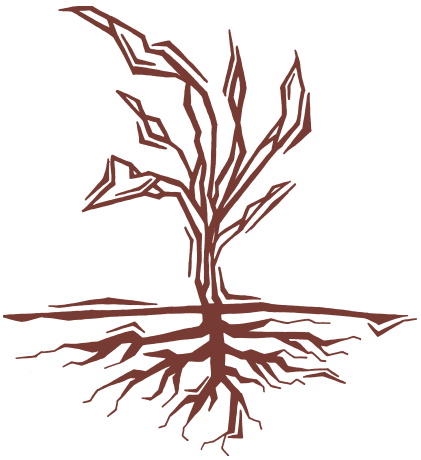

SOIL

Nitrogen and Irrigation Management no. 0.514

by T.A. Bauder, R.M. Waskom, and A. Andales[1] (6/08)

Good nitrogen and irrigation management practices can reduce the probability of nitrate leaching into groundwater and maintain profitable yields. Nitrogen (N) and irrigation management are complementary. Consequently, fields with low irrigation efficiency under tight nitrogen supplies will likely see N deficiency leading to reduced yields. Likewise, fields where irrigation efficiency has been improved may require less N for similar yields. The purpose of this fact sheet is to list practices to improve N and irrigation management. The practices recommended below must be fitted to the specific crop, soil and climate conditions of individual farms. Check with your local Colorado State University Extension county office, www.csuwater.info, or the publications listed below for additional information.

Quick Facts...

Good nitrogen and irrigation management practices increase yields while reducing fertilizer and irrigation costs.

Best management practices for nitrogen and irrigation management preserve water quality.

Nitrogen Management

Nitrogen is the plant nutrient most frequently deficient for maximum crop production. Discontinuing N fertilizer or manure applications typically decreases crop yields. The following practices are a part of a responsible nitrogen management plan.

- Choose a realistic yield expectation. A yield average of five successful crop years plus five percent is a recommended yield goal.
- Use soil analysis to assess N needs (see fact sheet 0.500, *Soil Sampling*, for procedures). If a soil contains high amounts of residual N, decrease N fertilizer accordingly. For more accurate assessment of N needs, use in-season soil sampling for nitrate testing to complement preplant testing.
- Use a reputable soil testing laboratory that provides recommendations consistent with your goals (see fact sheet 0.520, *Selecting an Analytical Laboratory*). Check laboratory provided fertilizer recommendations against university recommendations.
- Give N credit for manure and previous legumes. See Colorado State University Extension bulletins XCM 172 and 568A for determining the correct credits.
- Analyze irrigation water to determine if it contains nitrate-N. Multiply parts per million (ppm) of nitrate-N by 0.23 to get pounds of nitrate-N per acre-inch of water. Credit irrigation water applied during vegetative (pre-tassel or flowering) growth stages.
- Use plant tissue testing, the pre-sidedress soil nitrate test, or chlorophyll meter to assess the N status of the field and the need for additional N fertilizer when making in-season applications.

Recommended N Application Techniques

- Split N applications to improve uptake efficiency and yield return for

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fertilizer investment. Apply one-third at or prior to planting and the balance before the critical growth stage for that crop. This is especially important for sandy soils that may leach nitrate.

- 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.
- Incorporate urea, urea ammonium nitrate, ammonium sulfate, and manure into the soil to prevent volatilization losses of ammonia gas. Volatilization reduces N efficiency and necessitates higher N application rates.
- Use ammonium N fertilizers, such as anhydrous ammonia, to reduce nitrate leaching.
- Place N and phosphorus in the same band to increase yields, as well as N and phosphorus uptake efficiencies.
- Only apply N in irrigation water where irrigation efficiency and uniformity is high. Fertigation is not recommended in systems with runoff that is not captured in a lined tail-water pond for later reuse.
- Do not apply manure to frozen land, especially on slopes, to prevent N loss in runoff waters.
- Use slow-release N fertilizers, such as sulfur-coated urea or urea formaldehyde, on golf courses, lawns, or high-value crops where it is economical.
- Keep good records of N fertilizer and manure applications to help make N management decisions later.

Irrigation Management

Over-irrigation results in leaching of nitrate 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.

- Obtain information about your crop's water needs and critical growth stages, soil characteristics and irrigation system efficiency to properly schedule irrigations.
- Know how much water the crop uses on a daily or weekly basis. This is the evapotranspiration (ET) estimated from weather data or from an atmometer. ET rates are available at www.CoAgMet.com and are published by water districts, local Colorado State University 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 (See Table 1). 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 siphon tubes or gated pipes, 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.

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

- With surface irrigation, use cutback practices to reduce deep percolation and runoff.
- Operate sprinklers at proper pressure and nozzle spacing.
- When chemigating pesticide or fertilizer, leave room in the soil profile (10 to 20 percent) to store potential rainfall to avoid runoff or leaching.

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