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Crops Absorb Pharmaceuticals From Treated Sewage

Environmental Pollutants: Soybeans can accumulate drugs and personal care products commonly found in wastewater and solid waste

*By **Rachel A. Zurer***

RECYCLED FERTILIZER
Farmers often fertilize their crops with treated sewage, which may still contain pharmaceuticals
Credit: Dana W. Kolpin, U.S. Geological Survey

Each year, U.S. farmers fertilize their fields with millions of tons of treated sewage and irrigate with billions of gallons of recycled water. Through this treated waste, an array of pharmaceutical and personal care products (PPCPs) make their way unregulated from consumers' homes into farm fields. Now researchers find that at least one crop, soybeans, can readily absorb these chemicals, which raises concerns about the possible effects on people and animals that consume the PPCP-containing plants (*Environ. Sci. Technol.,* DOI: **10.1021/es1011115 <http://pubs.acs.org/cgi-bin/cen/trustedproxy.cgi?redirect=http://pubs.acs.org/doi/abs/10.1021/es1011115>**).

Researchers have previously shown that food crops take up veterinary medicines from manure fertilizer and some cabbage species absorb human pharmaceuticals when grown in hydroponic conditions. But environmental scientist **Chenxi Wu <http://www.eeescience.utoledo.edu/Faculty/Spongberg/GESS_web/gradstudents** and colleagues at the **University of Toledo <http://www.utoledo.edu/>** in Ohio wanted to determine if a major food crop could absorb common PPCPs under more realistic agricultural conditions, such as plants grown in soil. If the chemicals do find their way into the crops under real-life conditions, they could be toxic to the plants, Wu says. "Or they could accumulate through the food chain, and eventually end up in human

consumers," he adds.

In a greenhouse experiment, the scientists focused on soybeans, the second most-widely grown crop in the U.S. Half the plants grew in PPCP-tainted soil, to simulate fertilization with treated solid waste, while the researchers irrigated the other half with chemical-spiked water, to replicate wastewater irrigation. They laced water and soil with three pharmaceuticals—carbamazepine, diphenhydramine, and fluoxetine—and two antimicrobial compounds found in personal care products—triclosan and triclocarban.

The scientists analyzed plant tissue samples by mass spectrometry at two life stages: just before the soybeans flowered and after they sprouted beans. Wu and colleagues found that carbamazepine, triclosan, and triclocarban concentrated in root tissues, eventually moving into the stems and leaves. The antimicrobial compounds triclosan and triclocarban also accumulated in the beans themselves. But the soybean plants barely absorbed diphenhydramine and fluoxetine—the chemicals only appeared at low concentrations in the roots. Overall, the plants absorbed the chemicals more efficiently by irrigation than through the soil. The researchers are still trying to determine why.

Environmental chemist **Chad Kinney <http://csm.colostate-pueblo.edu/Chemistry/FacultyStaff/Pages/default.aspx>** of **Colorado State University, Pueblo <http://www.colostate-pueblo.edu/Pages/default.aspx>** , says the study underscores the need for further research into how PPCPs behave in agricultural settings. "The first thing you have to consider with human exposure through agriculture is whether it's even possible," Kinney says. "That's what was answered by this study."

Wu thinks that more toxicology studies should come next: "If you find those compounds in the plant, what are they going to do to the plants or to animals that eat the plants?"

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