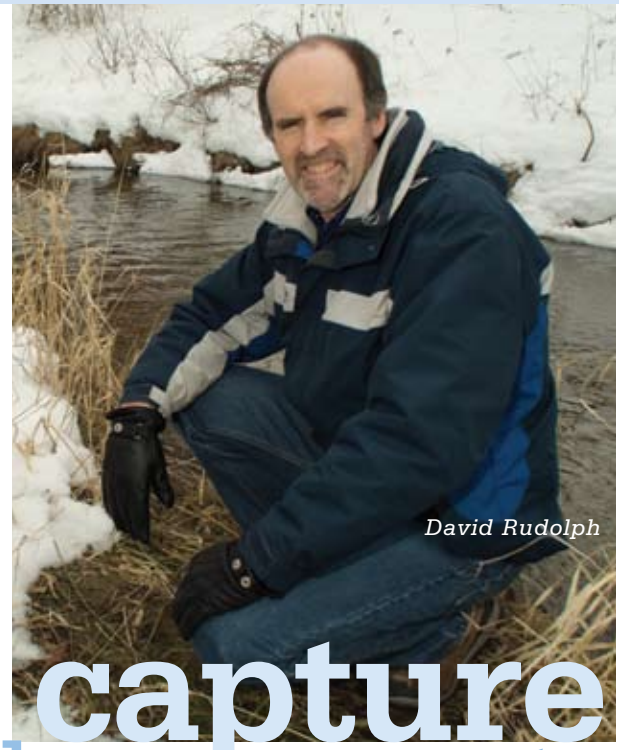
by MIKE MULHERN



MARTIN SCHWALBE

Tile drains capture less water than expected

Experiments conducted by a University of Waterloo team found that, in wet conditions and contrary to received wisdom, only a small percentage of the water passed through the tile drain

Tile drains are not nearly as effective at rapidly removing excess water as people assume, a good thing if you are concerned about applied animal nutrients getting into surface water bodies.

Experiments conducted last fall on a farm in the Upper Thames River watershed near Kintore were designed to mimic the worst conditions for applying pig manure – wet, macroporous soil in fields that are systematically tiled.

"We worked in the fall (late October, early November) when the crop was off," says one of the project leaders, Dr. David Rudolph, a professor in the Department of Earth Sciences, University of Waterloo. Dr. Brewster Conant Jr. was the other project leader. "The idea was to replicate a fall application of manure when the soil is wet and conditions for nutrient loss to surface water are potentially high," Rudolph says.

Typically, in these situations, there is no nutrient or water uptake from crops, tile drains are active and the weather is wet – all factors which promote nutrient movement through the soil profile and into groundwater or tile drains. Further increasing the environmental risk, in heavy soils there are large pores (macropores) caused by worm burrows, mud cracks and root holes, and that was another condition researchers were interested in evaluating when they applied chemical tracers to the surface of the recently harvested soybean field.

The research team found that tile drain discharge, even under those conditions, could only directly account for 10 to 15 per cent of the water that was applied to the surface of the field.

"The bottom line," Rudolph says, "is that tile drains capture much less than we ever would have expected. It has been conventionally assumed that the tiles have a very large area of influence. Field experiments show the influence is much smaller than we'd anticipate."

The experiments were conducted using a large-scale rainfall simulator to replicate natural precipitation over a tile drain. Dissolved, non-reactive chemical tracers were applied to the ground as a surrogate for liquid manure. Movement of the water and tracers were monitored in the soil profile, groundwater system and tile drain effluent.

Results indicated that, under relatively dry soil conditions, a typical three-hour rainstorm had virtually no influence on the amount of tile-drain discharge because the soil was able to absorb all the precipitation. In later experiments, when the soil was much wetter, the tile discharge increased rapidly in response to a similar three-hour rainstorm. However, researchers found that, even under the most vulnerable conditions, only "10 to 15 per cent of the applied water reached the tile within a 24-hour period."

The team concluded "that the majority of the infiltrating water enters the groundwater flow system and is either slow to reach the tile or bypasses the tiles completely." They found that, even under wet soil conditions, only a small percentage of tracer was able to reach the tile drain rapidly (within one hour) after application.

The researchers also measured the influence of macropores in conducting the tracer from ground surface to the tile drain. "Only the tracer applied within 20 centimetres from the centreline of the tile is captured rapidly by the drain. The tracer experiment also showed that, after a period of three weeks and several significant rain storms, only the tracer applied within about 50 centimetres of the tile centre line had arrived at the tile. The remainder had either entered the regional groundwater flow system and bypassed the tile drainage system or had not yet reached the tile drain."

"To help us further understand the risks that tile drains impose on our water resources," says Rudolph, "more field experiments are being conducted in other geological settings and under a wider range of climate conditions." He also adds that movement of the chemical tracers applied last fall is still being monitored.

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