# NITROGEN MANAGEMENT AND INHIBITORS

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Summary: Media attention in recent years has focus on nitrogen fertilizers as a possible source of nitrate nitrogen in the groundwater. Although nitrate nitrogen is part of the natural ecosystem fertilizer, nitrogen must be managed efficiently to reduce the chance of nitrates being lost through runoff or leached out of the rooting zone of the crop. Efficient use of fertilizer nitrogen should be a goal of every producer.

Best Management Practices (BMP's) will be the buzz phrase of the 1990's for American farmers. During the 1990's we will be competing on an international market for price. In addition, we will also face the American Consumer who has little knowledge about food production but intense fears of agricultural chemicals. It will be imperative that the consuming public be aware that producers are using best management practices to assure a safe quality product.

Fertilizer nitrogen best management practices are based on using nitrogen from available sources, setting realistic yield goals, best application methods and good irrigation water management. The main goal in the best management approach is making the most efficient use of the nitrogen fertilizer.

Yield Goal

The first step in determining the rate of nitrogen fertilizer needed is determining a realistic yield goal. Realistic yield goals should be based upon a field's past production capability for a given crop over a five year period. The average should be increased by five percent to take in account improved yield due to new varieties and management practices. Weather differences, particularly rainfall and temperature, from year to year cause the most variation in yield. Table 1 gives the amount of nitrogen needed to produce varying yield levels of sugarbeets and corn.

Table 1. Yield Goals Based on Total Nitrogen Needs

| Sugarbeets | | Corn | |
|---|---|---|---|
| Yield Goal Tons/Acre | Total N Needed Lbs/Acre Soil Residual & Applied N | Yield Goal Bushel/Acre | Total N Needed Lbs/Acre Soil Residual & Applied N |
| 18 | 126 | 100 | 145 |
| 20 | 140 | 120 | 170 |
| 22 | 154 | 140 | 200 |
| 24 | 168 | 160 | 230 |
| 26 | 182 | 180 | 260 |
| 28 | 196 | 200 | 290 |

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Residual Soil Nitrate

Once the yield goal is determined, the field should be soil sampled to determine residual nitrate. The residual nitrate is nitrogen that is remaining in the soil from past fertilizer applications, manure, legumes and organic matter. Soil should be sampled in two increments. The first sample depth should be 0-8 inches for measurements such as pH. Organic matter, phosphorus, potassium and micro nutrients if needed. The depth of the second sample will depend upon the crop being grown. Table 2 provides minimum sampling depths for crops grown in the Panhandle.

Table 2. Residual Nitrate Minimum Sampling Depths

| Crop | Depth |
|---|---|
| Corn | 4 feet |
| Wheat | 2 feet |
| Sugarbeets | 6 feet |
| Dry Beans | 3 feet |

Send soil samples to certified soil testing laboratories. Proper sampling techniques are also very important. The report you receive is only as good as the sample it represents.

Nitrogen Credits

As mentioned earlier nitrogen always has been part of the natural ecosystem. Nitrates have been found in groundwater long before the heavy use of commercial fertilizers. Nitrates in the irrigation water should be counted as a credit to the total nitrogen need of the growing crop. The pounds of nitrogen per acre credit can be calculated by multiplying 2.72 times the ppm nitrate nitrogen in the water sample for each twelve inches of irrigation water applied per acre.

Surface sources of irrigation water will vary in nitrate content depending upon runoff, time of year and a number of other factors. Credits for surface water are difficult to obtain.

Legumes have long been known for their ability to fix atmospheric nitrogen. When the plant dies, the nitrogen is released for use by the next crop. The amount of nitrogen that can be credited to the next crop is indicated in Table 3.

Table 3. Estimated Nitrogen Credit from Legumes

| Legume Crop | Nitrogen Fertilizer Reduction Per Acre |
|---|---|
| Dry Beans | 30-50 lbs. |
| Alfalfa (good stand) | 80-120 lbs. |
| (50% stand) | 40-60 lbs. |
| Sweet Clover | Same as Alfalfa |

The amount of nitrogen that can be credited to an animal waste varies with the type of animal and condition of the waste. In general, ½ of the total amount of nitrogen in the waste will be available the first year for crop needs and ¼ will be available the second year. Table 4 outlines the amount of nitrogen that is estimated for crop use the next growing season following application.

Table 4. Estimated Nitrogen Contribution from Manure for the First Crop after Application

| Source | Estimated Nitrogen Available to First Crop |
|---|---|
| Feedlot Manure | 4-6 lbs N/ton |
| Composted Feedlot Manure | 12-14 lbs N/ton |
| Swine Manure | 5-7 lbs N/ton |
| Sewage Sludge | 2-3 lbs N/ton |

It is a good idea to have a representative sample of the material analyzed for total nitrogen content, in order to more accurately determine the nitrogen contribution of the material. Moisture content, handling techniques and application methods all influence the nitrogen contribution to the crop in the first year.

Calculating Nitrogen Fertilizer Needed

The total nitrogen need of the crop is determined by yield goal and the estimated nitrogen consumed per unit of production. See Table 5.

Table 5. Estimated Nitrogen Consumption of Selected Crops

| Crop | Consumption |
|---|---|
| Corn | 1.2 lbs N/bushel |
| Wheat | 2 lbs. N/bushel |
| Sugarbeets | 7 lbs. N/ton |
| Sunflowers | 5 lbs. N/cwt. |

The formula for calculating fertilizer need is as follows: Fertilizer Nitrogen Need = Total Crop Need (Residual soil nitrate + Irrigation credit + legume credit + manure credit).

Example: A producer has had corn yields of 135, 180, 155, 170 and 145 bushels per acre this equals a five year average of 157 bushels per acre. The yield goal is the average plus five percent or 165 bushels per acre. A soil sample taken showed that 75 pounds nitrogen was in the rooting zone of the crop. The corn field will be irrigated by a center pivot and a water analysis showed a 10 ppm nitrate and the producer expects to apply at least twelve inches of water in the growing season. Dry beans were the previous crop and four tons per acre feedlot manure was applied last fall. Total nitrogen needed to produce 165 bushels per acre of corn is 198 pounds. Credits of 75 pounds residual soil nitrogen plus 27 pounds irrigation credit (2.72*10 ppm) plus 30 pounds legume credit plus 20 pounds manure

credit subtracted from the total nitrogen requirement equals a fertilizer nitrogen need of 46 pounds per acre. 198-(75+27+30+20)=46 pounds of fertilizer nitrogen. By using the nitrogen credits, 77 pounds of fertilizer nitrogen are saved.

Nitrification Inhibitors

Nitrification inhibitors have been on the market for some time. The products work by slowing down the conversion of ammonium nitrogen to nitrate. The inhibitors selectively reduce the population of nitrosomonas bacteria which convert the ammonium nitrogen to nitrate in the soil. Since nitrate is the form of nitrogen which leaches, retaining nitrogen in the ammonium form, which can still be taken up by plants, can reduce the potential for nitrate leaching. This can ultimately increase nitrogen use efficiency, since nitrate which has leached below the root zone is not available to the crop. Nitrification inhibitors should be considered when anhydrous ammonia is applied to sandy soils in spring prior to planting and loamy and clay soils when $NH_3$ is applied in the fall or early spring.