Mitigating Nitrous Oxide Emissions from an Irrigated Cropping System

Agricultural production in the western U.S. is an important part of the global food supply. However, due to concerns over impacts of agricultural greenhouse gases on the global climate, there is a need to test potential mitigation strategies, especially for nitrous oxide (N\textsubscript{2}O) from irrigated cropping systems in semiarid environments.

In a paper recently published in the *Soil Science Society of America Journal*, researchers report N\textsubscript{2}O emissions from a dairy forage rotation (silage corn–barley–alfalfa) in south-central Idaho that received various nitrogen sources, including conventional granular urea and an enhanced-efficiency fertilizer (SuperU, a stabilized granular urea with urease and nitrification inhibitors).

During corn production, the team found that cumulative N\textsubscript{2}O emissions were 53% lower with SuperU when compared with granular urea, and crop yields were unaffected. But when SuperU was used the following year with barley, cumulative N\textsubscript{2}O emissions were the same as those from granular urea. Furthermore, there was no lingering effect of SuperU on emissions when alfalfa was the subsequent crop. Overall, N\textsubscript{2}O–N emission losses as a percentage of total N applied were very low at ≤0.21%.

This work demonstrates that SuperU can reduce N\textsubscript{2}O emissions from irrigated cropping systems, but the results suggest that there is a crop-dependent effect. The study is currently being replicated for confirmation.


Collecting a gas sample at the GRACEnet plots in Kimberly, ID. Photo courtesy of R. Dungan.


Soil Carbon and Nitrogen Under a Long-term Fertilizer Gradient

The connection between commercial N fertilizer and soil organic carbon (SOC) is widely debated. In a recent article in the *Soil Science Society of America Journal*, researchers examined how long-term nitrogen use affected soil C and N in continuous corn production. The study was conducted at a long-term research trial site near Arlington, WI, established in 1958 and managed under three N rates: low (10 kg N ha\textsuperscript{-1}), recommended (168 kg N ha\textsuperscript{-1}), and high (280 kg N ha\textsuperscript{-1}).

The low rate of N application caused significant decreases in soil C and N content down to 100 cm while no differences were determined between the recommended and high rates of N. In addition, plots receiving the low application of N were lower in elevation and had less depth of the A horizon.

Researchers also reanalyzed archived samples from 1984, which showed no significant loss in soil C and N content in surface horizons when compared with 2011 samples as long as N fertilizer was applied at the recommended rate or higher. This research shows that N fertilizer was a benefit to this cropping system as maintenance, but not building, of SOC occurred. In addition, over-application of N, while not agronomically beneficial, was not detrimental to SOC, contrasting with previous suggestions that over-application of N would lead to degradation.

The authors also note that the total C return to the soil via corn stalks (estimated from yield) have increased linearly since the inception of the study (primarily attributed to improvement in corn genetics), suggesting a continual increase in C input may be required to maintain the same SOC content of the soil in this system.


This study focused on soil C and N in continuous corn production. Photo by M. Ruark.