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BEFORE THE
UNITED STATES HOUSE OF REPRESENTATIVES
COMMITTEE ON HOMELAND SECURITY
SUBCOMMITTEE ON PREVENTION OF NUCLEAR AND BIOLOGICAL ATTACK
ENTITLED
"AGROTERROISM'S PERFECT STORM: WHERE HUMAN AND ANINMAL DISEASE COLLIDE"

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Mr. Chairman and Members of the Subcommittee, I am Edward B. Knipling, Administrator of the Agricultural Research Service (ARS). We are the primary intramural science research agency of the United States Department of Agriculture (USDA). ARS operates a network of over 100 research laboratories across the Nation on all aspects of agricultural science, including crop and livestock protection and food safety research.

Thank you for the opportunity to appear before the Subcommittee today to present testimony about ARS' efforts to prevent agroterrorism, particularly zoonotic threats. I am pleased to inform you of ARS' research to prevent and prepare for these diseases, which are of particular significance as we seek to protect ourselves from agroterrorism. Zoonotic diseases represent an ongoing threat to animals and public health, propagating first in crucial species and potentially causing severe economic devastation before spreading to humans. Agricultural production is geographically scattered in sites that are difficult to protect. Groups of livestock are concentrated in confined locations and then transported and mixed with other groups on their way to market, which can facilitate the spread of disease from one animal to another. Furthermore, as Dr. Julie Gerberding, the Director of the Department of Health and Human Services (HHS) Centers for Disease Control and Prevention (CDC), has stated, "Eleven of the last 12 emerging infectious diseases that we're aware of in the world, that have had human health consequences, have probably arisen from animal sources." This is a significant reminder that protecting the health of our animals is an important part of protecting human health.

Mr. Chairman, in light of the significance of these threats, I am pleased to share with you recent ARS research efforts to prevent and prepare for zoonotic diseases. In fiscal year 2006, ARS spent $93,799,000 on food and agricultural defense, which was around 9 percent of our total annual budget. While there are many zoonotic diseases that could be considered in this hearing, I am discussing some examples that we believe could be the most serious threats to American agriculture.

Avian Influenza

The current strain of high pathogenic avian influenza (AI) circulating in Asia, Africa, and Europe has resulted in the death of at least 150 million domestic and wild birds that were either killed by the virus or destroyed because they were at risk of being infected. ARS scientists are conducting extensive research to better understand and control existing AI strains. While our focus is on poultry, ARS is also working with other organizations to track mutations that occur in existing AI strains in anticipation of the day when they may evolve into forms that are more contagious and deadly to poultry, other avian species including wild birds, and potentially humans.

The most effective means of controlling many zoonotic diseases is at the source, which in the case of AI is the domestic and wild birds that carry and contract the virus. ARS conducts AI research at its high containment facility in Athens, Georgia. This laboratory is recognized internationally as one of the

world's leading AI research centers.

There are several areas of AI that are under active investigation at this time. One key research area is the development of tests to rapidly detect AI infections in chickens and other avian species. ARS worked with the USDA Animal and Plant Health Inspection Service (APHIS) to develop and test a rapid detection method of finding AI infections in live bird markets. Using this test, researchers can determine infection with the H5 or H7 form of the virus in three hours. In addition, this test has proven successful for pen-side screening, pending the development of more sensitive screening tools in progress. This procedure was successfully employed in poultry markets in Texas and Virginia to contain AI outbreaks in previous years, and has now been distributed to laboratories throughout the United States to use in the future if new AI outbreaks are suspected.

ARS research has also supported the development of AI vaccines, which have several use restrictions. For the H5 and H7 sub-types of the virus, vaccine use requires APHIS, USDA, and State approval, along with a USDA license. For other sub-types of the virus, State approval is required for use. In the United States, immunization is not routinely practiced for trade reasons and because routine vaccination against certain strains is not cost-effective. However, poultry producers are now considering vaccination more often, because immunization against some AI strains can potentially control outbreaks at a lower cost than large-scale culling of poultry.

ARS research includes the development of vaccines to protect poultry from both established and mutating AI viruses. Some types of chickens are protected from AI infection for at least 20 weeks after a single vaccination. Two types of vaccines are currently available, but ARS research has shown that the vaccine must match the AI strain to provide optimal protection against the virus. In addition, if a bird is infected with a certain strain of AI and receives a vaccine developed for that strain, it will shed fewer viruses, which will limit its ability to transmit the infection to other birds. Building on this research, ARS has entered into several Cooperative Research and Development Agreements with private companies to accelerate the development of new vaccines to protect U.S. poultry and their use.

