Nitrogen fertilizers' impact on lawn soils

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Nitrogen fertilizers from farm fields often end up in aquatic ecosystems, resulting in water quality problems, such as toxic algae and underwater 'dead zones'. There are concerns that fertilizers used on lawns may also contribute to these problems. All of the lawns in the United States cover an area almost as large as Florida, making turfgrass our largest 'crop' and lawn fertilizer use a legitimate issue.

In a study funded by the National Science Foundation Ecosystem Studies and Long Term Ecological Research programs, researchers from Cornell University and the Cary Institute of Ecosystem Studies have utilized recent technological advances to measure gaseous nitrogen emissions in home lawns.

In the past, scientists have conducted nitrogen input-output studies on lawns to determine how much nitrogen is taken up by vegetation or deposited in soils, and how much is lost. These studies have rarely provided any accurate data, and the 'missing' nitrogen has usually been attributed to denitrification, a process that removes nitrogen from soils by converting nitrate into nitrogen gas.

High soil moisture, low soil oxygen, and sufficient nitrogen availability are all factors that lead to denitrification, which occurs mostly in small areas during brief time periods. This makes it hard to pinpoint peak activity, and measure the process outside of the lab. Additionally, because there is so much nitrogen gas in our atmosphere, it has been difficult for researchers to detect the nitrogen gas produced by denitrification.

In this study, researchers overcame these challenges to measure rates of denitrification from residential lawns in Baltimore, MD. They found that denitrification is an important pathway for removing excess nitrogen from lawns. Nitrogen removals by denitrification were equivalent to 15% of annual fertilizer inputs to the study lawns. The majority of this nitrogen removal occurred over a small time period when soil conditions were favorable to high rates of denitrification. While small amounts of nitrogen were transported to groundwater and streams, the majority of fertilizer nitrogen inputs were retained in lawn soils.

The results from this study are encouraging, but much more work needs to be done to apply the results to a wider range of soil, climatic, and lawn management conditions. While most of the nitrogen losses from denitrification were in the form of nitrogen gas, the results suggest the possibility of significant losses as nitrous oxide, a greenhouse gas more potent than carbon dioxide. Continuing excessive fertilizer applications will likely saturate soil storage capacity, resulting in the harmful transfer of nitrogen to surface and ground water.

The complete results from this study can be found in the November/December issue of *Journal of Environmental Quality*.

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