Plant buffers can slow runoff of veterinary antibiotics

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Field tests by University of Missouri scientists have backed up laboratory research indicating that buffer strips of grass and other plants can reduce the amount of herbicide and veterinary antibiotics in surface runoff from farm plots.

Vegetative buffer strips have already proven effective in limiting erosion as well as reducing sediment and nutrients in runoff.

The findings come amid concerns about the potential of veterinary antibiotics in surface water leading to the emergence of antibiotic-resistant bacteria. The antibiotics can enter the environment through manure from confined animal feeding operations and from crop fields fertilized with manure.

"Vegetative buffer systems are recognized as one of the most effective approaches to mitigate surface water runoff from agroecosystems, and we think that such systems also have the utility for reducing veterinary antibiotic loss," said Bob Lerch, USDA soil scientist and MU adjunct professor.

Researchers compared the effectiveness of three grass buffer treatments in reducing the transport of herbicides and veterinary antibiotics in surface runoff. Plant species used in the three treatments included tall fescue, switchgrass and native warm-season grasses—mainly eastern gamagrass. The control treatment was cultivated fallow.

The researchers applied three herbicides and three antibiotics, then generated surface water runoff using a rotating-boom rainfall simulator to create uniform soil moisture content. Water and suspended sediment samples were collected and measured.

All vegetative buffer systems significantly reduced the transport of both dissolved and sediment-bound herbicides atrazine, metolachlor and glyphosate in surface runoff by 58 to 72 percent, said Chung-Ho Lin, research assistant professor with the MU Center for Agroforestry and Department of Forestry.

In addition, the processes governing herbicide fate also applied to veterinary antibiotics. Four to eight meters of grass buffers reduced more than 70 percent of veterinary antibiotics in runoff surface water, Lin said. Using certain species, such as hybrid poplar, can further enhance degradation of deposited antibiotics.

Antibiotics included Tylan, used in swine feed to promote growth and as a disease preventative; sulfamethazine, also used in swine feed with other antibiotics, and Baytril 100, used for swine and cattle for respiratory illnesses.

Filter strips provide an opportunity to use an accepted practice in a manner that people had not explored before, said Keith Goyne, MU assistant professor of environmental soil chemistry.

Much Missouri soil is claypan, which tends to enhance runoff. From a surface water standpoint, buffers can work well in these soils, he said.

One goal of the research is to provide simple, practical guidelines that agencies, land managers and agroforestry practitioners can use in the design of effective buffer strips, Lerch said.

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