Estimating Nitrogen Losses From Wet Soils

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Wet soils cause nitrogen losses, and determining how much nitrogen is lost is necessary to choose the proper management options. In cases where high intensity rain results in high runoff, leaching losses will probably be low. The primary nitrogen loss mechanism in saturated soils is denitrification, which occurs when soil nitrate nitrogen (NO3-N) is converted to nitrogen gas by soil bacteria. Two to three days of soil saturation is required for bacteria to begin the denitrification process. Well-drained upland soils that have been wet from a series of rains probably have not experienced much denitrification. Soils in lower landscape positions that stay saturated longer will likely lose more N. Losses can be calculated by estimating 3 to 4 percent loss of fertilizer NO3-N for each day of saturation. Use the Table below to determine how much fertilizer NO3-N was in the soil.

EXAMPLE: Determining the Amount of N Loss

A farmer applied 175 lb nitrogen (N)/A as urea to corn grown on poorly drained soil. Because of a series of heavy rains, three weeks after application the field became saturated for seven days. How much N was lost?

Step 1. Determine the amount of applied N that was in the nitrate (NO3-N) form.

According to the table, 50% of the urea will be in the NO3-N form three weeks after application. 175 lb N x 50% = 88 lb N.

Step 2. Determine the amount of N lost.

Remember that two days are needed for the bacteria to begin the denitrification process. Therefore, denitrification occurred for five days (seven days total saturation minus two days to start the process). With 4 percent lost each day for five days, 20% would have been lost. 88 lb N x 20% = 18 lb N lost and 60 lb N remaining. The N loss calculated in this example is not as high as most people would assume. A soil N test can verify this estimation.

Nitrogen Soil Test

An additional tool for determining NO3-N in the soil after flooding is a NO3-N test. The soil sample should be taken down to 12 inches deep, and several samples should be taken in each field of both the low and higher ground. The samples should be mixed well and a subsample sent for nitrate analysis.

If the nitrate-N is less than 11 ppm, there is a low amount of plant-available N in the soil. Therefore, there is a good chance corn will respond to a sidedress application of N ranging from 100 to 150 lbs N/acre.

If the nitrate-N is between 11 and 25 ppm, there is a greater amount of plant-available N in the soil, indicating corn may or may not respond to sidedress N. The recommended sidedress N application at this soil test level is 0 to 100 lbs N/acre. If the soil test nitrate-N is close to 11 ppm, then higher sidedress N rates would be used. Lower rates would be used as nitrate-N approaches 25 ppm. The test is least accurate in this range, so the test results can only be used as a broad guide.

If soil test nitrate-N is greater than 25 ppm, there is adequate plant-available N in the soil, which indicates corn will probably not respond to sidedress N application.

Nitrogen Broadcast Prior to Rain

Farmers sometimes broadcast fertilizer nitrogen on a field within 24 hours of a heavy rain. In most cases, very little nitrogen is lost to runoff, especially if the field was under no-till soil management. The nitrogen fertilizer begins to dissolve almost immediately after being applied to the soil surface and will dissolve completely in a short period of time. As rain begins, the first water that falls moves into the soil, taking most of the fertilizer nitrogen with it. Once in the soil, most of the fertilizer nitrogen is protected from runoff. The only exception is a very intense rain soon after application that also erodes topsoil from sloping areas. Even in this situation, the loss would probably be less than one third of the fertilizer applied. Δ

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