Nitrogen Value from Plowing a Sod

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Nitrogen Value From Plowing a Sod

M. S. Smith

With economic conditions as they are, crop producers need to effectively use all the resources available to them. To help offset high N fertilizer prices, one resource that may be used to significantly reduce production costs is the organic N accumulated in and on soils. When crops are planted into a tilled sod the requirement for added N fertilizer will usually be less than on land previously in row crops. The following discussion considers the processes and factors determining the quantity and availability of N in a sod, and offers some guidelines for estimating the N value of a sod.

Mineralization of N in a sod

The conversion of N in organic matter to the plant-available inorganic forms, nitrate (NO$_3^-$) and ammonium (NH$_4^+$), is termed mineralization. The amount of mineralized N available to a crop is determined by the amount of organic N available for microbial decomposition, the ratio of carbon to nitrogen in the decomposed material, the rate of decomposition, and the persistence of the inorganic N following its production.

Large quantities of organic N are present in soils; even a soil with a fairly low organic matter content of about 1% contains almost 1,000 pounds of N per acre. However, most of this N mineralizes slowly, particularly in soils that have been in row crops. Usually no more than 1 to 3% of the organic matter is broken down each year. The N contained in plants and fresh plant residues is in a form that is much more available for mineralization by soil microbes. Analysis of mixed grass sods on 6 soil types at Princeton and Lexington, Kentucky showed 50 to 90 pounds of N per acre in the above-ground grasses and legumes. These should be taken as minimum values since measurements were made early in the spring before much growth occurred and since the analysis did not include N in roots. A good stand of legumes may contain 250 pounds or more of N per acre.

The quality of the organic material also influences the amount of N mineralized. Straw, for example, contains little decomposable N and, since the ratio of carbon to nitrogen is high, most or all of the N present will be tied up (immobilized) by the microbes in their own cells as they decompose the straw. Succulent legume tissues are
more rapidly decomposed and since they contain more N than is required by the microbes, there will be an immediate release of plant available N. Mineralization of grass sods will fall between these extremes. The decomposability and N content of grass sods will also be dependent on the fertility of the soils they grow on; a high fertility soil will produce a sod with a higher N mineralization potential. Thus, production of up to 140 pounds per acre of inorganic N during the growing season has been measured after an old sod on a fertile Maury soil at Lexington, Kentucky was plowed, but only 15 to 25 pounds from grass sods on infertile Purdy-Johnsburg soils at Princeton, Kentucky.

The rates of N mineralization and persistence of the mineralized N is as unpredictable as the weather, upon which these processes depend. In general less mineralized N will be available to crops on poorly drained than on well drained soils. This is due to slower organic matter decomposition and more rapid denitrification loss of the inorganic N as it is produced. Also less mineralization can be expected in no-till systems than when the sod is plowed under.

**Estimating the N value of a sod**

To obtain a generalized estimate of the N in a sod which will be made available to a crop, follow the steps below.

1. Age and quality of sod: If the sod is thin, has few or no legumes, and has been established for 4 years or less it would have an estimated value of 25 pounds/acre. If it is well-established, at least 5 years old, or contains some legumes give it a value of 50 pounds N.
2. Fertility and drainage: Reduce the estimate by 25 pounds N if the soil is less than moderately well drained or if the sod has not been fertilized and the soil is low in organic matter (1% or less).
3. Legume density: Estimate the percentage of legumes in the stand and add 1 pound N value for every percentage point over 25.
4. Tillage: For no-till, use only one half the estimated N value.

Considering all the variables discussed above, it should be clear that we can do no better than approximate the N made available to a crop from a sod. However, the estimation procedure above is conservative, particularly for fertile, well-drained soils, and reducing the N fertilizer applied by the amount calculated above will save money without sacrificing yield.