Making *the* Connection

K-State, Sandia Lab developing rapid disease-detection system.

Story by
MARY LOU PETER

As Mike Whitehair quietly moves through the pen of cattle, something captures his attention.

The Abilene, Kan., veterinarian pauses, pulls out a cell phone and punches in a code — not to make a call, but to start through a series of questions on the tiny screen, questions regarding clinical signs he may be seeing in the cattle and illnesses they could represent.

Such is the vision of the Rapid Syndrome Validation Project for Animals (RSVP-A), being developed by Kansas State University (K-State) and Sandia National Laboratories, Albuquerque, N.M. The project is an Internet-based system for rapid detection and reporting of infectious disease outbreaks in cattle.

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>
> ***— Mark Spire***

Whitehair, co-owner of the Abilene Animal Hospital, is helping K-State veterinarians test the initial version of the project in a private-practice setting.

"The need to be able to quickly recognize disease symptoms — whether introduced naturally, accidentally or by humans intent on havoc — has never been more important," says K-State Research veterinarian and project leader Mark Spire.

At stake is a multibillion-dollar industry in Kansas that is the leading agricultural income generator, he says. The state was home to 6.35 million cattle during 2001, according to U.S. Department of Agriculture (USDA) data. It annually ranks at or near the nation's top cattle feeding and beef processing states.

"As a result, Kansas imports over 4 million head of cattle for grazing and feeding purposes and nearly 2 million for slaughter," Spire says. "As a net importer of livestock, this large movement of cattle from every region of the country into Kansas has the potential to introduce disease not native to this area.

"Plus, the risk of introducing pathogens is significantly increased by the movement of workers, vehicles and visitors to and from cattle operations every day," he continues. "And since most of the animals are concentrated in large facilities, the high density in small areas heightens the risk of catastrophic economic losses resulting from acts of agroterrorism or from naturally introduced diseases."

Down to a science

The RSVP-A system will help scientists and agencies determine the specifics (down to the county) where clusters of animals are showing similar, but unusual, symptoms.

Cattle owner anonymity is built into the program, however, Whitehair says.

The project is modeled after Sandia's RSVP-H software for humans and is funded by the Department of Homeland Security through the USDA and, ultimately, the Kansas Animal Health Department. It has been in development since February 2001.

Initially focused on cattle, the system may be extended to other species, says Brad De Groot, project member and veterinary epidemiologist with K-State's Department of Diagnostic Medicine and Pathobiology.

The RSVP-A project may be the tool to fill a gap in this country's livestock disease diagnostic systems, says Kevin Varner, Topeka-based veterinarian with the USDA's Animal and Plant Health Inspection Service (APHIS).

"We have an excellent system for finding diseases that we expect to find — diseases that we already know about," Varner says, citing brucellosis (Bang's disease), pseudorabies and tuberculosis. "We've historically not done a good job of quickly detecting emerging diseases in this country."

Mike Whitehair, co-owner of the Abilene (Kan.) Animal Hospital, is helping K-State veterinarians test the initial version of the RSVP-A in a private-practice setting. [PHOTO COURTESY OF MIKE WHITEHAIR]

Testing phase

The initial test phase, which started in May 2003, will last 18 months, Varner says. If the system still looks feasible at the end of that time, the testing could either be extended or the program could be launched nationally.

"The focus is to capture data at the point of activity — when the practitioner is in the field — so we're not asking him or her to remember to do a report when they get back to the office," De Groot says.

The project, if successful, will give veterinarians a way to pool their observations when they aren't thinking (at least initially) that they are looking at a looming crisis, he says. Veterinarians look at their clients' cattle every day to determine why they are sick or not performing well. They examine lameness, skin and mucosal lesions, birth defects, deaths, diarrhea, central nervous

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RSVP-A project at a glance

Kansas State University (K-State) and Sandia National Laboratories, Albuquerque, N.M., have teamed up to develop the Rapid Syndrome Validation Project for Animals (RSVP-A). It is an Internet-based system in Kansas used for the rapid detection and reporting of infectious disease outbreaks in cattle. The initial effort is funded by the U.S. Department of Agriculture (USDA) and the Kansas Animal Health Department.

RSVP-A is being developed to:

- improve day-to-day animal health monitoring and production;
- provide an early detection and reporting system to mitigate agroterrorist attacks on Kansas and U.S. livestock; and
- monitor disease patterns within livestock production units, using the latest wireless technology to monitor six clinical syndromes detected by veterinarians.

