"Antibiotic Use in Agriculture and Its Impact on the Terrestrial Environment," Advances in Agronomy, 2005 87:1-54, Kuldip Kumar, Satish C. Gupta, Yogesh Chander and Ashok K. Singh

Abstract

Since their discovery, antibiotics have been instrumental in treating infectious diseases that were previously known to kill humans and animals. However, their widespread use as an additive in animal feeds has raised concerns about the development of antibiotic-resistant microorganisms. Increasingly, more microorganisms are becoming resistant to multiple antibiotics. A high proportion of the antibiotics added to animal feed is excreted in urine or manure. In some cases, as much as 90% of the antibiotic administered orally may pass through the animal unchanged. Once excreted in urine and manure, these antibiotics can enter surface and/or groundwater through nonpoint source pollution from manure-applied lands. The literature shows that most of the antibiotics are strongly adsorbed in soils and are not readily degraded. An important environmental concern is the presence of antibiotics in sources of potable water. Except erythromycin and some sulfa drugs, most of the antibiotics found in surface waters have been only in minute quantities. In all cases, the amounts observed are in parts per billion ranges; 100- to 1000-fold below minimum inhibitory concentration. Tetracyclines and penicillins, two of the most commonly used antibiotics in animal agriculture, have seldom been found in sources of potable water. There has been some reported presence of resistant bacteria in surface waters. This may have been from transport of resistant bacteria via animal or insect vectors, in airborne dusts, or simply water flow from some antibiotic-rich setting such as manure lagoons. Direct toxic effects of antibiotics on plants and soil microflora and -fauna are unlikely because of the low concentrations at which antibiotics in manure are land-applied. The indirect effects of antibiotics on the food web, however, cannot be discounted at this stage. Decrease in some components of the soil microbial populations due to manure-applied antibiotics could cause loss of food sources for other soil organisms, which, in turn, could affect important soil microbial processes such as decomposition and mineralization. Also, **repeated application of antibiotic-laden manure can provide an environment in which selection of antibiotic-resistant bacteria can occur.** Prudent use of antibiotics to a bare minimum along with alternative methods that minimize development and proliferation of resistant bacteria need investigation.