TECHNICAL NOTES

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POLLUTION CONTROL

Planning to Avoid Leaching of Nitrate

Preliminary investigations indicate irrigated cropland and livestock feed as probable sources of some increasing nitrate (NO_3) in ground and surface waters. Because nitrate is approaching levels injurious to health in some water supplies, this is a problem of national concern.

Many complex principles are involved as we attempt to analyze the nitrogen cycle. Fortunately, only a few of these are needed to manage intensively farmed irrigated acres for considerable reduction of NO_3 losses to leaching:

1. All of the nitrogen of commercial fertilizers in general use on mineral soils is rapidly converted to NO_3 when applied to the soil. Slow release sources available are currently too expensive to be competitive.

2. For practical purposes, organic matter is the only material capable of tying up nitrogen against leaching in soils and the low organic matter level of most cropped soils places a sharp limit on this. Also, high available nitrogen in soil with favorable moisture and temperature causes rapid decomposition of its organic matter.

3. A favorable balance of other plant nutrients is necessary for efficient utilization of nitrogen by plants.

4. Much data shows that as successive increments of nitrogen are added to a crop, less crop yield increase is realized from each increment. Thus successively heavier applications of nitrogen leave accelerating increments unused and subject to leaching. This may be illustrated as follows:

Pounds N Applied	Corn Yield	N Removed in Grain (lbs)	Increment of N Not Used (Subject to Leaching)
50	50	50	0
100	75	75	25
200	100	100	100

The chart on page one shows that gross production can be increased using a fixed amount of nitrogen by distributing it over larger acreages. Many farm operators could increase net incomes by applying this principle. Quite often for example, all of the nitrogen goes on cropland with none on pasture. In such cases diverting part of the nitrogen to pasture offers a profit increasing alternative that would increase the percent of applied nitrogen used by the crops.

5. Plants will make most efficient use of nitrogen when environmental factors are most favorable for growth. Good soil tilth, adequate moisture, adapted crop variety, freedom from insects and disease are factors contributing to efficient utilization.

CONSERVATION PRACTICES AND NITRATE POLLUTION

Consideration of the five principles above indicate that a number of soil and water conservation practices will reduce nitrate leaching losses significantly if properly applied.

1. Crop residue use - Much nitrogen can often be tied up in crop residues until it is needed for the next crop by exercising some control over the decomposition rate. Nitrogen will be held until decomposition of the residues has reduced the carbon:nitrogen ratio to about 10:1. Residues left on the soil surface keep the decomposition rate to a minimum. Mixing with soil to the right degree helps obtain the decomposition rate desired. Adding nitrogen may be desirable to increase the decomposition rate in some instances. Even if the residues decompose before planting time, they still function to save nitrogen by reducing the time interval during which leaching can occur.

2. Cover and green manure crops - These hold nitrogen left over from a crop by using it. The nitrogen is released for use of the next crop by tillage or mowing.

3. Irrigation water management - Great losses of nitrogen by leaching frequently occur in the absence of water management. When any portion of a field is over-irrigated, available nitrogen is leached beyond the root zone. There are a number of water management practices that can be used to conserve nitrogen:

   a. Land leveling, length of run and head adjustments for even watering.

   b. Avoid over watering.

c. Put nitrogen on in irrigation water as a method of using split applications. This avoids leaching losses as compared to single large applications of nitrogen. A further refinement is made by applying the nitrogen during the final quarter or half of the irrigation period when irrigation is by furrow or sprinklers. Tailwater recovery systems will help avoid nitrate losses.

d. If leaching to remove salt is required, do this when soil nitrogen is low or tied up by organic matter or a cover crop.

4. Split applications will conserve nitrogen by supplying it close to the time it is needed by the crop. Many crops need about half their nitrogen during the final quarter of growth. Applying the total requirement at planting time provides a long interval for nitrogen to be leached before the crop is ready to use it. Current research is making progress in coating urea for "timed release" and the product should be available soon. It will have considerable value for crops and situations where split applications are not practical.

5. Conservation cropping systems may conserve nitrogen:

   a. By maintaining soil tilth and organic matter

   b. By alternating shallow and deep-rooted crops to pick up deep soil nitrogen.

   c. By reducing diseases, insects and weeds.

   d. Use both grasses and legumes in the rotation hay and pasture phase of rotations. Grass will use nitrogen fixed by legume bacteria that might otherwise be lost to leaching.

6. Frequent spreading of feedlot manure. - Recent studies list manure accumulations in feedlots as major contributants to groundwater nitrate. Frequent spreading of the manure over cropland will reduce this. Better still, provide for longer grazing seasons and let the animals do the spreading.

Various natural factors operate in fixing atmospheric nitrogen into forms usable by plants and other factors are similarly operating to convert usable forms to elemental nitrogen. Ordinarily these conversions are relatively insignificant as they apply to individual farm units and can be discounted in applying principles and techniques described in the preceding paragraphs.

By teaching farm operators to effectively use the practices and guidelines discussed herein for efficient use of nitrogen, we can effectively reduce the amount of nitrate being carried into our ground and surface water supplies.

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