Veterinarians carry cell phones and personal digital assistants (PDAs) that also include RSVP-A software. When they see clinical signs of concern, they log into the RSVP-A system using the device and go through a series of questions about the syndrome they're observing. They incorporate baseline information (such as location, gender and number of animals involved), syndrome classification and disease incident patterns at different time intervals.

All data are stored on a central server, linked to the K-State Veterinary Diagnostic Laboratory. The system can provide immediate feedback on reported syndromes to state offices of the USDA's Animal Plant and Health Inspection Service (APHIS) and the Kansas Animal Health Department.

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system (CNS) problems, and various other maladies in the course of their daily work. The RSVP-A system takes the information they gather beyond the individual farm or veterinary clinic and inserts it into a central database.

Using the handheld devices may seem foreign to some veterinarians at first, but the fact that each unit is a working cell phone and personal digital assistant (PDA) should help practitioners adapt. Plus, once a veterinarian is familiar with the software, it takes less than a minute to enter the data if he or she sees unusual symptoms, De Groot says.

"The only way to prepare for the unknown is to practice," Whitehair says.

Eventually, the technology may allow for transmission of photos of the clinical signs in question.

The system's initial testing is being done in the five-county area that Whitehair's practice covers — home to about 225,000 head of cattle. That phase, which began in spring 2003 after more than two years in development, is expected to continue through typically busy and quiet times on cattle operations.

De Groot said the testing was expanded in early fall to 17 collaborating Kansas veterinary practices, covering about 1.6 million head of cattle in the 20-county region, from Pratt to Greenwood County, and Dickinson to Kingman County.

"Our intention is to run this project for a couple of years," says Kansas Livestock Commissioner George Teagarden, whose office awarded the RSVP-A research funding to K-State. "If it proves to be a feasible tool to rapidly detect disease outbreaks in cattle, we'll try to continue it."

Teagarden says there are no funds available currently to take the program beyond the Kansas test phase. However, other states have expressed interest in the research, and there may be partnership possibilities with them or the USDA if the Kansas test proves successful, he says.

"At the extreme, it could be a very important tool," Teagarden adds. "If we found a disease before it became widespread — for example, stopped it at the farm or county level — it could be a boon to the Kansas livestock industry and, in turn, to the Kansas economy in general."

"This is a system that potentially holds great promise," Varner adds. "We're really excited about the possibilities."

Editor's Note: *Mary Lou Peter is interim news coordinator for K-State Research and Extension, the Kansas State University Agricultural Experiment Station and Cooperative Extension Service. For more information about this program, call Spire at (785) 532-4201 or De Groot at (785) 532-4845.*

Forage Management by Touch of a Button

Matching grazing animals with the right forage may be quicker and easier, thanks to remote sensing.

An Agricultural Research Service (ARS) study has revealed little difference between forage nutrient data collected in the field by a portable light-wave-reading machine and information obtained through conventional lab analysis. The one notable difference — remotely acquired information was ready for use in hours, as opposed to the days it took to get lab data.

The study was led by soil scientist Patrick Starks of ARS' Great Plains Agroclimate and Natural Resources Research Unit in El Reno, Okla., and Samuel Coleman of ARS' Subtropical Agricultural Research Station (STARS) in Brooksville, Fla. ARS is the chief scientific research agency for the U.S. Department of Agriculture (USDA).

According to Starks, remote sensing may eventually provide real-time quality assessment and nutritional landscape mapping of grazing lands. This can lead to improved range and pasture management and better-informed harvesting decisions.

Current forage analysis uses near-infrared spectroscopy and chemical procedures that, while accurate and site-specific, are time-consuming. Remote sensing collects data through detection and measurement of reflected or emitted light, heat, sound and radio waves.

The research conducted at El Reno focused on *Cynodon dactylon*, commonly known as Midland 99 Bermuda grass, alone and with a scattering of other plants. The study compared how the two data-collecting methods detect concentrations of nitrogen and other components.

The researchers used a handheld commercial hyperspectral radiometer — a device that measures reflectance in 252 wave bands of the electromagnetic spectrum — to scan plants and estimate their digestibilities. After scanning, the plants were collected and analyzed for comparison using traditional laboratory methods.

This approach will later be tested on other warm- and cool-season grasses.

Animal nutritionist William Phillips and animal geneticist Michael Brown of the ARS Forage and Livestock Production Research Unit in El Reno are involved in the study. Starks and 20 other scientists participated in an ARS review of agricultural use of remote sensing that was recently published in the journal *Photogrammetric Engineering & Remote Sensing*.