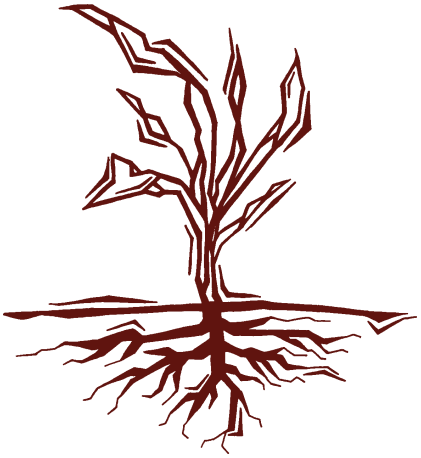

SOIL

Nitrogen and Irrigation Management no. 0.514

by P.N. Soltanpour, I. Broner and R.H. Follett [1]

Quick Facts...

Good nitrogen and irrigation management practices increase yields and reduce the probability of nitrate, pesticides and salt leaching into ground water.

Best management practices for nitrogen and irrigation management preserve the quality of ground water.

In 1987, the U.S. Congress enacted the Water Quality Act of 1987. It requires states to assess their waters and develop nonpoint source management programs to control and reduce specific nonpoint sources of pollution. Colorado State University Cooperative Extension's role is to educate the public on ways to reduce the impact of nitrogen fertilizers on groundwater quality.

Good nitrogen and irrigation management practices can reduce the probability of nitrate leaching into groundwater and maintain profitable yields. The nitrogen (N) and irrigation management practices recommended here must be fitted to the specific crop, soil and climate conditions of individual farms. Farmers should check with their county Cooperative Extension office for additional information.

Nitrogen Management

Discontinuing N fertilizer typically decreases crop yields by one-third in the first year. Therefore, N is a must for most crops. Manage it carefully.

- Use soil analysis to assess N needs (see fact sheet 0.500, *Soil Sampling*, for procedures). If a soil is already high in residual N, decrease N fertilizer accordingly. For more accurate assessment of N needs, use in-season soil sampling for nitrates testing to complement preplant testing.
- Choose a realistic yield goal. An unattainably high yield goal results in excessive and inefficient fertilizer recommendations.
- Analyze irrigation water to give credit for any nitrate N it contains. Multiply parts per million (ppm) of nitrate N by 2.7 to get pounds of nitrate N per acre-foot of water. Then multiply by acre feet of water applied to get total N application.
- Split N applications. Apply half at planting and the balance at the critical growth stage for that crop. This is especially important for sandy soils that may leach nitrates.
- Use ammonium N fertilizers, such as anhydrous ammonia, to reduce nitrate leaching. Enhance its efficiency with nitrification inhibitors (chemicals that prevent change of non-leachable ammonium to leachable nitrate).
- Give N credit for manure and previous legumes. Credit 5, 30 and 50 pounds per acre per ton of manure and previous bean and alfalfa crops, respectively.
- Use slow-release N fertilizers, such as sulfur-coated urea or urea formaldehyde, on golf courses, lawns, etc.
- Incorporate urea, urea ammonium nitrate and ammonium sulfate into the soil to prevent volatilization losses of ammonia gas. This reduces N efficiency and necessitates higher N application rates.
- Place N and phosphorus in the same band to increase yields, as well as N and phosphorus uptake efficiencies.

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References

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- When applying N to irrigation water, do not allow the runoff to enter surface waters or lakes. Reuse the runoff for irrigation. For tailwater recovery systems refer to 4.709, *Tailwater Recovery for Surface Irrigation*.
- Follow soil conservation practices (minimum till, strip cropping, contour planting, etc.) to prevent soil erosion that results in pollution of surface water with N. When necessary, improve drainage to increase N efficiency.
- Do not apply manure to frozen land, especially on slopes, to prevent N loss in runoff waters.
- Under sprinkler and drip irrigation, N can be split into appropriate quantities determined by crop growth stage. This is especially good on sandy soils.
- Do not allow back flow of fertilizers into the well head.
- Avoid application of high rates of N in the fall or at planting time. Rates can be adjusted during the season if conditions warrant more N fertilizer.
- In crops such as malting barley and sugarbeets, excessive N reduces crop quality and profits.
- Use a portable chlorophyll meter to determine the greenness of leaves at different times (e.g., V6, V10, tassel) to assess the N status of the crop and the need for additional N fertilizer.
- All farm practices that increase yields result in larger N uptake and less leaching of nitrates.

Table 1: Typical application efficiencies of irrigation systems.

Type	Percent
Micro sprinklers and drip	85-95
Low pressure center pivots	80-90
High pressure center pivots	75-85
Side roll/hand move sprinklers	60-70
Flood irrigation	20-50
Border irrigation	40-60
Furrow no cutback	40-60
Furrow with cutback	60-80
Furrow with surge	70-90

Irrigation Management

Irrigation water management (irrigation scheduling) can save 30 to 50 percent of water and energy. Good water management also increases yields.

Overirrigation can result in leaching of fertilizers to the groundwater and reduces the efficiency of N fertilizers. Therefore, irrigation water management is essential for profitable yields and good water quality. Schedule irrigation according to the guidelines below. See 4.708, *Irrigation Scheduling*, for definitions and explanations of terminology.

- Knowledge of crop, growth stages, soil characteristics and irrigation system efficiency is needed to properly schedule irrigations.
- Know how much water the crop uses on a daily or weekly basis. This is the evapotranspiration estimated from weather data or from evaporative devices such as an atmometer. Evapotranspiration rates also are published by local Cooperative Extension offices, newspapers and Natural Resources Conservation Service offices in some areas.
- Determine the soil's moisture content in the effective root zone and its maximum water-holding capacity by measurement or the feel method. See 4.700, *Estimating Soil Moisture*.
- The difference between the maximum water-holding capacity and the actual water content is the net amount of water to be applied.
- Determine the application efficiency of your irrigation systems. Consult a qualified irrigation technician.
- If feasible, use irrigation systems that give higher application efficiencies.
- The gross amount of water to be applied is the net amount divided by the application efficiency of the irrigation system.
- Use measuring devices such as flumes and water meters to determine how much water you apply. When using syphon tubes or gated pipes to determine it, multiply the stream flow rate by the irrigation duration.
- Use a soil probe to monitor soil moisture. Probe the field during and after irrigation to determine depth of water penetration.
- With surface irrigation, use cutback practices to reduce deep percolation and runoff.
- Operate sprinklers at proper pressure. Don't irrigate when it's windy. Irrigate at night when feasible, because there is less wind.

[1]*P.N. Soltanpour, Colorado State University professor, soil and crop sciences; I. Broner, Cooperative Extension irrigation specialist and assistant professor, chemical and bioresource engineering; and R.H. Follett, former Cooperative Extension agronomist and professor, soil and crop sciences.*

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