



GOLF TURF NEWS

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Gaseous Loss of Nitrogen from Turf

Nitrogen is the most important nutrient for turfgrass culture in terms of how much is required, how often it needs to be applied, total cost, and the amount of "greening-up" caused by an application of nitrogen fertilizer as compared with other fertilizer applications. There is a wealth of information on the above parameters, but less is known about the fate of nitrogen fertilizers after application. People applying nitrogen fertilizer usually assume that the turfgrass plants take-up all the fertilizer that is applied. If there is not the usual "green-up" response, then they will blame the fertilizer for not working properly. But all fertilizers do indeed respond very predictably to weather, soil, and cultural conditions. Understanding the possible fates after application is key to making fertilizers efficient and maximizing the response.

We have been primarily concerned in Florida with the loss of nitrogen fertilizers by leaching because of the sand soils with low cation exchange capacity, high rainfall, and excessive irrigation. Research at the Ft. Lauderdale R.E.C. has shown that these conditions favorable for nitrogen leaching combined with the use of nitrate nitrogen fertilizers can lead to potentially large amounts of fertilizer losses (up to 60% of that applied).

However, everyone should be aware that potentially large gaseous losses into the atmosphere of applied nitrogen fertilizers can occur. Under certain conditions in Florida, gaseous losses can be as significant as leaching losses. One of the processes of gaseous losses of fertilizers is volatilization.

Volatilization is the loss into the atmosphere of ammonia (NH_3) as a gas. It can occur with any ammoniacal fertilizer materials, such as ammonium sulfate or ammonium nitrate, when the soil pH is above 7.5. Under these conditions as much as one-third of the amount of fertilizer applied can be lost into the atmosphere. Very little ammonia (1%) is lost from these materials when the soils are acid.

The greatest concern with ammonia volatilization is with urea fertilizer, because of the large amount of gaseous losses under varying conditions. Urea is the alkaline form of ammonia. It is readily converted to ammonium carbonate by an enzyme called "urease." This enzyme is present wherever there is microbial activity, such as on leaves, or in thatch and soil. The ammonium carbonate is an unstable chemical form and ammonia is readily

released into the atmosphere. Urea fertilizers are usually broken down within 3 days of application.

Field tests on turf have shown ammonia volatilization losses to average 20-30% after an urea fertilizer application. When urea was applied to bare acid sand soils, the volatile losses were up to 59% of the urea applied. The higher the soil pH, the greater were the losses. The study also showed that by increasing soil moisture and temperatures ammonia losses were also increased. It was interesting to note that these studies showed about 95% of the volatile losses occurred within 7 days of application.

A recent laboratory study examined the differences in ammonia volatilization from urea applied as either a granular or a liquid. Ammonia losses from granular urea ranged from 1 to 55% of that applied, whereas ammonia losses from liquid urea were 2-26% of the urea applied. The actual losses depended upon the temperature and relative humidity conditions in the experiment. Increasing temperature and humidity generally increased the losses observed. Periodic wetting and drying of the turf caused surges of ammonia losses. Irrigation immediately after fertilization by either method of urea application significantly reduced volatilization to minor losses.

To obtain the maximum fertilizer efficiency (greatest turf response), the turf manager must carefully plan and implement a fertilizer program. Fertilizers should be applied to turf that has soil moisture near field capacity. This will help minimize potential leaching. The proper fertilizer source should be selected for the particular turf situation. If one is using urea fertilizers, the above research information indicates it is essential to water-in the fertilizer to minimize volatilization losses. Likewise, other nitrogen fertilizer sources will also benefit from being washed into the soil, not only to reduced volatilization, but also to get the fertilizer into the soil for root uptake. An application of a $\frac{1}{8}$ to $\frac{1}{4}$ inch of water is sufficient to wash the fertilizer into the thatch and soil. This should be done as soon as possible after fertilizer application. Using these techniques, a turf manager can make the most efficient use of fertilizer applications.

References: 1) Tito, S., J.R. Street, and T.J. Logan. 1984. Factors affecting ammonia volatilization from urea applied to turfgrass in a laboratory study. Proc. Amer. Soc. Agron. p.155. 2) Volk, G.M. 1959. Volatile loss of ammonia following surface application of urea to turf or bare soils. Agron. J. 51:746-749. ■