OSU strives to protect drinking water

Water. We need it to exist, yet we all take it for granted. However, clean water is becoming more difficult to find.

Cities all across America obtain drinking water from local reservoirs, rivers, lakes and groundwater. However, agricultural runoff is a main source of phosphorus pollution in surface waters, said Libby Dayton, soil and environmental chemistry graduate student at Oklahoma State University.

Dayton said several different agricultural sources might contribute to the phosphorus pollution.

"It may be caused by an over-application of phosphorus to soil," Dayton said. "It's typical in concentrated animal feeding operations, but can also come from an over-application of phosphorus fertilizer."

The problem occurs when rain washes nutrients, containing phosphorus, from pastures or nearby concentrated animal feeding operations into surface water bodies.

Dayton said the phosphorus is not toxic, but it promotes the growth of unwanted algae. Nevertheless, scientists at OSU just might have a potential solution to the phosphorus runoff problem.

"If you keep the phosphorus on the field with the animal waste you have less risk of polluting streams that eventually run into source water," said Nicholas Basta, associate professor of soil chemistry at OSU.

Scientists at OSU, the State Department of Environmental Quality and drinking water treatment facilities across the state have been working together to solve this problem. The process of treating water for safe drinking requires the removal of sediment from the water. Large amounts of residual are generated when treating drinking water, and treatment plants are faced with the problem of disposing the residual.

Basta, along with another OSU scientist, is working to find beneficial uses for those wastes. Basta said the residuals collected from drinking water plants throughout the state were characterized and were found to have varying adsorption capacities.

"We collected materials from all over the state and characterized them," Basta said. "They all have different potentials for adsorbing phosphorus."

Rod Walker

Josh Pittman, plant and soil sciences senior, tests a water sample in the soil science lab.

Dayton said the sorption capacity is related to the amount of amorphous aluminum in the residual.

"We've found most aluminum residuals trap phosphorus," Basta said.

Nevertheless, some experiments had to be performed. OSU scientists conducted a small-scale experiment using poultry litter and the water treatment residuals. The experiment consisted of four box plots in which different amounts of the residuals were applied on top of poultry litter.

Two plots contained different amounts of the residuals broadcasted evenly, a buffer strip was placed on a third plot, and the final plot served as the control for the experiment on which poultry litter was applied but no residuals were applied.

A heavy rain was simulated over the plots with the use of a rain simulator built at OSU, and the water runoff was collected for testing.

Just as the scientists hoped, the water samples collected from all the tests plots, except the control, showed significant decreases in the amount of phosphorus in the runoff.

"This was the first time this material was used to remove phosphorus from runoff," Basta said. "With these treatments you can cut the phosphorus runoff in half."

This experiment showed potential for protecting drinking water supplies from phosphorus contamination. The test plots were a success, but the test needed to be performed on a larger scale. Earlier this year, OSU applied water treatment residuals to a 10-acre pasture near Miami, Okla. The pasture was located near a poultry operation and had a massive amount of litter present.

A pond downhill from the pasture had been contaminated by phosphorus and was covered with algae. Basta said water tests revealed the runoff water contained three parts per million phosphorus, an excessive amount. The team applied water treatment residuals to the pasture in the amount of 10 tons per acre, simulated a heavy rain, and collected water samples.

According to the Miami study, the sample revealed a 70-percent reduction in phosphorus, but there is still potential for even better results.

"If 20 tons are applied per acre then you would reduce the phosphorus by 90 percent," Basta said.

OSU plans to work with other universities in the future to protect drinking water.

"We're hoping to put together a multi-regional study with other universities and environmental consulting firms and do something on a larger scale, taking what we learned with our preliminary studies and do something a little more comprehensive," Dayton said.

This may not be the entire answer to keeping drinking water safe from phosphorus runoff, but it is a step in the right direction, Basta said. CJ

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