

# Nitrogen loss expected with heavy rainfall

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After 2 to 6 inches of rain fell on most of central South Dakota - and more in isolated areas - in the last couple weeks; South Dakota State University Extension Soil Specialist, Ron Gelderman, says some fields may experience nitrogen loss.

Whether [nitrogen](#) leaching has occurred depends on many factors says Gelderman.

"There are many considerations including; [soil](#) type, amount of rainfall, rainfall intensity, when nitrogen was applied, nitrification inhibitors used, organic matter levels and many more," Gelderman said.

## Two modes of nitrogen loss

With heavy rains Gelderman says the two primary modes for nitrogen loss include leaching - where nitrate-N can be moved down in the soil profile and sometimes out of the root zone (4 to 5 feet). Denitrification is the other mode of nitrogen loss. Denitrification is where nitrate can be biologically converted to gaseous nitrogen forms and lost to the atmosphere.

"With present soil temperatures in the low, to mid 60's, nitrogen fertilizer should mostly have converted to nitrate by now," Gelderman said. "It usually takes urea two to four weeks to convert to nitrate depending on temperatures. So we can assume normal spring nitrogen applications were susceptible to both leaching and denitrification."

## Soil type & rainfall

Gelderman says medium to fine textured soils can hold 2 to 3 inches of moisture per foot; while coarse soils (sand, sandy loams and loamy sands) are in the range of retaining 1 to 1.5 inches per foot.

"Previous to the rainfall, most soils were probably already close saturation. Therefore less water would be needed to move nitrate deeper," he said. "The other factor is intensity of rainfall. If it comes hard - a large part of the rainfall can runoff into lower areas or waterways etcetera. Runoff will be higher with tilled, fine textured soils."

According to past data and observations with rainfalls of this type, Gelderman does not believe recent rainfalls resulted in large nitrate losses on medium and fine textured soils. However, in fields with course textured soils, 4 to 6 inches of rainfall would be enough to move nitrogen 2 to 3 feet.

"We usually have bigger leaching loss issues when rainfalls of this amount occur slowly - perhaps over a two-week period," Gelderman said. "Significant denitrification losses occur the longer saturated soil conditions exist and the warmer the soil temperature."

He points to Illinois and Nebraska data as an indicator of denitrification rates at about 3 percent per day for soil temps in the 60's.

Gelderman says saturation for long periods usually occurs in the lower areas of the landscape. However, he adds that significant denitrification in these areas is not the only problem.

"Limited oxygen to plant roots - up to seven to 10 days or more - can kill the plant or cause root changes that will severely limit yield potential,"

he said. "Therefore if these areas dry out, and the plants are living, it is probably not profitable to apply nitrogen to these areas."

He says denitrification is usually only a problem with surface soils because that is where most of the bacteria that break down organic matter are located.

"These are the same bacteria that use nitrate under low oxygen conditions," Gelderman said. "In low organic matter soils, or subsoils, there are fewer of these microbes."

## **Advice to growers**

Gelderman says if growers suspect significant nitrogen loss they should soil sample at least a few fields to determine loss trends.

He directs growers to probe down 3 feet, taking samples in 1-foot increments to be analyzed for nitrate-N.

"This will give some indication of total available nitrate-N in this depth and also an idea about N movement. This information can then be extrapolated to other fields with similar conditions," Gelderman said.

He warns growers to avoid applying nitrogen after heavy rains based on plant color.

"Plant roots growing in a saturated soil under low oxygen conditions cannot effectively take up nutrients. Therefore, a plant can exhibit nitrogen deficiency symptoms, even though the soil can have adequate nitrate-N," he said. "Once root zone aeration is established, these plants will often green up - although yield potential may have been reduced."

Many growers ask Gelderman if applying foliar N will help green up the

plants? If leaching is the problem, and soils are not saturated, a foliar application will not help. "It's too small an amount to meet the plant's needs - even assuming that the plant takes up this N foliarly - which is unlikely," he said.

"In this case the producer would be better advised to apply more N as a broadcast or injected application."

Gelderman adds that if the plant is a yellow color, and it is due to possible denitrification losses a grower would need to wait until the soil is firm enough to hold a sprayer.

"By that time, the plant will probably green up on its own, or roots will be so damaged that the N will make little difference in yield potential," Gelderman said.

Provided by South Dakota State University

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