

Rapid Test Unveiled

Colorado State University demonstrates new rapid test to diagnose seven costly animal diseases.

by Dell Rae Moellenberg

Colorado State University's Veterinary Diagnostic Laboratory, in collaboration with the U.S. Department of Homeland Security (DHS), the USDA's National Veterinary Services Laboratories (NVSL) and National Animal Health Laboratory Network, and the Lawrence Livermore National Laboratory (LLNL) demonstrated in late July a new rapid diagnostic test for seven important and economically devastating animal diseases, including foot-and-mouth disease (FMD).

In addition to testing for FMD, the assay simultaneously tests for bovine viral diarrhea (BVD), bovine herpes-1, bovine parapox virus complex, bluetongue, swine vesicular disease and vesicular exanthema of swine.

The new diagnostic tool reduces the period required to detect FMD and the six other diseases — which all have similar symptoms — from days to hours, and can

simultaneously detect all seven diseases in one sample. The tool, which can provide individual sample results within five hours, is in the process of being validated by the U.S. Department of Agriculture (USDA) and can process up to 1,000 samples within 10 hours.

Animal disease experts estimate that the United States would lose up to \$3 million in direct costs for every hour's delay in diagnosing FMD. Typical testing procedures and tools require about 100 hours to process 1,000 samples, and do not allow for simultaneous testing of these diseases, creating a time-consuming testing process.

The rapid test allows officials to detect these diseases early, providing an opportunity to more quickly trace and minimize the spread of these diseases and enhance the nation's ability to respond to natural or terrorist introduction of these diseases into the national animal population.

History

The concept of an assay that could test for multiple livestock diseases grew out of the 2001 outbreak of FMD in the United Kingdom, which caused about \$5 billion in losses to the food and agriculture sector, and even greater losses to tourism. Up to 10 million sheep, pigs and cows were destroyed, and for several months, the nation was banned from exporting livestock and animal products that could potentially transmit the virus.

The new testing tool was developed by LLNL in partnership with the U.S. DHS, the USDA and the University of California, Davis (UC-Davis). Homeland Security funded the efforts to develop the assay.

"This equipment could further enhance the university's Veterinary Diagnostic Laboratory's ability to assist in detecting devastating animal diseases," Barb Powers, laboratory director, said. "We are one of two laboratories in the nation with the training to use this tool in its high-capacity format. This would allow us to test for the Western region."

Simultaneous testing for these diseases has not been possible in

the past. When animals with symptoms of these diseases are observed, unless they have strong evidence that the disease is FMD, laboratories first test one-by-one for diseases that are known to exist in the United States. These diseases include BVD, bovine herpes-1, bovine parapox virus complex and bluetongue.

If these diseases are not detected, tests are then conducted for foreign animal diseases. Along with FMD, swine vesicular disease and vesicular exanthema of swine are considered foreign animal diseases.

Future

FMD is endemic in many parts of the world and is an extremely contagious viral disease of cloven-hoofed animals such as cattle, pigs, sheep, goats, deer and water buffalo. Animals afflicted with FMD usually do not die and can recover, though with reduced productivity. Due to FMD's highly infectious nature and effect on productivity, its presence in a country would immediately halt international trade of ag products. A vaccine is available for FMD, but it only reduces the severity of symptoms; it does not prevent infection or completely stop transmission of the disease.

"This new diagnostic assay will significantly enhance the future security of U.S. agriculture by providing improved technology for animal disease diagnostics," Tammy Beckham, deputy director of science for the DHS at the Plum Island Animal Disease Center, says.

Barbara Martin, the National Animal Health Laboratories Network coordinator for the USDA, also stresses how the test would assist detection and protect animal health. "With an assay capable of detecting a foreign animal disease, we'll be able to detect it early, and reduce the spread and the economic impact of the disease," Martin said.

The new assay can be adapted to help detect other diseases, including diseases that affect humans, and could contribute to any public health system response. The assay also is integrated with USDA's information technology system for tracking animal samples, developed by the department between 2003 and 2006. With this capability, the sample could be rapidly traced back to the herd of origin and the affected animal,



PHOTO COURTESY OF COLORADO STATE UNIVERSITY

► Pam Hullinger, LLNL veterinarian, retrieves a test swab sample from Sassy, a cow used for teaching purposes, at the Colorado State University Veterinary Teaching Hospital. A sample such as this one could be used in the assay demonstrated by the university's veterinary diagnostic laboratory.

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minimizing the risk of the disease's spread, Martin says.

"The test provides a tool that could be used for surveillance to significantly enhance the nation's capacity to detect foot-and-mouth disease early," says Pam Hullinger, LLNL veterinarian and team member. "Finding the first case of FMD as soon as possible is critical to minimizing the scope and impact of an outbreak."

"What the U.S. veterinarians who went to England really wanted was a test for confirming FMD with a quick turnaround, so they could make a decision on how to handle the individual farms," says Alex

Ardans, director of the UC-Davis-operated California Animal Health and Food Safety Laboratory System.

UC-Davis researchers helped to provide vision and key direction for the assay's development and also provided samples of domestic livestock viruses, which were important in the development of the multiplex assay.

The testing tool screens for both DNA and RNA viruses at the same time. It uses 17 signatures — unique regions of DNA or RNA — to assist in detecting FMD and the six other diseases that resemble FMD.

Studies to determine the performance characteristics of the assay are being performed at LLNL, DHS's Plum Island Animal Disease Center, the USDA Animal and Plant Health Inspection Service (APHIS) NVSL and within the National Animal

Health Laboratories Network. For the work, the USDA and DHS at Plum Island provided scientific expertise, vision, viral isolates and lab space. Development work is ongoing at LLNL and Plum Island.

"While still in the development phase, this collaborative project between the DHS Plum Island Animal Disease Center, LLNL, UC-Davis, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service and the National Animal Health Laboratories Network will significantly enhance the future security of U.S. agriculture by providing improved technology for animal disease diagnostics," Beckham says.



Editor's Note: *Dell Rae Moellenberg is senior media and community relations coordinator for CSU News & Information, which supplied this article. For more information call (970) 491-6009.*