LAND STEWARDSHIP PROJECT

LSP Myth Buster #68

An ongoing Land Stewardship Project series on ag myths and ways of deflating them.

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➔ *Myth*: When Nitrogen is Gone, it Can be Forgotten

➔ ***Fact***: Nitrogen, the most abundant element in our air, is also a key component of our corn production system. But this foundation of many a bin-busting harvest is also a vexing source of fertility to wrangle and control. Almost 30% of nitrogen applied as commercial fertilizer or manure is not taken up by plants. One estimate is that in the U.S. on average over 34 pounds of nitrogen is lost on each cultivated crop acre per year.

Nitrogen's wandering ways create environmental problems, especially when it makes its way into water. And nitrous oxide is a greenhouse gas that's over 270 times more powerful than carbon dioxide, staying in the atmosphere for a century.

What is perhaps the most frustrating thing about nitrogen pollution is that it does not lend itself to an immediate cause-and-effect solution scenario. When soil-saving practices like no-till, cover cropping, or grassed waterways are put into place, a reduction in erosion can often be noted almost immediately. However, when a farmer decreases fertilizer applications or drops them altogether on a field, nitrate levels in water samples don't always decrease the following year, or, in some cases, even several years down the road. That's because "legacy nitrogen" can be stored beneath the surface for a long time.

The long-term role legacy nitrogen can play in polluting the environment far into the future was reinforced recently when a pair of economists examined measurements of nitrogen concentrations in water at thousands of locations throughout the Corn Belt and compared them to what crops were being raised upstream.

The researchers found that the nitrogen load in small rivers and streams increases by about 0.4 pounds annually for each additional acre of corn planted within 50 miles upstream. That's 50 times less than the nitrogen-based pollution turned up by modeling-based studies. Good news, right?

Unfortunately, no. It turns out we have a very good idea of how much nitrogen is being applied to all that corn and how much the corn actually utilizes to make a crop. There's a massive black hole of lost nitrogen between those two agronomic realities, one that weighs in at several million tons. A study in the journal *Environmental Research Letters* showed that in Iowa and Illinois, 22 to 62 pounds of nitrogen per acre had annually accumulated below ground in recent decades. This wouldn't be a problem if all that hidden nitrogen stayed put, but in fact it can show up as a pollutant years later.

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"Millions of tons of nitrogen are waiting to pollute waterways."

— economist Aaron Smith

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"Millions of tons of nitrogen are waiting to pollute waterways, a legacy of Corn Belt agriculture," writes agricultural and resource economist Aaron Smith.

So what do we do? One way to remove legacy nitrogen from the system is to restore wetlands on marginal acres that don't consistently yield good crops anyway. These habitats are extremely effective at taking up excess fertility and using it to grow plants.

And it's clear we must stop putting so much nitrogen into the system in the first place. Over the long term, that means less of a reliance on such a nitrogen-hungry crop as corn. But even the current corn monoculture can be tweaked to make it a little less of a nitrogen nuisance. Innovative soil-health practices such as what members of LSP's Soil Health Hubs are implementing — cover cropping, diversifying rotations with small grains, no-tilling, and managed rotational grazing — have proven effective at not only cutting down the

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This **Myth Buster** *is brought to you by the members and staff of the Land Stewardship Project, a private, nonprofit organization devoted to fostering an ethic of stewardship for farmland and to seeing more successful farmers on the land raising crops and livestock. For more information, call 612-722-6377 or visit landstewardshipproject.org.*

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amount of synthetic fertilizer farmers rely on, but in establishing the kind of plant systems that can soak up excess nitrogen.

Despite great strides in recent decades around calibrating fertilizer applications to more closely align with what the corn plant can actually take up, the fact remains that farmers still tend to apply more than needed as "yield insurance." But University of Minnesota trials show there is not always a linear relationship between nitrogen rate and yield.

In fact, if you're a farmer, there is probably a financial incentive to use *less* fertilizer. When U of M Extension recently analyzed financial data from thousands of farms, it found that the most profitable farms spent an average of $217 per acre on fertilizer for corn while the least profitable farms spent $289 per acre.

Part of the problem is that farmers are often getting their fertilizer recommendations from a sector of the industry which has a big incentive not to see nitrogen applications go down: fertilizer dealers. In 2021, fertilizer prices began to soar and the fertilizer giants — just three companies control the bulk of the North American fertilizer market — blamed it on such factors as the rising cost of natural gas, which is integral to producing their product. Research by the group Farm Action shows that while natural gas costs increased only modestly, fertilizer prices spiked by more than 100%, and corporate profits jumped by nearly 300% over the same period. Meanwhile, farmers were paying two or three times more for fertilizer.

Besides support for practices that naturally build fertility, we need to hold fertilizer companies accountable for a system that encourages overapplication. And a new policy, processing, and marketing infrastructure that makes farm diversification profitable is long overdue.

More than a century ago, two German scientists revolutionized agriculture when they developed a system for converting atmospheric nitrogen into a form we could use to fertilize plants. That means humans now have power over the nitrogen cycle. As the old saying goes, with great power comes great responsibility.

More Information

- "Agriculture's Nitrogen Legacy," *Journal of Environmental Economics & Management*, https://www.sciencedirect.com/journal/journal-of-environmental-economics-and-management
- "Fertilizer: The Hidden Engine of Corporate Power," Farm Action, https://farmaction.us/fertilizer-the-hidden-engine-of-corporate-power
- LSP's Soil Builders' Network: https://landstewardshipproject.org/soil-health

More Myth Busters

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