

## **The Soil Nitrogen Cycle**

The soil nitrogen cycle is a living, breathing system that is driven by the biological activity in the soil. Our understanding of this cycle will help us in making nitrogen management decisions. The soil nitrogen cycle can be broken up into five parts: nitrogen fixation, mineralization, nitrification, immobilization, and denitrification.

Nitrogen fixation is the addition of nitrogen to the soil. Nitrogen can enter the soil through atmospheric fixation, industrial fixation, and biological fixation. Atmospheric fixation happens when lightning oxidizes nitrogen. The nitrogen oxides dissolve in rain water and enter the soil. Biological fixation happens when bacteria reduce nitrogen gas into ammonia. Industrial fixation is the conversion of nitrogen gas into ammonia. Industrial produced ammonia can then be transformed in urea, ammonium nitrate, ammonium sulfate, and other nitrogen solutions.

Once nitrogen has been added to the soil it goes through an ongoing set of transformations and losses. The form in which nitrogen is supplied determines the transformation and how quickly loss can occur. If the nitrogen source is ammonia or converts to ammonia, the ammonia that is supplied is susceptible to volatilization losses or can be converted into ammonium-N.

Ammonium-N is a stable form of nitrogen and can be held by the soils cation exchange capacity. Ammonium-N is plant available or can be converted to nitrate-N. The conversion of ammonium-N to nitrate-N is the process of nitrification. Both ammonium-N and nitrate-N can be immobilized by bacteria in the soil.

Immobilization is the process of converting inorganic-N into organic-N. The higher the carbon: nitrogen ratio of the plant residue the greater amount of nitrogen that can be immobilized. Immobilized nitrogen will eventually mineralize into available nitrogen. Mineralization is the conversion of nitrogen that is stored in organic matter into ammonia and further converted into ammonium-N

The nitrate-N that is not immobilized is plant available or can be lost to the environment. Nitrate-N can be lost by leaching or denitrification. Leaching is the movement of nitrate-N with water out of the root zone. Denitrification is the process of converting nitrate-N into nitrogen gas.

The soil nitrogen cycle is very complex and is in continual motion. Our understanding of this system will help us make better nitrogen management decisions