ARS is leading research in demonstrating that the accumulation of mutations in the AI viral genome can reduce the effectiveness of vaccines. As a result, three vaccines have been developed using DNA splicing techniques, and all of them have initially shown promise in protecting against AI. Using these vaccines would allow immunized birds to be distinguished from naturally infected birds, thus reducing trade issues. These new vaccines are now being compared to existing vaccines to evaluate their cost effectiveness.

ARS is also studying AI in free-flying waterfowl by working with collaborators at the Moscow-based International Science and Technology Center. Researchers are collecting samples from wild birds that follow migratory flyways over Russia. This sampling technique allows constant monitoring of AI virus strains, and provides scientists with an early warning system when new strains emerge in wild populations.

AI viruses obtained from the United States, Hong Kong, Italy, El Salvador, Chile, Netherlands, Indonesia, Viet Nam, and South Korea are being evaluated by ARS for their genetic markers, potential virulence, source, and spread. ARS is developing and evaluating techniques to predict which low pathogenicity AI viruses are at greatest risk for changing into high pathogenicity AI viruses.

Working with CDC, ARS has tested proposed human influenza vaccines to make sure they pose no threat to poultry production in the unlikely case the viruses used by commercial manufacturers for vaccine production are accidentally released into the poultry environment. In addition, ARS has shared data on AI vaccines and vaccination with the Food and Agriculture Organization and the World Organization for Animal Health.

Anthrax

Bacillus anthracis is a spore-forming bacterium that can be found in soil and can cause disease - commonly known as anthrax - in livestock and other animals. Anthrax spores could be used as an agroterrorism agent in several ways. This might include intentional contamination of many different types of food including liquid egg products, milk or meat. In addition, humans can become infected by handling products from infected animals, inhaling anthrax spores from contaminated animal products, and consuming meat products from infected animals. Without treatment, the mortality rate for pulmonary anthrax is 70-80%. In many cases, pulmonary and gastrointestinal anthrax is fatal if not treated immediately. However the mortality rate for gastrointestinal infections is not as high, perhaps 50%, and less then 1% for cutaneous, if properly treated.

In 2001, anthrax was successfully deployed as a biological weapon when letters containing anthrax spores were sent to several locations via the U.S. postal system. Five people died as a result, and USDA established a temporary mobile laboratory in Washington, D.C. to assist in examination of suspicious envelopes received at several government agency mailrooms.

ARS works to prevent anthrax contamination of food by improving detection methods, evaluating growth and survival patterns of the spores, and developing improved processing techniques to remove them from and/or deactivate them in liquid egg, milk and meat products. ARS researchers have studied and developed methods for detecting anthrax in milk at various stages during the course of transport and processing. Scientists showed that the Ruggedized Advanced Pathogen Identification Device (RAPID) can be used to detect very low numbers of anthrax in milk. Researchers also determined that high-temperature pasteurization does not sufficiently deactivate anthrax spores in milk. To supplement the pasteurizing process, ARS has developed a micro-filtration process can remove anthrax spores to a level well below infectious thresholds; this process can be used to decrease the likelihood that the milk supply will be harmful.. Microfiltration is being used commercially for a variety of reasons, including the removal of bacteria.

Researchers have also studied the survival trends of anthrax when contaminated meat is stored and cooked at various temperatures. The scientists developed models for predicting the growth and survival of the bacteria as well as recommendations for storage and cooking to reduce contamination. Researchers continue to work on improving processing techniques to deactivate anthrax in liquid egg products, where it can also threaten the safety of food. In light of the mortality rates associated with gastrointestinal infection, anthrax research to develop improved detection and processing techniques is critical, and ARS continues to work toward meeting this need.

Brucellosis

Brucellosis has been classified by the United States bio-defense community as a potential agent for bioterrorism, and is one of the most important zoonotic diseases of livestock worldwide. It can cause significant illness and lead to abortion and death in animals and humans. There are several *Brucella* species but many can infect all mammals to some degree. Wildlife, including bison, elk, and feral swine, can carry and transmit brucellosis to domestic animals.

