PROTECTING ANIMAL HEALTH THROUGH DISEASE DETECTION, PREVENTION, AND CONTROL

The ARS Animal Health research program protects and ensures the safety of the nation's agriculture and food supply through improved disease detection, prevention, and control. ARS researchers are developing diagnostics, vaccines, and other mitigation strategies for many diseases found in multiple livestock species to provide stakeholders with tools to reduce the need for antibiotics, facilitate antibiotic stewardship, and preserve animal welfare. ARS scientists developed vaccines against Streptococcus suis and avian coccidiosis that have been transferred to commercial partners for further development. The following accomplishments highlight ARS advances in animal health research in 2021.

Discovery of continuous cell line to detect African swine fever virus infectious field isolates. African swine fever virus (ASFV) field isolates only replicate in primary cultures of swine white blood cells (macrophages), which are time consuming to prepare and require a herd of healthy donor pigs. These factors make swine macrophage cultures inaccessible for most diagnostic laboratories trying to identify infections in suspect field samples. ARS scientists in Greenport, New York, discovered that a cell line of monkey origin, Ma-104, was highly susceptible to infection with field isolates of ASFV. Results showed Ma-104 cells can be readily infected by all ASFV isolates tested. Furthermore, ARS researchers discovered the detection sensitivity was just below that of primary swine macrophage cultures and above the sensitivity of conventional real-time PCR methods. This discovery is of paramount importance for ASFV diagnostics as it will enable diagnostic laboratories worldwide to perform detection of ASFV infectious particles using a readily available cell line that is easy to grow. A patent covering the use of Ma-104 cells for ASFV diagnostic was filed by the ARS Office of Technology Transfer.

> **"ARS scientists have identified a genetic change that can reduce boar taint in pork without the need for castration, which improves production efficency and pig welfare and creates opportunities for further scientific discovery of the underlying biology of reproduction in male and female pigs."**

Remotely operated nematode sprayers provide non-chemical control of cattle fever ticks. Cattle fever ticks (CFT) threaten U.S. animal agriculture because they transmit the microbes that cause bovine babesiosis, a disease that causes rapid death in cattle. In south Texas, wildlife such as white-tailed deer and nilgai antelope serve as alternative hosts for CFT, complicating efforts to eradicate the ticks. A novel technology to treat wildlife infested with cattle fever ticks with microscopic parasitic roundworms (nematodes) was successfully tested and shown to be effective. ARS scientists in Edinburg, Texas, worked closely with the Animal and Plant Health Inspection Service-Veterinary Services and ranchers in south Texas to conduct large-scale field tests of a nematode sprayer to eradicate CFT on free-ranging nilgai antelope. More than 100 sprayers were deployed to apply nematodes across more than 5,000 acres as the nilgai moved through fence crossings. Treated nilgai were found to be infested with significantly lower numbers of cattle fever ticks than non-treated nilgai.

Better dewormers for small ruminants. Anthelminthic drug resistance cripples attempts to deworm sheep and goats, which can lead to increased morbidity and mortality. Veterinarians and farmers urgently need new tools to protect animal health and ensure the productivity of small ruminant farms. ARS researchers in Beltsville, Maryland, worked with university collaborators to refine a new, safe,

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and cost-effective method to produce a potent therapeutic paraprobiotic called Inactivated Bacterium with Cytosolic Crystals (IBACC). Whereas a probiotic contains live microbes, a paraprobiotic contains inactivated microbes to enhance health. When given to sheep, 3 doses reduced the number of eggs shed by 90 percent, the total number of worms by 72 percent, and the number of female worms by 96 percent. Biologists think worms will face difficulty evolving resistance to this therapy. Once commercialized, this approach has enormous potential to benefit livestock producers.

New Johne's vaccine for cattle. Johne's disease, a serious disease of dairy cattle, is caused by *Mycobacterium avium subsp paratuberculosis* (MAP). ARS researchers in Ames, Iowa, conducted trials in dairy calves to test a new sub-unit Johne's disease vaccine containing a cocktail of recombinant proteins. In two trials, the highest dosages of the vaccine significantly reduced MAP colonization of intestinal tissues and resulted in the greatest reduction in infection. The vaccine also reduced fecal shedding of the pathogen, which is important for stopping on-farm transmission. Data has been used to support the patent application for this vaccine. These results will be of interest to producers, regulatory personnel, and researchers interested in intervention strategies for preventing Johne's disease in domestic livestock.

Cheung, Lance (with permission of the Navajo Nation). Navajo Technical University (NTU) has been working with the U.S. Department of Agriculture (USDA) as they continue to improve their Veterinary Technology program. September 9, 2019. https://flic.kr/p/2hZ6U9T