SEEDS The OARDC Research Enhancement Competitive Grants Program

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Ohio Agricultural Research and Development Center
College of Food, Agricultural, and Environmental Sciences

Reduction of Antibiotic-Resistant Bacteria Present in Food Animal Manures by Composting and Anaerobic Digestion

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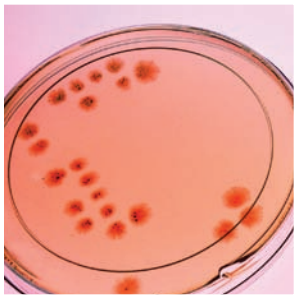
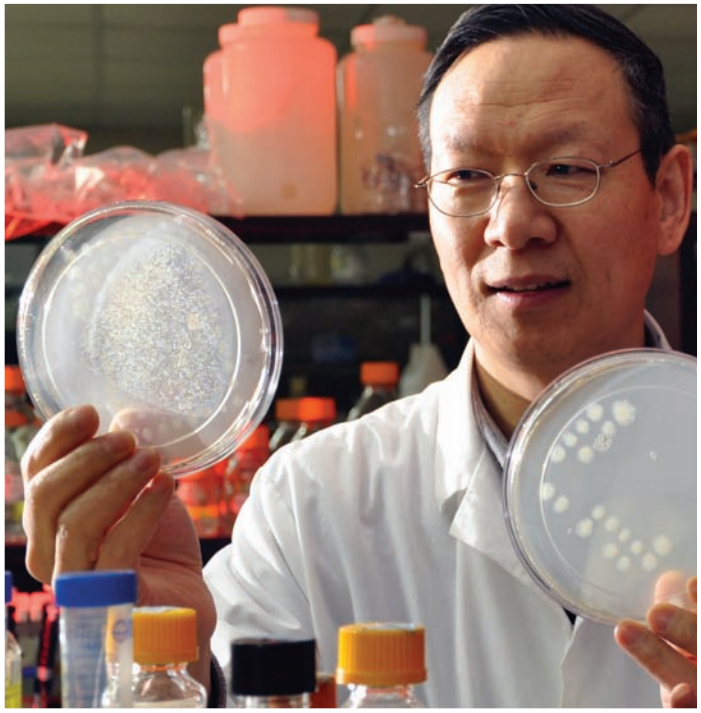


Background

Antimicrobial drugs are arguably the most important drugs developed in human history. They have saved human and animal lives and cured infections in an unprecedented magnitude, not matched by any other drug. Human and animal resistance to antimicrobial drugs has developed against all antimicrobial pharmaceuticals and has become a widespread global problem.

The pervasive occurrence of antimicrobial resistance not only poses a severe risk to the health and well-being of both humans and animals but also leads to considerable economic losses. The Institute of Medicine estimates the annual cost of infections caused by antibiotic-resistant bacteria to be $4 to $5 billion U.S. dollars. Thus, antimicrobial resistance has become a great concern not only in the United States but also other countries around the globe. Because such a large quantity of antimicrobial drugs—up to 50% of the antimicrobial drugs produced in the United States—is used in farm animal production to promote growth performance, much of the concern over antimicrobial resistance is directed at the use of antimicrobial drugs in farm animals. Animal manure is the largest antimicrobial resistance reservoir because most of the antibiotic-resistant bacteria arising from farm animals winds up in manure; thus, manure treatment offers a critical control point to contain or even destroy antimicrobial resistance.



Because effective strategies are needed to curtail the growing problem of antibiotic-resistant bacteria, a SEEDS grant was awarded to fund research specific to tetracycline resistance. The Seed Grant Competition is designed to encourage new and innovative research and generate the preliminary data needed for successful application to competitive extramural funding sources.

Objectives

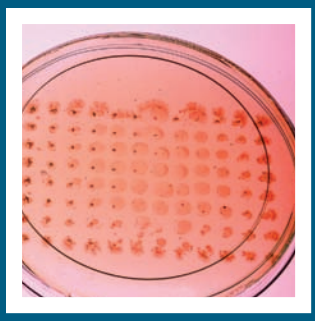
The primary objective of this SEEDS grant study was to investigate the reduction of antimicrobial resistance to tetracycline and other antimicrobial drugs in manure treatment systems employed by animal farms. OARDC scientists sought to identify effective manure treatment systems so that they can be used to reduce the antimicrobial resistance arising from animal farms. Investigators studied both full-scale, on-farm animal manure treatment systems and lab-scale manure treatment systems.

Challenges

Using antimicrobial resistance to tetracyclines and macrolidelincosamide-streptogramin B as models, the study found that storage of animal manure and wastes in conventional, on-farm lagoons does not result in any significant reduction of antimicrobial resistance. Animal manure and wastes were treated by biofilters, bacteria used to combat and remove pollutants.

Results

Treating wastes and manure with biofilters did not appreciably reduce antimicrobial resistance. Anaerobic digestion and composting at mesophilic or moderate temperature significantly reduced the antimicrobial resistance in animal manure. The most effective treatment was composting at thermophilic or high temperature, which resulted in five to seven orders of magnitude reduction of antimicrobial resistance. Researchers concluded that both anaerobic digestion and composting—especially at elevated temperatures—are effective and practical to reduce antimicrobial resistance arising from animal production.



The Future

The proven effectiveness of anaerobic digestion and composting at high temperatures is of interest to industry and producers for practical applications in animal production. This high-profile research was presented at the 108th General Meeting of the American Society for Microbiology and published in such notable publications as the *Journal of Animal Science*, *Microbial Ecology in Health and Disease*, and *Applied and Environmental Microbiology*.

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