Researchers study pesticide pathways into the atmosphere

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When soil moisture levels increase, pesticide losses to the atmosphere through volatilization also rise. In one long-term field study, U.S. Department of Agriculture (USDA) scientists found that herbicide volatilization consistently resulted in herbicide losses that exceed losses from field runoff.

Agricultural Research Service (ARS) soil scientist Timothy Gish and ARS micrometeorologist John Prueger led the investigation, which looked at the field dynamics of atrazine and metolachlor, two herbicides commonly used in corn production. Both herbicides are known to contaminate surface and ground water, which was primarily thought to occur through surface runoff.

Gish works at the ARS Hydrology and Remote Sensing Laboratory in Beltsville, Md., and Prueger works at the agency's National Laboratory for Agriculture and the Environment in Ames, Iowa. ARS is USDA's chief intramural scientific research agency, and this work supports the USDA priority of promoting sustainable agriculture.

Many experts believed that volatilization was not a contributing factor to water contamination because atrazine and metolachlor had a low vapor pressure. However, the monitoring of both herbicide volatilization and surface runoff at the field-scale over multiple years had never been done.

So the team set up a 10-year study in an experimental field in Beltsville

that is equipped with remote sensing gear and other instrumentation for monitoring local meteorology, air contaminates, soil properties, plant characteristics, and groundwater quality. This allowed the team to carry out their studies on a well-characterized site where only the meteorology—and the soil water content—would vary.

Prueger and Gish observed that when air temperatures increased, soil moisture levels had a tremendous impact on how readily atrazine and metolachlor volatilized into the air, a key factor that had not been included in previous models of pesticide volatilization. When soils were dry and air temperatures increased, there was no increase in herbicide volatilization, but herbicide volatilization increased significantly when temperatures rose and soils were wet.

Most surprising was that throughout the study, herbicide volatilization losses were significantly larger than surface runoff. When averaged over the two herbicides, loss by volatilization was about 25 times larger than losses from surface runoff.

Results from this work were published in the *Journal of Environmental Quality*.

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