IPNI
Plant Nutrition TODAY
Better Crops, Better Environment...through Science

From Scientific Staff of the
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Spring 2016, No. 7

SUITES OF 4R NITROGEN PRACTICES FOR BETTER CROPS AND ENVIRONMENTAL PROTECTION

Crop producers and their professional advisers are constantly looking for ways to increase yields and improve the bottom line. Good soil fertility and plant nutrition management are fundamental to achieving those economic goals, and nitrogen (N) management ranks high on the management list. Among the 17 essential plant nutrients, N may be among the most difficult to properly manage. It can escape from fields both during and after fertilizer N application; depending on the N source, application equipment, soil characteristics, and environmental conditions.

Sizeable amounts of N can be lost as ammonia gas from urea-containing sources (including manure) through a process termed volatilization; especially, if not incorporated by rainfall, tillage, or placement beneath the soil surface. Anhydrous ammonia and aqua ammonia sources may also evolve ammonia directly, if not properly soil incorporated. Because nitrate-N is so mobile in soils, nitrate-containing N sources may be at considerable risk of leaching and drainage losses; depending on the soil, the seasonality of precipitation, and the precipitation to evapotranspiration ratio. Even N sources that do not contain nitrate must also be managed with an understanding of potential losses with water movement. Microorganisms in healthy soils convert ammonium to nitrate (nitrification), and this transformation—found in virtually all soils—can occur rapidly (days to a few weeks) under warm moist conditions. When soils become waterlogged because of excessive rainfall or flooding, significant amounts of the nitrate may be converted to benign di-nitrogen (N_2) gas, and small amounts may also be lost as nitrous oxide (N_2O)—a potent greenhouse gas that contributes to global warming and atmospheric ozone depletion.

The key with soil and cropping system N management, is to get as much of the applied N into the crop as possible, in synchrony with crop uptake demand; while minimizing the ammonium or nitrate residual in the soil at the end of the growing season. With the many ways that N can escape from the soil, and the possible swapping of one N loss pathway for another, how can a crop producer optimize his/her crop N nutrition? Past science has shown that there is no magical “silver bullet” cure to prevent all N loss. Switching to an alternative N source, or using specific newer fertilizer technologies and tools, may help improve cropping system and plant recovery of the applied N. However, recent science is indicating that it is the groups or suites of 4R *(right source, rate, time, and place)* N management practices that, when combined, collectively help enhance crop N uptake and help limit the risks of N loss to the environment.

Crop producers are encouraged to talk with their crop advisers and their fertilizer dealers; to review their past N management practices, explore opportunities for greater fertilizer N effectiveness, and to adapt to changing conditions. By considering the many different 4R N management options available, different suites or combinations of practices might be selected that fit each farmer and field scenario. Yet, deciding on the optimal suite of 4R N management practices can be daunting and like choosing the “just right” wedding dress for a daughter. Consider getting knowledgeable, professional advice in making your 4R N management suite selection. It could pay good dividends, and lead to satisfying results … for better crops and environmental protection.

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Note: ***Plant Nutrition TODAY*** articles are available online at the IPNI website: www.ipni.net/pnt