Irrigation Water Management

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What is Irrigation Water Management?

Irrigation water management is managing the rate, amount, and timing of irrigation water according to crop needs and maintaining or improving the existing irrigation system. The frequency and amount of irrigation applications is managed to obtain the optimum yields, use the appropriate amount of irrigation water, and is based on soil moisture and crop water usage.

How it helps water and soil resources

In most cases, irrigation water management will reduce irrigation water losses due to runoff, deep percolation, evaporation, leaks, and allow for effective use of moisture from rainfall. Groundwater quality is improved by reducing nutrient and pesticide leaching. Each inch of water that is prevented from leaching below an irrigated corn crop's root zone can prevent the loss of about 5 lbs/acre of nitrate nitrogen contained in leached water. Surface water quality is improved by reducing runoff water, which may contain sediment, nutrients, and pesticides.

Where it can be utilized

Irrigation water management will work on all irrigated lands. Its use is important when the current irrigation system capacity is limited or when soil and water resources are being degraded. Net returns can be increased by reducing input costs, which include reduced pumping costs, and minimizing loss of soil, water, nutrients, and pesticides.

Where to get help

For assistance in improving irrigation water management, and in selecting an appropriate irrigation system on your farm, contact the Natural Resources Conservation Service, Cooperative Extension, or a private consultant.

Requirements of irrigation water management

In order to manage irrigation water properly it is critical that the irrigator has the ability to:

- Measure the amount of water delivered to the field and calculate the amount of water applied per irrigation.
- Measure the amount of rainfall.

Additional items that follow may allow the irrigator to manage irrigation water more efficiently:

- Determine the timing and amount of irrigation applications needed, based on soil moisture, crop water use, and stages of plant growth.
- Determine delivery losses due to leaks and take corrective action as necessary.
- Adjust application amounts and timing, in order to compensate for changes in field conditions.

Irrigation Scheduling

Irrigation scheduling techniques use a water balance accounting procedure. The amount of water stored in the crop's root zone is balanced before and after irrigation applications. Applications amount, rate, and timing are scheduled to replace soil moisture used by the crop, plus allowing some storage for rainfall.

- Methods of monitoring available soil moisture and uniform application can include; the soil "feel and appearance" method, moisture probes, tensiometers, moisture blocks, and other methods.
- Normally, no more than 50 percent of the soil moisture available to the crop should be depleted before being replenished.
- Determining the last irrigation is important in order to limit off-season nitrogen leaching, leave room in the root zone for off-season rainfall, and to obtain optimum test weight and crop yields.

Soil Moisture

For soils that do not have restrictive layers, and have an adequate supply of water throughout the root zone, 40 percent of the crop's water extraction occurs in the upper quarter of the root zone, 30 percent in the second quarter, 20 percent in the third quarter, and 10 percent in the bottom quarter. Under these conditions most corn varieties will extract 90 percent of water in the upper three feet of the root zone.

Table I. Approximate available water capacity for various soil types.

Soil Type	Available Water in the Upper 3 feet of the soil profile (inches)
Silty Clay and Clay	4.9
Silty Clay Loam or Clay Loam	6.9
Silt Loam over Silty Clay or Clay	5.2
Silt Loam	7.1
Loamy Sand	3.8
Fine Sand	2.5

Crops

- Evapotranspiration or "ET" (crop water usage) is the amount of water transpired by the crop and the amount evaporated from soil and plant surfaces.
- Corn can have average crop water use of less than 0.10 inches in May and September.
- Average peak crop water use in Nebraska for corn, sorghum, soybeans, alfalfa, and wheat is about 0.30 to 0.35 inch per day.

Table II. Seasonal crop water usage (ET) in Nebraska (inches/year).

Crop	West	Central	East
Corn	23-26	24-27	25-28
Soybeans	20-22	21-23	22-25
Dry Beans	15-16	NA	NA
Sorghum	18-20	19-22	20-23
Winter Wheat	16-18	16-18	16-18
Alfalfa	31-33	32-35	34-36
Sugar Beets	24-26	NA	NA

Furrow Irrigation Systems

- Length of irrigation runs and stream size should be based on soil intake characteristics.
- Maximum stream size should be based on:
  - ✓ Maximum non-erosive streams
  - ✓ Furrow capacity (spacing and depth)
- Optimum set times are based on row grade, intake rate, and length of run. For best uniformity, furrow set time should be based on an optimum cutoff ratio. Optimum cutoff ratios are as follows: 0.3 for course soils (sands), 0.5 for medium textured soils (silt loam), and 0.7 for fine textured soils (silty clay). When a tail water recovery system is in place, cutoff ratios should be less. Cutoff ratios are calculated by dividing the time required for water to advance to the end of the furrow by the total set time.
- Irrigating every other furrow can be a more flexible method and provide mid-season flexibility to adjust irrigation amounts due to changes in field conditions.
- Furrow irrigation management techniques that may improve efficiency from standard furrow irrigation include surge and tailwater recovery systems.
- Maintaining uniform row grade, eliminating low spots, and performing other needed maintenance is important for furrow systems to work properly.

Sprinkler Irrigation Systems

Sprinkler system design is based on the amount of irrigation water that can infiltrate the soil, surface storage provided by crop residue and tillage until water can be absorbed, and crop water needs.

- Low pressure sprinkler systems should only be used when the amount of irrigation water applied does not cause excessive runoff.
- Sprinkler system wheel track erosion should be adequately controlled.

For more information refer to the *Nebraska Irrigation Guide* available at Natural Resources Conservation Service offices, or refer to the University of Nebraska *NEBGuide* and *NEBFacts*.

Gross Irrigation Water Application

Gross Irrigation Water Application for:

_____

Date:

_____

County:

_____

Location:

_____ Section _____ , T ____R ____

Item	Standard Furrow	Surge	Sprinkler
A. Water Supply (gpm)			
B. Furrow Length (feet)			
C. Furrow Spacing (feet)			
D. Rows per side x 2			
E. Rows per set			
F. Acres per set = B x C x D/43,560 (surge)			
G. Acres per set = B x C x E/43,560 (standard furrow)			
H. Set time/revolution time (hours)			
I. Acres under sprinkler			
Gross Application for Furrow Irrigation = A x 0.0022 x H/G =	_____	_____	inches
Gross Application for Surge Irrigation = A x 0.0022 x H/F =	_____	_____	inches
Gross Application for Sprinkler Irrigation = A x 0.0022 x H/I =	_____	_____	inches

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