Nitrogen fertilizer recommendations are determined by a simple four-step process of determining: 1) yield goals, 2) crop requirements, 3) nitrogen gains, and 4) nitrogen losses.

Establishing Yield Goals
The most important part of making a nitrogen fertilizer recommendation is establishing a realistic yield goal. Accomplish this by averaging the yields from the previous five years and increasing that number by 5 to 10%. Once this goal is established, one must determine how much nitrogen it will take to reach his goal.

Estimating Crop Requirements
To determine initial nitrogen guidelines, yield goals must be multiplied by a crop-removal rate. A crop-removal rate is the amount of nitrogen taken up by the crop during one growing season. Each crop type has a different factor for calculating total nitrogen needs. The crop-removal rate for corn is 1.20 pounds per bushel; wheat has a rate of 2.6, and milo has a rate of 1.3 pounds per bushel. Thus, for a yield goal of 200 bushels of corn per acre, the nitrogen requirement will be 200 x 1.20 for an initial guideline of 240 pounds of nitrogen needed per acre.

Example Of Nitrogen Recommendations
Once you have a guideline established, you need to adjust this number by taking into account how nitrogen gains and losses will affect the nitrogen available to the crops during the growing season. These factors will have an impact on how much nitrogen should be applied. The following example demonstrates how to take gains and losses into account.

Field Data
Intended Crop: 200 bushels of corn
Previous Crop: 60 bushels of soybeans
Soil-test info: 3% organic matter, 15 ppm of nitrate, 10.5 CEC, 7.5 soil pH
Crop residue is 70% cover with nitrogen fertilizer urea surface applied.

Calculation
200 x 1.20 = 240 lbs/acre (crop total nitrogen requirement)
- 30 lbs (residual nitrate)
- 30 lbs (OM mineralization estimate)
- 40 lbs (legume factor capped at 40 pounds)
Total needed: 140 lbs of nitrogen fertilizer

Estimating Nitrogen Gains
Nitrogen gains will reduce your nitrogen fertilizer application rate. The key soil process that contributes to increased nitrogen availability is mineralization. Mineralization is the decomposition of soil organic matter and plant residues with subsequent release of nitrogen. In general, 10 to 30 pounds of nitrogen will be released for every 1% of organic matter in the soil. This factor ranges from 10 to 30 because soil microbe activity is dependent on soil temperature, moisture, aeration, fertility, and carbon content. A safe estimate is 10 pounds for each percent of soil organic matter, although you could increase the factor for particularly warm, wet soil.
Legume credits are based on the breakdown of legume residue in the year following harvest and the significance of that residue as a nitrogen fertilizer. Legume credits are the equivalent of one pound of nitrogen per bushel of the harvested legume crop, with a cap of 40 pounds per year per acre.

**Estimating Nitrogen Losses**

It is important to keep in mind the factors that govern nitrogen losses. If they are ignored, an early season nitrogen deficiency could appear. Regrettably, unlike mineralization and legume credits, it is much more difficult to determine nitrogen losses in the soil. Current research is working toward creating some guidelines for nitrogen losses. In the meantime, growers should consider the following factors.

**Volatilization** – If urea is surface applied on a soil with a high pH and no incorporation, the nitrogen loss could be as high as 50%.

**Immobilization** – With 70% residue cover and surface-applied nitrogen, the short-term loss on the field in our example could be up to 30 pounds of nitrogen. You would want to either increase the preplant application rate or recommend knifing in the nitrogen.

**Leaching** – A CEC of 10.5 would indicate a course-textured soil subject to high leaching losses. If urea is applied as preplant, losses could be as high as 30% or more with moderate to high spring rainfall. An ammonium stabilizer or split applications would be beneficial in reducing this loss. If a soil’s leaching potential is high, then the nitrate carried over from the previous year may be leached below the rooting zone. In this example, the nitrate credit may need to be reduced or eliminated.

**Denitrification** – For our example, denitrification should not be a problem. With a course-textured soil, drainage should be adequate; thus, saturated soil conditions should be avoided.

Taking into account these loss factors, we may need to increase our nitrogen fertilizer application rate from 140 pounds per acre to as much as 170 pounds per acre.

**Summary**

When making a recommendation for nitrogen applications, it is important to consider all factors within the nitrogen cycle. If the factors governing nitrogen losses and gains are underestimated, a nitrogen deficiency will occur or too much nitrogen can be applied.

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