterinary diseases and is currently a postdoctoral fellow at the University of Pretoria. Prof Quan is a researcher and associate professor at UP's Department of Veterinary Tropical Diseases.

Abortions are one of the biggest concerns faced by the cattle industry worldwide. While there aren't figures available regarding the economic losses suffered annually at a local level, an Argentine study conducted in 2022 found that the average cost of a single abortion in dairy and beef cattle herds is US\$1 415 (\pm R26 700) and US\$440 (\pm R8 300), respectively.

These findings were published in a scientific article titled "Spatial-temporal trends and economic losses associated with bovine abortifacients in central



Prof Melvyn Quan.



The Luminex xMap machine.

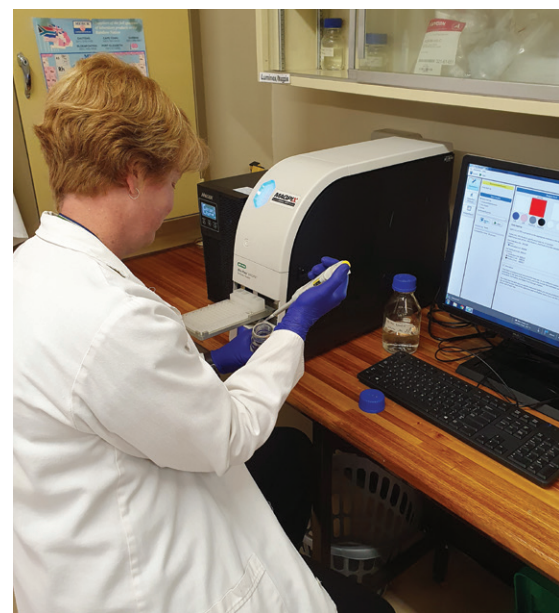
Argentina" in the journal *Tropical Animal Health and Production* (30 July 2022).

Limits to existing techniques

Several factors can lead to a female aborting her developing calf. These include infectious diseases, genetic abnormalities, toxicity, and nutrition. Dr Loots says determining the cause of abortion is important for implementing preventative measures. However, this can often be challenging and the global success rate is a mere 30 to 40%.

Traditional methods to diagnose cattle abortions include post-mortem examinations and laboratory tests such as serology or isolation/culturing of organisms. These methods are prone to environmental contamination, are costly, and involve lengthy waiting periods.

Polymerase chain reaction (PCR) assays can rapidly detect abortion-causing



Dr Angelika Loots prepares the xMAP machine for sample testing.

pathogens and have partly overcome the challenges of traditional diagnostic methods. This laboratory technique for recognising bacteria and viruses is rapid, simple, and sensitive. However, these assays are still limited to individual testing of each pathogen.

Emerging PCR techniques, such as multiplex PCR or real-time PCR, allow for the detection of multiple pathogens at once. Yet, even these advanced techniques can only detect a small number of pathogens at a time, as each target pathogen requires a unique fluorescent dye. Since the number of available dyes is limited, the technique is limited.

Diagnostic advancements

The Faculty of Veterinary Medicine at UP is exploring new technology, such as the Luminex xMap technology, for the quick and accurate diagnosis of cattle abortions. This cutting-edge technology addresses some of the biggest limitations of traditional diagnostic methods by using tiny magnetic beads, each dyed with two different colours. By adjusting the concentration of these dyes,

the xMap can identify up to 500 unique beads.

This technology is powerful as each bead can be labelled with a molecule that detects a specific pathogen. This means scientists can program the system to identify 500 different pathogens, allowing for a multiplex setup that tests all pathogens at once. In just one test, the xMap technology could screen for all known infectious causes of cattle abortions, delivering results quickly and efficiently. This allows for the quick detection and control of diseases on a large scale, as well as the prevention or restriction of outbreaks, says Dr Loots.

Funding from the red meat industry has enabled researchers to develop a multiplex system for the simultaneous detection of several abortive agents in South Africa. These include *Brucella* spp. (bovine brucellosis), *Listeria* spp. (listeriosis), infectious bovine rhinotracheitis (IBR), and bovine viral diarrhoea virus (BVDV).

Where to from here?

Early laboratory testing looks promising. In laboratory trials, the technology

successfully detected known samples of *Brucella abortus*, *Listeria monocytogenes*, and bovine alphaherpesvirus 1 (BoHV-1) – all pathogens that can cause cattle abortions.

The researchers have also determined the optimal conditions in which to attach each bead to the specific pathogen. This is a crucial step in ensuring accurate detection of the pathogen. Although the validation of this method is still being confirmed, it is clear to the researchers that it has great potential. This can assist with quicker and more informed decisions, leading to more rapid responses and effective prevention strategies.

As these technologies continue to evolve and as new insights emerge, producers can expect more efficient tools for swift and accurate identification of the causes of abortion, says Dr Loots. ^{SF}

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