ARS researchers are conducting extensive research on brucellosis at the National Animal Disease Center in Ames, Iowa, with a fiscal year 2006 budget of $2,987,500. Brucellosis has been subject to an intensive eradication campaign in the U.S. for the last 50 years, and great progress has been made in eradicating it from the Nation’s cattle and swine. However, brucellosis has been a tremendous burden for livestock producers. Over the years, Federal and State governments, along with the livestock industry, have spent billions of dollars to control and eliminate the disease.

ARS has been very active in researching Brucellosis. Genetic studies have identified specific genetic

patterns in different *Brucella* species, which gives scientists information to use in their search for effective diagnostic techniques and vaccines. Vaccines are being tested on wild and domestic animals to find effective immunization protocols for the treatment of brucellosis and for its eradication in wildlife. Another key area is research into new diagnostic methods that will allow researchers to trace the source of Brucellosis outbreaks in the field.

Rift Valley Fever

When considering both economic and public health implications, the Rift Valley Fever virus is a priority biological threat agent for the U.S. livestock industries. Rift Valley Fever is transmitted by mosquitoes and affects both humans and animals. Rift Valley Fever is more likely to cause severe disease and death in animals than in humans, but human fatality rates as high as 20% have been reported and it can cause severe vision damage, hemorrhaging, and inflammation of the brain in those who survive. There have not been any reported outbreaks in the United States, but an introduction of the virus could be catastrophic to the agricultural economy. The disease has already moved out of East Africa into Egypt, Yemen, and Saudi Arabia. North American livestock have no resistance to the virus, so it would spread rapidly, resulting in major bans on product transport and export from infected areas.

ARS is currently working with CDC and the Department of Defense to develop detection techniques, to evaluate vaccines, and to develop control methods tailored to the cause of infection and the method of transmission. ARS researchers have developed models to detect environmental conditions that may precede disease outbreaks, which will be useful for agricultural and public health officials for enhancing disease surveillance and preparing for an outbreak. Other ARS scientists are studying the mosquitoes that carry the virus to determine natural infection rates and the genetic factors that affect transmission. ARS is also collaborating with the Canadian Food Inspection Agency to develop detection methods and effective vaccines for Rift Valley Fever.

Related Food Safety and Health Research

ARS conducts research to detect and control other biological agents such as *Yersinia pestis* and *Salmonella* species that can be intentionally used to make the food supply unsafe. The knowledge of detection methods, the decontamination process, and control of organism growth that ARS has gained in these research programs all contribute to a better understanding of how to protect against bioterrorism attacks on the agriculture and food system using zoonotic agents.

For instance, ARS has determined that microarray technology is a highly effective means of detecting potential bioterrorism agents. Microarray technology allows researchers to simultaneously test thousands of samples and to discriminate among pathogen species and their different strains. By combining this technology with the Agency's genome sequencing studies, ARS will be able to detect and characterize more than 25 pathogens and toxins that threaten the safety of food. Regarding meat contamination, ARS researchers have determined that ionizing radiation is a highly effective means of deactivating pathogens such as *Yersinia pestis*.

In support of USDA action ARS, in association with the Food Safety Inspection Service, used a tool developed by the HHS Food and Drug Administration, the Department of Defense, the Department of Homeland Security, and the Central Intelligence Agency to assess and predict how vulnerable a certain food system is to attack. This tool considers seven factors: criticality, accessibility, recuperability, vulnerability, effect, recognizability, and shock (CARVER + Shock). By assessing these factors, researchers determine the level of threat that toxins and threat agents pose to a given food system and establish research priorities. In other collaborative efforts, ARS is working with the United States Army to develop portable imaging devices for pathogen detection. ARS is also working with the Food Emergency Response Network Methods Subcommittee to evaluate technologies to be incorporated into a Biosecurity Protocol Manual.

Surveillance

ARS is working with other USDA agencies to develop a surveillance program to determine how farm practices affect bacterial populations and the antibiotic resistance levels of those bacteria. This program will serve as a model for future surveillance efforts on a national level, assisting the Food Safety and Inspection Service, the Food and Drug Administration, and the food animal industry in the production of safe food products. It also promises to be vital to the Department of Homeland Security's National Biosurveillance Integration System and to its efforts to limit damages to the economy, animal health, and public health. The project is conducted by ARS researchers in Ames, Iowa; Athens, Georgia; College Station, Texas; and Beltsville, Maryland.

In summary, ARS is pleased to work toward preventing and preparing for agroterrorism and zoonotic diseases. We thank you for the opportunity to share our research with you. Mr. Chairman, this concludes my remarks. I would be happy to answer any questions.