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Protect Ground Water with Nitrogen Management

Nitrogen fertilizer and water management are two key factors which affect ground water quality. Irrigation scheduling, the application of water according to crop requirements, will ensure good yields and save water. The amount of irrigation water to apply on each crop is determined by the evapotranspiration (ET) for each location. Soil type, crop rooting depth, soil moisture level and soil salinity level all must be considered. Excessive applied water causes leaching of nitrates and other chemicals into ground water. Occasionally, a 2-3 inch rain falls just after an irrigation and will cause similar, but uncontrolled, leaching.

To carefully manage nitrogen, you must consider the source, the rate, time of application, and method of application. Soil testing before applying fertilizer is recommended. For wheat, corn, sugarbeets and other deep rooted crops, a deep sample (0-3 feet) can save money and result in improved nitrogen fertilizer recommendations. When sampling, always separate the first foot from the deeper sample. This insures proper fertilizer nutrient recommendations (other than nitrogen) for the field. Apply the recommended amount of nitrogen for your realistic yield goal. Consider all sources of nitrogen with test recommendations. This includes manure, legumes and nitrate found in irrigation water. Split N application. Nitrogen application methods vary depending on the irrigation system, farmer preference and equipment. All N sources are equally effective if managed properly.

Healthy, vigorous plants will absorb nitrogen and do not leave high nitrate levels in soils to be leached into ground water as shown in Figure 1.

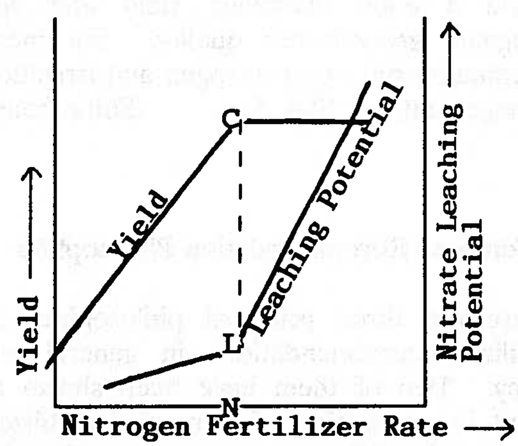

Figure 1. Showing when fertilizer nitrogen is applied at the correct rate (N) for a good yield (C), low amounts of nitrate leaching (L) will result. Excessive fertilizer nitrogen rates result in excessive nitrate leaching.

Some water sources, both from well or surface ditch, may add significant amounts of nitrogen to the crop. For example, well water with a 10 ppm NO_3-N concentration will have 27 lbs of

NO_3-N per acre-foot (10ppm X 2.7 million pounds of water/acre-foot = 27 lbs of NO_3-N/acre-foot of water). If the farmer applies 2 acre feet of water containing 10 ppm NO_3-N to a crop, he should subtract 54 lbs of N from his fertilizer recommendation.

To illustrate the importance of deep sampling, the following example is given. During 1990, 3 cornfields in South Platte Basin, sampled 3 foot deep, resulted in fertilizer N recommendations which were 27, 33 and 47 lbs/acre lower than recommendations based on 1 foot samples. In a sugar beet field, the difference was 73 lbs N/acre. These fields had higher subsoil NO_3-N levels than the average calculated from one-foot samples.

Soil test every year to measure residual nitrates and other plant nutrients. Samples should be at least 2 feet deep. Let a qualified person make a fertilizer recommendation. Give credit to nitrate nitrogen (NO_3-N) in irrigation water, to legume as a previous crop, and to manure. Manage your irrigation carefully to avoid unnecessary leaching of nitrates. Following these procedures, you will insure a good economic yield and will safeguard groundwater quality. For more information on sound nitrogen and irrigation management, see SIA .514. (Soltanpour)

Fertilizer Recommendation Philosophies

There are three principal philosophies of fertilizer recommendations in general use today. Two of them have been shown to result in application of unneeded fertilizer. This brief article is meant to describe the three approaches and encourage continued use of the nutrient sufficiency approach.

Most of the differences in nutrient recommendations between private soil testing companies and state soil testing services are the result of philosophical differences rather than technical ones. Differences in extractants, methods, and analytical techniques are important. However, differences in philosophies have by far the greatest impact on recommended fertilizer rates.

The **Nutrient Sufficiency** approach uses soil tests which predict the soil's potential of supplying immobile nutrients. Fertilizer is recommended only if the soil cannot supply enough of a nutrient to meet the specified production goal. If the soil's supply of the nutrient is sufficient, no fertilizer is recommended.

The **Cation Balance** approach is based on the concept of an "ideal soil" for all crops. Fertilizer is recommended to bring the cation ratios closer to that of the "ideal soil". Many who still use this approach do not realize that the concept has been shown to be invalid -- there is no ideal ratio. Plants do well under a wide range of cation ratios. Adding fertilizer to correct nutrient ratios has no beneficial effect on the crop and often means applying fertilizer without yield responses.

