FIELD FACTS

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Nitrogen Management – 2012

Fall-applied nitrogen fertilizer is eventually converted to $N0_3^-$ and may be subject to weather-related losses.

Given the warm winter and exceptionally warm March, many customers are concerned about the condition of fall-applied nitrogen (N). The good news is, our fall N is still there; the bad news is, a much greater portion is subject to loss than we would normally expect at the end of March.

Figure 1 depicts two processes with important ramifications for nitrogen fertilizers. Both are mediated by soil micro-organisms and consequently are highly dependent on temperature – the warmer the soil, the faster they occur. Soil moisture content affects these processes differently – nitrification requires a well aerated, but moist soil; denitrification requires saturated, or nearly saturated, soil moisture levels.

Nitrification - occurs in well-aerated warm soils

- $NH_4^+ \rightarrow NO_2^- \rightarrow NO_3^-$

Denitrification - occurs in saturated, warm soils

- $NO_3^- \rightarrow N_2, NO, N_2O$ **Lost to Atmosphere**

Figure 1. *Two critical processes (nitrification and denitrification)that influence the fate of nitrogen fertilizers.*

Once anhydrous ammonia (NH_3) is injected into the soil it immediately becomes ammonium (NH_4^+); this is the safe form, as it is neither leached nor denitrified. With enough time and adequate temperatures, however, all NH_4^+ will nitrify to nitrate (NO_3^-). Nitrification does not cause N loss, the NO_3^- formed is simply an N form that can be lost. Denitrification, however, occurring with very wet soils, does cause N losses.

Table 1 indicates approximate denitrification rates for various temperatures – nitrification can be expected to proceed at a similar pace. When temperatures are below 40ºF nitrification occurs very slowly, so despite an unseasonably warm winter (temperatures averaged 33.6ºF at Peoria, IL), almost no nitrification would have occurred.

In contrast, temperatures the second half of March averaged 66ºF at Peoria, where normally temperatures are 43ºF. During that extremely warm two-week period, over half of the soil NH_4^+ would have converted to NO_3^-.

Even if N is in the nitrate form, denitrification losses do not occur except under near-saturated to ponded conditions.

Although we have increased potential for N loss to occur in 2012, large N losses have not and will not occur unless saturated soil conditions persist between now and mid June when corn begins rapid N uptake. Rainfall quantity and intensity between now and then will dictate the effectiveness of fall-applied N.

Table 1. *Influence of temperature on the rate of denitrification. Nitrification will proceed at similar rates.*

Temperature (° F)	Denitrification Rate (% / Day)
< 40°	Very little
40 to 55°	1 to 2%
55 to 65°	2 to 3%
65 to 75°	4 to 5%