

Danville Co-op Agronomy Newsletter – February 2009

The relationship between soil carbon and nitrogen (reprint by Dr. Ray Ward)

Soil organic matter (OM) is the decomposed residues and microorganisms not the residues left on the soil surface. The real carbon sequestration occurs in the decomposed plant residues. The stable organic matter has a carbon to nitrogen (C: N) ratio in the range of 10:1 to 12:1. If a soil has 3% OM in the top 8 inches of soil there is 36 tons of OM per acre. Organic matter is 58% carbon (C) so 3% OM means there is 21 tons of C per acre. So a C:N of 10:1 means 21 tons of C and 2.1 tons of nitrogen (N) or 4200 lbs. of N per acre. How much of this N is available each year depends on the cropping system. The release is approximately 0.5% for grassland, 1.0% for conventional tilled small grain, 2.0% for conventional tilled row crops and 4.0% for conventional tilled summer fallow. For no-till the release of N is probably between 0.5 and 1.0% per year.

What happens to N when crop residue and N fertilizer are added to the soil? If the crop residue has a C: N ratio of greater than 30, the microbial population will use the available soil N to decompose the residue. This process is referred to as immobilization of N. On the other hand, if the C: N ratio is less than 20 the microbial population will release additional available N. This process is referred to as mineralization.

Early in the report I gave an example of estimating available nitrogen for different crops based on cropping practice. In no-till we do not disturb the soil so the rate of release should be near the grassland release. When we hear about tilling no-till land we can assume that we will get a tremendous release of available N from the organic N on or very near the soil surface. However, it will only take one year to release most of this N from the organic matter and then the process will have to start over again. The short-term benefit could be very costly to future cropping.

The amount of nitrogen fertilizer to apply depends on the nitrogen supplying capability of the soil. The “pool” of available nitrogen sources include, 1) organic N sources such as animal manure, sewage sludge, and compost, 2) nitrogen fixing rhizobium associated with legume plants, 3) nitrogen fixing microbes, 4) nitrogen fertilizer and 5) fixed soil ammonium. All of these sources of nitrogen are mineralized to nitrate in time.

Since nitrate is the predominate form of N used by plants, a measure of residual nitrate in the root zone before planting the intended non-legume crop is a good method of estimating N fertilizer needed. The residual nitrate test is a good measure of available nitrate in most Great Plains soils where nitrate leaching is minimal. Two exceptions to the value of the residual soil nitrate test are leaching and denitrification. Nitrate is soluble therefore it is mobile in soil water.

Where rainfall is great enough to move water deeper than the soil root zone during the growing season, the residual soil nitrate test may be a poor estimate of available nitrogen. Nitrate in poorly drained soils that remain wet for a period of time can be lost by denitrification. Nitrification requires oxygen. If oxygen is low in the soil, nitrification will be low. Therefore, oxygen is necessary for nitrification.

I hope you enjoyed this article regarding Nitrogen facts. If there is any other subjects you would like me to include in this forum, please e-mail your request to rkenney@danvillecoop.com or mention this newsletter to one of the staff members and we will try to answer any questions or bring to you resources in the form of articles that may be of interest.

Please remember, your top-dress nitrogen needs to be in the root-zone by the time your wheat comes out of dormancy. Call us to get yours ordered! Thank You!