When using the **Build-up and Maintenance** approach, immobile nutrients are added in excess for several years until the soil fertility has been built up to high levels. Thereafter, the producer applies the amount of nutrient expected to be removed by the crop. The maintenance approach sounds like good conservation, but it disregards the fact that the soil supplies many nutrients from its mineral reserves. It incorrectly assumes that the soil does not have nutrient supplying power and that you have to replace nutrients that are removed from the field. It ignores the fact when yield goals are not obtained, immobile nutrients accumulate in soil and often reach levels where continued addition of fertilizer may have a detrimental effect on crop performance.

The Nutrient Sufficiency approach is the fertilization recommendation philosophy which best serves the crop producer. With it, a nutrient is recommended only when the soil cannot supply sufficient quantities for desired crop performance. Excess fertilization is avoided, fertilizer resources are conserved, and crop performance is not limited by nutrient supply. (Follett)

Zero Keeps Getting Smaller

Over the past 40 years, scientists have developed the ability to detect smaller and smaller amounts of any substance in our food and water.

In the 1950s, trace amounts of both man-made and natural chemicals could be detected at one part per million. Any level below that was considered zero.

By 1965, one part per billion was detectable. Zero had become smaller.

Today, one part per trillion has become a reality -- and one part per quadrillion isn't far away. All the while, ZERO keeps getting smaller.

These scientific achievements, while commendable, fuel consumer fears of pesticide residues. Just because something can be detected at a smaller level, doesn't necessarily mean that the risk level has changed.

The ability to detect residues at lower concentrations translates into the ability to research risks and benefits at lower concentrations. Industry is committed to using new technology to continuously update risk analyses.

With this commitment, safe, recommended usage levels can continue to be developed through extensive testing.

The following comparisons put detectable numbers in better perspective.

Think of one part per million as:

- 1 inch in 16 miles.
- 1 cent in $10,000.
- 1 minute in 2 years.
- 1 postage stamp on the surface of a baseball diamond.

Think of one part per billion as:

- 1 inch in 16,000 miles.
- 1 cent in $10 million.
- 1 second in 32 years.

Think of one part per trillion as:

- 1 inch in 16 million miles (more than 600 times around the earth).
- 1 second in 320 centuries.
- 1 flea on 360 million elephants.

(Follett)
(Adapted from the July, 1991 issue of the **Bottom Line,** Dow Elanco.)

Marketing High Quality Alfalfa to Beef Producers

A major agricultural publishing firm recently concluded that 35% of the alfalfa grown in the U.S. is utilized in beef production, 37% is utilized by dairy cattle, 18% by horses and 10% by others. Many alfalfa producers tend to identify only dairymen as high quality alfalfa buyers. While this is still good philosophy, there is still great potential for the beef industry to purchase high quality alfalfa, particularly as benefits of feeding high quality alfalfa become better known. A recent study conducted at the University of Wisconsin involving steers of different weight illustrates alfalfa value to beef (Table 1). This study showed that beef cattle can benefit from high quality alfalfa, particularly when fed to younger cattle. All energy rations were balanced using shelled corn. The 16% CP alfalfa required more corn in the ration and thereby raised

Table 1 Effect of alfalfa hay quality on gain and cost of gain.

Steer Weight	%CP	ADG	$/cwt Gain
400-600	22	2.1	59.2
	16	1.7	64.1
600-1000	22	3.1	39.6
	16	2.9	49.9
1000-1200	22	2.8	59.0
	16	2.7	59.7

production costs. For example, feeding high quality hay vs. low quality to 400-600 lbs. steers, reduced the cost of gain by 7.6% and 20.6% for 600-1000 lbs. steers. Reduction in cost of gain was not observed with the heavier class of steers.

Thus, it would appear that beef producers should pay closer attention to the quality of alfalfa hay they feed. However, this is often not the case. For example, W-L Research surveyed cattle feeders and found that only a small percentage of the respondents listed quality parameters (CP, ADF, and RFV) as criteria utilized when buying alfalfa. Thus, much educational effort is needed to demonstrate the potential benefit of feeding high quality alfalfa to beef cattle.

(Shanahan)
(Adapted from the **W-L Research Summer 1991 Haymaker**)

Water Quality

Farmstead Assessment

On-farm nutrient and pesticide management minimizing water quality problems usually emphasizes field and chemical application technology. However, significant opportunities for groundwater protection and education are available at the farmstead. Many farmers do not perceive that farmstead activities may pose a significant threat to their drinking water supplies, even though these hazards are often present in close proximity to household wells.

