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COMBATING ANTIMICROBIAL RESISTANCE (AMR)

ARS research elucidates the factors associated with antimicrobial resistance (AMR) in agricultural settings and develops tools and alternatives to antibiotics that mitigate AMR for the benefit of human, animal, and ecosystem health. Antimicrobials such as antibiotics will remain an essential tool for treating animal and human diseases, though the growing prevalence of resistant bacteria has garnered global concerns over the prudent use of antibiotics in animals. The following FY 2019 accomplishments highlight ARS advances in optimizing the use of and reducing the need for antibiotics in agriculture.

Restoring effectiveness of antibiotics. Tunicamycin is a powerful antibiotic that can be combined with penicillins to restore their effectiveness against otherwise resistant bacterial strains. However, tunicamycin's toxicity in humans and animals has limited its use. ARS scientists in Peoria, Illinois, developed a technology to modify tunicamycin into less harmful derivatives while still retaining the ability to enhance penicillins. This technology holds promise for reducing the use of traditional antibiotics to treat livestock and reinstituting shelved antibiotics that were once rendered ineffective due to AMR.

Investigating susceptibility of foodborne pathogens to commercial and household biocides. Biocides are a type of antimicrobial used to reduce bacterial contamination during retail meat processing. In a study of 17 common household and commercial biocides, ARS researchers in Athens, Georgia, identified several biocides that were ineffective against antibiotic-resistant Salmonella isolates. However, they did not find an overall correlation between resistance of Salmonella to the biocides and antibiotics.

AMR distribution differs among methicillin-resistant Staphylococcus aureus (MRSA) isolates from healthcare and agricultural sources. ARS researchers in Ames, Iowa, found that swine-associated MRSA isolates harbored resistance to fewer antibiotics than clinical MRSA isolates from humans who had no swine contact. The two sets of samples had little overlap in AMR genes. These results suggest that swine do not play a major role in maintaining a MRSA reservoir for humans.

Developing tools to combat AMR in a postharvest fungus of apples. ARS researchers in Beltsville, Maryland, in collaboration with Cornell University, developed a sensitivity assay to identify fungicide-resistant strains of blue mold that can form during apple storage and produce a mycotoxin. Extension professionals now use this assay to monitor fungicide resistance to maintain the efficacy of current postharvest chemicals against this postharvest fungus of apples.

Low-cost anaerobic digester reduces antibiotics in farm waste. ARS scientists in Beltsville, Maryland, in collaboration with University of Maryland scientists, demonstrated that an on-farm anaerobic digestion system for reducing antibiotic compounds in farm waste removed 70 percent of the antibiotic monensin, a widely used antibiotic in animal husbandry. Anaerobic digestion systems such as this would reduce point source pollution runoff from farms into important watersheds.