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

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NITROGEN IN SOIL ORGANIC MATTER – HOW MUCH IS RELEASED IN YOUR FIELD?

The most difficult task for any farmer and crop adviser who is developing a N management plan is estimating the fertilizer and/or manure N rate for the expected crop uptake demand. While crop N uptake demand can be estimated based on a three to five-year yield history, knowledge of expected uptake (and removal) at the targeted crop yield, new crop genetic yield potential, and the provision of other essential nutrients and adequate plant protection… the most unpredictable factor that complicates such estimation is the weather.

In sandy mineral soils of the southern U.S., the soil organic matter content of the surface soil is often below 1%, while in the Midwest and Great Plains it can range above 4% because those areas natively supported productive grasslands. Humus is considered the more stable fraction and makes up roughly two-thirds to more than three-quarters of soil organic matter. The N content of organic matter is approximately 5%. The rate of release of the N from soil organic matter depends to a great extent on the C to N ratio of the organic matter acted upon by soil microorganisms. On average, soil organic matter has a C to N ratio of 10:1. If we assume that an acre of soil roughly 6 2/3 in. deep weighs about 2,000,000 lb, then that surface soil depth may contain between 20,000 and 80,000 lb of organic matter; or between 1,000 and 4,000 lb of total N/A.

It is not uncommon for some to use a general rule of thumb of about 1 to 2% release of N in soil organic matter, during the spring through summer growing season each year. The release rate varies with soil texture or CEC, soil pH, soil microbial population, the prevailing temperature and moisture, as well as with any soil disturbance by tillage. The range of N released (mineralized) by soil microbes may be approximately 10 to 80 lb/A each growing season, or more. Obviously, more N is released during warm, moist conditions as opposed to those that are cool and dry. With such a broad range, it is no surprise that there have been many attempts to develop more reliable measures of “potentially available soil N”, and in some regions, soil N tests have met with some calibration and field validation success. Often, these “potentially available soil N” tests require sampling beyond the typical 0 to 6 in. depth, and may require sampling to 2 or 3 ft. deep.

In 2007, the International Plant Nutrition Institute (IPNI) published 13 papers from the Proceedings of a 2006 Symposium on Managing Crop N for Weather at the Meetings of the Soil Science Society of America (SSSA). For more specifics and guidance on ways to better account for weather in your 2012 crop N management plan, consider visiting the IPNI webpage where the proceedings may be purchased: http://ppi-store.stores.yahoo.net/books.html. Also consider contacting your Land Grant University extension office or your crop adviser to learn more about soil N testing and how to improve your crop N management plan. By integrating weather variability into your planning, and by using in-season direct plant tissue N testing, or surrogate measures by chlorophyll meters and precision agriculture crop N sensors, you may achieve improved N use efficiency.

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Abbreviations: N = nitrogen, C= carbon, CEC = cation exchange capacity.