



What ARS Does: Improving Crop, Livestock, and Aquaculture Production

The ARS Animal Production and Protection research program prioritizes management practices that ensure consumers can access an abundant supply of competitively priced, high quality animal products that enhance human health, while ensuring domestic food security and enhancing the efficiency, competitiveness, and environmental sustainability of the food animal industry. New and efficient processes that provide solutions to developing issues within animal agriculture production, such as industry sustainability, are necessary for safeguarding animal genetic resources.



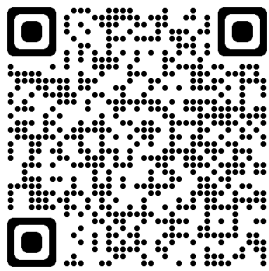
Key 2022 accomplishments include researching genetically engineered vaccines, identifying genetic and environmental relationships, and modeling technologies for more sustainable animal agriculture processes.

Modeling liver abscess formation in cattle to reduce antibiotic use. Liver abscesses in cattle result in significant economic costs for producers and the beef packing industry due to reduced growth rates and an increased incidence of rumen acidosis that affects animal health and welfare and reduces carcass value. Unfortunately, liver abscesses are only clearly identified at harvest when organs are inspected, which limits live animal research for identifying causes and solutions. ARS scientists in Lubbock, Texas, and university collaborators developed a real-world, live animal liver abscess model that more closely aligns with the natural development of abscesses in cattle. They used dietary changes and oral infusions of naturally occurring bacteria to increase the identification of cattle with liver abscesses and to evaluate intervention and mitigation strategies that reduce liver abscesses in beef production systems. The model will enable testing of alternatives to antibiotic treatment, reduce the need for antimicrobial use and the potential development of antibiotic resistance, improve cattle health and wellbeing, and improve economic returns at the farm and packer levels. [\(NP 101\)](#)

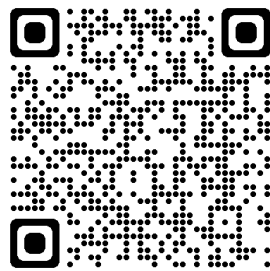
Optimized cryopreservation of turkey genetic resources. For most livestock species, sperm cryopreservation effectively captures the entire genome. However, in birds, female chromosomes determine gender, so complete genome capture and preservation entails collecting female gonads as well as sperm. Effective cryopreservation is not possible for eggs, so reproductive biology expertise driving female gonad retrieval, preservation, and re-introduction is critically needed in the turkey and across avian species. ARS scientists in Beltsville, Maryland, in collaboration with scientists in Canada, perfected turkey female gonad (ovary) retrieval timing in chicks. They also established an optimized surgical method and timeframe for transplanting ovaries to recipient birds. Results indicate that 91 percent of ovarian grafts were successful if tissue was collected from 7-day old donors and implanted into 2-day old recipients under the surgical process. This discovery represents a major scientific advancement and provides industry and research institutions with a powerful tool to preserve valuable turkey lines in frozen form for future use. [\(NP 101\)](#)

Development and approval of the first African swine fever vaccine. African swine fever (ASF) is a devastating and highly lethal disease of pigs for which there were no commercial vaccines. ARS scientists at the Plum Island Animal Disease Center (PIADC) in New York successfully developed innovative genetic engineering techniques that enabled the discovery of a live attenuated vaccine that was shown to be fully protective and safe in experimental clinical studies at PIADC. The vaccine was subsequently transferred in June 2020 to the National Veterinary Joint Stock Company (NAVETCO) in Vietnam through a research agreement. ARS scientists working in partnership with NAVETCO successfully tested, in record time, the vaccine against locally circulating Vietnamese ASF virus field strains in pigs of European and Asian genetic background. NAVETCO also showed that the vaccine is genetically stable, remains attenuated, and has no toxicity when inoculated in domestic pigs. NAVETCO received a certificate of Marketing Authorization from the Vietnamese Department of Agriculture and Rural Development on June 3, 2022, making this the first ASFV vaccine ever approved for commercial use. The vaccine is currently being deployed under controlled field conditions in swine farms in Vietnam to further evaluate its safety and efficacy characteristics. If successful, Vietnamese authorities will develop plans to integrate ASF vaccination in their National ASF Control Program. [\(NP 103\)](#)

Beef composite breed composition not stable over time. Composite cattle breeds are commonly used in the U.S. beef industry to combine individual pure breed strengths and benefit from the hybrid vigor obtained by crossing divergent genetics. In statistical theory and classic quantitative genetics, composite breeds under no selection pressure are thought to maintain consistent breed composition percentages from generation to generation that follow initial breed development. Genomic tools and technological advances now make lineage tracing and breed composition estimation more powerful. ARS scientists in Miles City, Montana, and Fort Collins, Colorado, evaluated genomic breed composition over time in an ARS three-breed composite formed in the 1980s and their results indicate that the current genetic composition changed substantially from quantitative estimates. These changes show that original breed proportions are not stable over generations: environment and management, independent of artificial selection, influence the alleles that remain over extended periods of time, and favorable alleles originating from the most environmentally adaptive breeds increase in frequency. This finding suggests there is an opportunity to identify genetic types that are more fit for a given environment and supports application of genetic by environment by management principles in U.S. beef cattle production. [\(NP 101\)](#)



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