



**Science
Societies**

Are we underestimating nitrous oxide emissions from corn fields?

Nearly a third of emissions may happen outside the growing season

By Shea Topel

| February 25, 2025

DOWN TO EARTH



Adobe Firefly AI-generated image.

Nitrous oxide (N₂O) is a dangerous greenhouse gas and one of the biggest threats to our ozone layer. Most of this gas comes from fertilizer, and so national measurements are done during the growing season, but a lot of the N₂O from agriculture is emitted outside of the growing season as well.

A recent study from [Agricultural & Environmental Letters](#) estimated that 31% of all U.S. N₂O emissions from corn agriculture come from outside the growing season. This is a huge challenge because if we're missing a big chunk of the emissions out there, we might make the wrong policy decisions going forward. Management is possible, but the entire system needs to be considered to craft best practices.

Nitrous oxide is the third most important greenhouse gas in the world. Emissions have been rising for decades with the highest rates appearing in the 2020s. Managing N₂O emissions is tough because they tend to appear in high concentrations at very specific moments in time.

Some studies found that 89% of normal N₂O emission measurements only take place during the growing season. Many other studies have reported huge emissions outside of the growing season, incentivizing scientists to broaden their scope.

How much N₂O is emitted outside the growing season?

During the fallow period, the time when farmers don't seed their land so that the soil can recover and retain moisture, N₂O can still be emitted from thawing freezes, wet soil, and other factors. Different studies have made various estimates for how much N₂O is emitted at these times with variance ranging from 7–93% and typical estimates suggesting 30–50%.

The study took data from corn plantings across the country before calculating nitrogen applications at the county level. Ultimately, it estimated that the total N₂O emissions that happen outside the growing season are equal to anywhere from 10,000 to 15,000 gigagrams (about 22 to 33 trillion pounds) of CO₂ every year.

This is the first holistic assessment of how much growing-season-focused methods may underestimate N₂O emissions from corn fields, and hopefully, it can push the industry to discuss new solutions and innovations for combatting climate change.

Thankfully, policies can still be put in place to reduce these emissions without sacrificing yields—focusing on reducing surplus nitrogen fertilizer can lower N₂O emissions without penalizing farmers that apply nitrogen amounts well matched to crop growth needs. With more global measurements and awareness given through reports like these, we can push policymakers to set new regulations and make sure that our atmosphere and planet don't have to suffer.

Dig deeper

Check out the original article in the journal *Agricultural & Environmental Letters*:

Buma, B. (2024). Including non-growing season emissions of N₂O in US maize could raise net CO₂e emissions by 31% annually. *Agricultural & Environmental Letters*, 9, e20146. <https://doi.org/10.1002/ael2.20146>

*Text © const today = new Date();const year = today.getFullYear();
document.currentScript.insertAdjacentHTML('beforebegin', year);. The authors. CC BY-
NC-ND 4.0. Except where otherwise noted, images are subject to copyright. Any reuse
without express permission from the copyright owner is prohibited.*