

HERBICIDES AND THEIR METABOLITES IN THE SURFACE WATERS OF THE MISSISSIPPI RIVER ALLUVIAL PLAIN

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The broad flat Mississippi River Alluvial Plain, located on both sides of the Mississippi River (predominately in Arkansas, Louisiana, Mississippi, and Missouri) is one of the most agriculturally productive areas in the United States. The major crops grown in this area include corn, cotton, rice, and soybeans. Although pesticides are used in row crop production throughout the United States to improve yields and protect crops, pesticide use in the Mississippi River Alluvial Plain exceeds that of most other parts of the United States. The greater use of pesticides is largely because of the intense weed and insect pressure in the humid southeastern United States and the types of crops, such as cotton, that are slow growing and very susceptible to yield loss. There is concern that this heavy use of pesticides may contaminate surface waters. In addition to the parent compounds, metabolites of the pesticides may also contaminate surface waters. The toxicological significance of the presence of these metabolites in surface water is not usually known because most studies focus on the toxicity of the parent compounds. During the 1996 and 1997 growing season, surface-water samples were collected from streams in the Mississippi River Alluvial Plain and analyzed for selected herbicides and metabolites. The herbicides for which the surface-water samples were analyzed include atrazine (6-chloro-*N*-ethyl-*N'*-(1-methylethyl)-1,3,5-triazine-2, 4-diamine), cyanazine (2-[[4-chloro-6-(ethylamino)-1,3,5-triazin-2-yl]amino]-2-methylpropanenitrile), fluometuron (*N,N*-dimethyl-*N'*-[3-(trifluoromethyl)phenyl]urea), norflurazon (4-chloro-5-(methylamino)-2-(3-(trifluoromethyl)phenyl)-3(2*H*)-pyridazinone), and propanil (*N*-(3,4-dichlorophenyl)propanamide), some of the most heavily used herbicides in the Alluvial Plain. In addition, the surface-water samples were analyzed for at least one metabolite for each herbicide. The results indicate that for some herbicides, such as propanil, the parent compound is almost never detected above the reporting level in surface water; however, 3,4-dichloroaniline, a metabolite of propanil, was detected frequently throughout the growing season after the application of propanil. The concentration of 3,4-dichloroaniline did not exceed 1.0 ug/L in any sample. Other herbicides such as atrazine and fluometuron were detected frequently with a range in concentrations from 1 to 10 ug/L, and their metabolites were also detected frequently, but at lower concentrations ranging from 0.05 to 1 ug/L. Metabolites represent about 10 percent of the total concentration in samples collected at the beginning of the growing season, but become proportionally more significant later in the season as the parent compound dissipates and degrades. Metabolites represented as much as 50 percent of the total concentration at the end of the growing season.