INSTITUTE FOR INFECTIOUS ANIMAL DISEASES

Agricultural Screening Tools

IMPACT STATEMENT

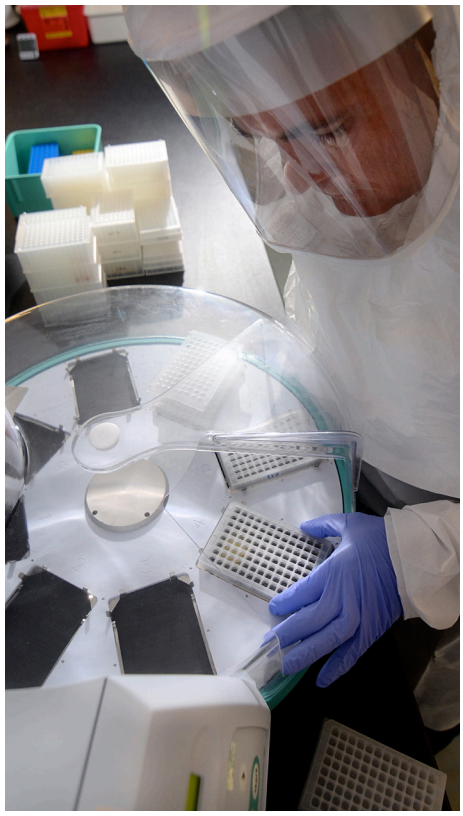
High-consequence animal diseases pose catastrophic risks to the U.S. agricultural sector - a one trillion dollar business and the world's leading exporter of food. Animal agriculture in particular - which comprises an estimated 40% of the value of global agricultural output - is built upon a "just in time" process that carefully coordinates the production and transportation of livestock, poultry and their products.

For developing countries, food security is a major challenge that affects not only livelihood and health, but also correlates with political and economic stability. Small-holder livestock farmers are crucial to the stabilization of many African agri-based economies, and contribute the bulk of the national herd. For example, in Zimbabwe, nearly 90 percent of the national herd is owned by the small-holder sector. For that reason, it is crucial to boost small-holder livestock production, including developing diagnostic assays that can be implemented in field settings to help protect this important segment of the global economy.

Tools that screen for high-consequence animal diseases allow for an accurate and timeline diagnosis while fitting into established business routines serve to support the business continuity of animal agriculture in the U.S. while also protecting the global food supply, public health and economy.

THE CHALLENGE

New tools and technologies are needed to protect the agriculture and public health sectors against high-consequence transboundary, emerging and zoonotic diseases. Methods are needed for rapid detection of, response to and recovery from animal disease events to support business continuity in developed counties, ensure livestock welfare, and promote food security and household nutrition for developing nations. Identified needs include development of veterinary medical countermeasures and pen-side/field-side tests, including hand held detection systems, sample pooling and preservation technologies, and in-process monitoring devices.



THE SOLUTION

Based on recommendations from a series of workshops to coordinate and enhance the agrosecurity enterprise, the Institute for Infectious Animal Diseases (IIAD) and partners proposed and were awarded a number of research efforts whose outcomes can be integrated with minimal disruption into daily business practices to help establish the "proof of negative" status essential to maintain business continuity. Many of these technologies also have applications in an international setting where these diseases are encountered more frequently or are endemic. These research efforts will facilitate rapid sampling, transport, testing and reporting of results to promote efficient and effective disease control.

APPLICATIONS

Development of a Prototype and Bench Validation of a 3B FMDV Competitive ELISA Kit

The goal of this effort is to develop a prototype competitive enzyme-linked immunosorbent assay (ELISA) using a highly specific antibody against the FMDV 3B non-structural protein for use in a diagnostic kit capable of differentiating infected from vaccinated animals (DIVA). The ability to produce and distribute a faster and more sensitive DIVA diagnostic on the U.S. mainland will improve outbreak response time and capacity, enabling a more rapid recovery. This effort is ongoing, with the goal of performing a field study to evaluate assay performance in 2015-2016 as part of a U.S. Department of Homeland Security (DHS) funded effort to evaluate next-generation foot-and-mouth disease virus (FMDV) vaccines and diagnostics in an international endemic setting.

Partners: Texas A&M Veterinary Medical Diagnostic Laboratory (TVMDL); Pirbright Institute; U.S. Department of Agriculture (USDA) Foreign Animal Disease Diagnostic Laboratory; VMRD, Inc.; USDA Agricultural Research Service; DHS Plum Island Animal Disease Center.

Optimization and Validation of a Real-Time RT-PCR Assay for Rapid Detection of FMDV for Use in Bulk-Tank Milk Samples

The objectives of this study were to define, optimize and standardize RNA extraction and polymerase chain reaction (PCR)-mediated detection of FMDV from bulk-tank milk samples and obtain data suitable to support a national surveillance plan for screening milk for FMDV. The assay was validated with samples taken from experimentally infected animals and bulk-tank milk samples from FMDV endemic countries, and resulting recommendations regarding fitness for purpose will facilitate the use of this assay in the U.S. to determine the status of herds or premises during an FMDV outbreak. Demonstration of negative status will support product movement under the Secure Milk Supply Plan for business continuity.

Partners: TVMDL; Pirbright Institute; USDA Foreign Animal Disease Diagnostic Laboratory; Wisconsin Veterinary Diagnostic Laboratory; California Animal Health and Food Safety Laboratory; USDA National Animal Health Laboratory Network; the dairy industry.

Development of a Mutiplex RT-qPCR Assay for Surveillance of Foreign Animal Diseases During Routine Testing of Oral Fluid Samples

This assay supports a comprehensive swine surveillance program for endemic disease testing with the multiplexed ability to test for foreign animal diseases (FAD) using the same pooled sample of oral fluids. A successful proof of concept demonstrated multiplexed detection of African swine fever virus, classical swine fever virus, and FMDV with similar sensitivity to individual singleplex assays. In addition, the same sample can be run in parallel to detect endemic pathogens of importance to the U.S. swine industry. This economic method for FAD surveillance allows rapid herd-level disease detection while promoting conservation of reagents, which may be in short supply during an outbreak.

Partners: TVMDL; USDA Foreign Animal Disease Diagnostic Laboratory; National Pork Board.

The Matrix-Chaperone: Ambient Temperature Biospecimen Collection, Transport and Banking for Simplified Animal Disease Screening

The Matrix-Chaperone swab is a novel field collection technology for the collection, preservation and shipping of biological samples without the need for refrigeration or additional containment. This technology has been tested for use in wild birds, and is currently being evaluated by international partners for larger scale field testing; current results indicate similar preservation to traditional sample collection tools with greatly simplified ease of use for field work. Eliminating cold chain requirements simplifies sample shipping to diagnostic laboratories during a disease outbreak and has the potential to be especially impactful in the developing world where refrigeration is not always possible.

Partners: TVMDL; Gentegra; Texas A&M University College of Veterinary Medicine & Biomedical Sciences.

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