Research Experiences for Undergraduates (REU) and Research Experiences for Veterinary Students (REV) 2011 Abstract

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Modeling of *Escherichia coli* O157:H7 through the Beef Cattle Production System.
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Escherichia coli O157:H7 is an important foodborne pathogen that colonizes the large intestines of cattle. A type III secreted protein (TTSP) vaccine has recently been developed and is marketed to reduce the amount of O157:H7 colonization and shedding in the feces of cattle. We used a discrete-time model that incorporates the cow/calf, stocker, and feedlot stages of beef production to understand the effects of this vaccine on the transmission of O157:H7 in an infected cattle herd. The model focuses on use of control measures, by showing the effects of vaccination at the different levels and by incorporating the effects of management changes (i.e. pasture rotation). Vaccination was only effective at the feedlot production stage, since vaccination any earlier still allowed time for the system to become high prevalence again before the feedlot level. However, at the cow/calf production stage, rotating the animals among pastures every 5 weeks allows the environment to have much less of an effect on transmission and maintains a low prevalence herd at a low prevalence of O157:H7. Management was much less important at the stocker production stage, as the very low density of animals did not allow for a great amount of direct transmission or environmental buildup. Vaccination at the feedlot production stage had the most effect on a low level prevalence herd, where it helped maintain a low prevalence. However, with high prevalence herds, the vaccine did not have enough of an effect to decrease the herd to a low prevalence of the bacteria. We propose that a combination control method of both pasture rotation at the cow/calf level and then vaccination at the feedlot level will create and maintain a low prevalence herd until the time of transport to slaughter.