Better Long-term Management Enhances Soil C and N Stocks

Traditional practices, such as conventional tillage with crop–fallow, have reduced dryland soil carbon and nitrogen over the last several decades by 30 to 50% of their original levels in the northern Great Plains. Improved management practices are needed to restore carbon and nitrogen levels and sustain soil quality and productivity.

In a study in the September–October 2015 issue of Agronomy Journal, researchers report the 30-year effect of tillage and cropping sequence combinations on dryland soil carbon and nitrogen and crop yield in the northern Great Plains. Specifically, they found that reduced tillage with continuous cropping increased soil carbon and nitrogen storage by 12 to 98% compared with traditional practices after 30 years.

Moreover, although soil carbon and nitrogen storage decreased from original levels in all treatments, reduced tillage with continuous cropping resulted in minimal losses. Continuous cropping also increased annualized mean crop grain yield by 23 to 30% compared with traditional practices after 30 years.

Wheat Nitrous Oxide Emissions Vary Year to Year

The Intergovernmental Panel on Climate Change estimates that 1.25% of the nitrogen fertilizer applied to crops is lost as nitrous oxide (N₂O). Yet no data for winter wheat production in the U.S. southern Great Plains is included in this estimate. Winter wheat production in this area represents 8.5 million ha.

To fill this knowledge gap, a study in the September–October 2015 issue of Agronomy Journal determined the effects of nitrogen (N) fertilizer rate on N₂O emissions from a dryland, winter wheat–summer fallow system in the southern Great Plains.

What the researchers found is that cumulative emissions of N₂O varied year to year and were influenced by environment and N rate. In plots that received N fertilizer, nitrous oxide emissions were typically highest following the N application, as well as toward the end of the summer fallow period, when summer rainfall and temperature were conducive to N₂O production.

Some plots that historically received high N fertilizer each year went unfertilized in 2012 and 2013, producing N₂O emissions equivalent to the mid-range of the fertilized treatments. Annual cumulative emissions ranged from 0.009 to 0.024 kg N₂O per kg N applied, with an average of 0.015 kg N₂O per kg N applied, illustrating the variability in N₂O emissions.