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Survival of zoonotic pathogenic bacteria in the agroecosystem

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Abstract:

Pathogenic bacteria originating in food animals can be introduced into the environment through field-spreading of manures and thence potentially into the food production system. A number of recent, high-profile cases of food-borne human illnesses have been linked to manure management practices. We are conducting a series of field experiments to examine survival trends of zoonotic pathogens in the soil system and in manure handling facilities on a dairy farm. Sample containers were sentinel chambers, PVC cylinders with ends sealed by 0.2 micron membranes, which allowed equilibration of chamber contents with environmental variables while preventing pathogen escape. In Trial 1, three strains each of *Salmonella enterica* (Dublin, Newport, and Typhimurium) and *E. coli* O157:H7 (stx+, stx-, and streptomycin-resistant stx+) were separately inoculated at 7 log₁₀ g⁻¹ into dairy manure-amended soil and used to fill replicated arrays of sentinel chambers buried under grass sod. Five of the six strains declined in concentration at rates of 0.40 to 0.48 log₁₀ week⁻¹, while the resistant stx+ strain declined at approximately half that rate. *Salmonella* Newport and Typhimurium have persisted at low levels past day 160. In Trial 2, *Salmonella* Newport or *E. coli* stx+ were inoculated into manure-soil mixture sentinels under sod, and into dairy manure alone and submerged in a dairy effluent lagoon, or buried in a static manure solids compost pile. No *Salmonella* or *E. coli* O157:H7 were found after 18 hrs in the compost, presumably killed by high temperatures, which reached 64 C. *Salmonella* in the soil in the second study declined by 0.49 log₁₀ week⁻¹, while *E. coli* in the soil, and both pathogens in the lagoon declined at higher rates, 0.77 to 0.97 log₁₀ week⁻¹. Presence of zoonotic pathogens in the soil over many months emphasizes the need for further study to modify environmental persistence.

Impact Statement:

Upon completion, the several laboratory and field-based phases of the project will have generated important information on survival of potentially dangerous zoonotic pathogens under natural environmental conditions found on food animal production facilities, further informed by studies conducted under controlled laboratory conditions. To pursue the project and generate the proposed deliverables, the lead investigative organization, the University of Pennsylvania is partnering with the veterinary microbiology laboratories, the *Salmonella* Reference Center and the *E. coli* Reference Center. Information developed by this project will expand the knowledge base needed to adequately address and develop strategies to counter the emerging and serious issue of human and animal disease linked to pathogens originating in food animal production..

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