Wells are designed to provide clean drinking water. Improperly maintained or constructed wells can allow bacteria, nutrients, or chemical contaminants to directly enter the groundwater and potentially affect the health of livestock and the family. Documented cases of farmstead activities such as corral runoff, cesspool location, or pesticide spill areas causing well contamination have prompted some states to reexamine farmstead regulation.

Rural families should be encouraged to have their well water tested annually, especially if a problem is suspected. Water quality testing may provide extension personnel an opportunity to help families assess farmstead activities which could impact groundwater quality. In all cases, it should be emphasized that groundwater contamination is an issue of responsibility, not of assigning blame. Much nitrate and pesticide contamination of groundwater has occurred while farmers have been using the best management information available to them.

Well water should be tested more frequently if there are:

- unexplained illnesses in the family
- pregnancies in the family
- changes in livestock performance
- neighbors finding contaminants in their water
- changes in water taste, odor, color,

and clarity
- chemical or petroleum product spills or back-siphonage

The American Farm Bureau has published a "Water Quality Self-Help Checklist" which provides many good points for rural families. Other states, such as Wisconsin, are working on farmstead assessment guides that will be available in the near future. Farmers should be encouraged to evaluate farmstead activities which may cause groundwater contamination.

A farmstead assessment and recommended criteria follows:

1. A site analysis determining aquifer vulnerability, soil characteristics and depth to groundwater.
2. Pesticide and fertilizer storage and handling practices
   - mix and store 100 ft. or more downslope from well
   - rinse spray equipment away from farmstead
   - container disposal by approved methods
   - properly contain and report any spills
   - local fire dept. should know location of chemical storage facilities
   - keep records to reduce pesticide inventory
3. Petroleum product storage and handling practices
   - monitor underground storage tanks over 20 years old or within 100 ft. of well
   - maintain inventory of products going into and out of underground storage tanks to monitor leakage
   - install automatic shutoff valve on filler nozzles
   - properly close abandoned tanks
4. Farm and home hazardous waste
   - solvents, used petroleum products, cleaning products, paints, and other commonly used chemicals are potentially hazardous substances and should be contained and disposed of properly
   - hazardous products should be used and stored at least 150 ft. from wells
   - return or reuse excess products
5. Livestock yard management
   - minimum of 200 ft. between livestock yards and well
   - manure storage sites should not be located where soils are shallow or the water table is high
   - divert clean water around livestock yards and storage areas
   - clean yards and pens regularly. Manure used as fertilizer should be correctly credited to N budget
   - control and contain runoff from livestock yards
6. Silage storage
   - silage stored at >65% moisture can produce leachate containing nitrate and organic acids
   - locate trench- or pit silos at least 250 ft. from wells
   - prevent leachate from runoff or entering surface water

The condition and location of the farmstead drinking-water well can be significant components of groundwater contamination. Proper farmstead management will help minimize groundwater contamination from agricultural chemicals and waste products. Farmstead assessment is a valuable educational tool which we can use to raise farmer awareness of best management practices and groundwater protection. See your Extension agent for specific conditions on your farm and for water quality analysis procedures. (Waskom)

Managing Stored Grain

Storage conditions for grain in Colorado are superior to midwestern and southern states because of the low humidity and low grain moisture content in the field at harvest time.

My intuition says that this year, because of higher humidity and a cool August, many may have trouble storing grain this winter (Heat unit accumulations for 1 May to 15 July are about average). Cooler temperatures result in slower drying of corn in the field during the fall months. The last heavy snows in eastern Colorado, were during the winters of 1985 and 1986. Since that time, the fall and winter months have been relatively mild. You know what they say about people who try and predict the weather. At Fort Collins, the average fall date of temperatures below 28°F is the 11th of October and 10% of the time, it may freeze before the 1st of October. Similar data for other locations in Colorado are available from the Colorado Climate Center at Colorado State University. That's enough about the weather.

If cool damp weather prevails, we may be harvesting grain with slightly higher moisture levels than in previous years. Soil moisture will affect the grain maturing process. Your shutoff date for irrigation will depend on soil type, present soil moisture and maturity of the corn. Plan on reducing the amount of water applied during the last irrigation. Check soil moisture levels with a probe to help plan how much water to apply during the final irrigation for the season.

Safe grain moisture content for corn during short term storage is 15.5 percent. Moisture should be reduced to 14% or less for extended storage. Small grain such as wheat, barley or oats should have moisture levels below 13% for extended storage. Periodic aeration controls moisture migration caused by temperature changes.

For a complete discussion about managing stored grain, refer to SIA No. .117, Managing Stored Grain, . Contained in this fact sheet are tables showing safe storage moisture content for many grains, discussion on Grain temperature and moisture migration, management of "fines" in storage, airflow rates, fan operation time, airflow direction, and frozen grain. For your copy, contact your local extension office and ask for SIA number .117. (Croissant)

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Sincerely,

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