Agronomic Directions
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Understanding the Role and Fate of Nitrogen: Part-One of a Two-Part Series

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Nitrogen (N) is one of the most yield-limiting inputs and we can control the amount available to our crop. Managing N inputs to achieve a balance between profitable crop production and environmentally tolerable levels of nitrates in water supplies is a year-round goal of farmers. The behavior of N in the soil system is complex and the route that N follows in and out of the soil system is collectively called the "nitrogen cycle". Understanding the nitrogen cycle is essential for a more efficient nitrogen management program.

Nitrogen makes up 78% of Earth's atmosphere, however, atmospheric nitrogen (N_2 gas) has limited availability for biological use. Legumes, such as soybeans and alfalfa, are exceptions and can use N_2 gas through **biological fixation**. In this process, nodule-forming *Rhizobium* bacteria inhabit the roots and convert atmospheric N_2 to a form the plant can use. Any portion of a legume crop left after harvest, including the roots and nodules, can supply N to the soil system when the plant material is decomposed.

There are two categories of **commercial nitrogen fertilizers**:

- Ammonium fertilizers (anhydrous ammonia and ammonium sulfate)
- Urea-containing fertilizers (Urea, 28% and 32%)

Humus is a material collected over a long period of time and referred to as **soil organic matter**. Soil contains approximately 2,000 pounds N in organic forms for each percent of organic matter. Decomposition of this portion of organic matter proceeds at a rather slow rate releasing about 20 lbs/N/acre/year for each percent of organic matter.

Nitrogen exists in **crop residues** in complex organic forms and the residue must decay before the N is made available for plant use. This can take several years and non-leguminous plants contain relatively small amounts of N compared with legumes.

Another important source of N for plant growth is **animal manure**. The amount of N supplied by manure will vary with the type of livestock, handling, rate applied, and method of application. An analysis of manure is recommended since the N form and content of manures varies widely.

Nitrogen, present or added to the soil, is subject to several changes that dictate the availability of N to plants and influence the potential movement of nitrates to water supplies. We will discuss these transformations and the potential for N loss from the soil system in Part 2.