NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
IRRIGATION WATER MANAGEMENT
(Ac.)
CODE 449

DEFINITION
The process of determining and controlling the volume, frequency, and application rate of irrigation water.

PURPOSE
- Improve irrigation water use efficiency
- Minimize irrigation induced soil erosion
- Decrease degradation of surface and groundwater resources
- Manage salts in the crop root zone
- Manage air, soil, or plant micro-climate
- Reduce energy use

CONDITIONS WHERE PRACTICE APPLIES
This practice is applicable to all irrigated lands.

An irrigation system adapted for site conditions (soil, slope, crop grown, climate, water quantity and quality, air quality, etc.) must be in place and capable of efficiently applying water to meet the intended purpose(s).

CRITERIA
General Criteria Applicable to All Purposes
Develop an Irrigation Water Management (IWM) Plan that will guide the irrigator or decision-maker in the adoption of methods and tools for the proper management and application of irrigation water.

Include in the plan the method the producer is adopting to monitor the incidences of irrigation events that result in deep percolation.

When irrigation water is limited, the IWM Plan should address the need to meet water requirements during critical crop growth stages.

Include in the IWM plan the method the producer is adopting for determining the flow rate or total volume of irrigation water required, and actually applied, for each irrigation event.

Include in the IWM plan the method(s) the producer is adopting for determining the timing of each irrigation event. A management allowed depletion (MAD) or other suitable threshold soil/plant moisture status shall be established to trigger the need for irrigation. At least one of the following methods must be used to indicate crop water use:

- Evapo-transpiration of the crop, using appropriate crop coefficients and reference evapo-transpiration data or other climate based methods,
- Soil moisture monitoring, and/or
- Quantitative monitoring of plant moisture status (e.g. leaf water potential or leaf/canopy temperature measurements).

When irrigation water is not available on demand, such as when sometimes provided by an irrigation district, use the planned availability to determine the timing of the irrigation event. In this case, adjust irrigations amounts appropriately.

In locations where rain is expected during the growing season, and where a soil water balance is calculated, include measurements from a rain gauge (or other accurate method of determining local rainfall) that represent the managed field(s).
Include in the plan the method(s) the producer is adopting to determine the volume of water needed for each irrigation event. These may include, as applicable:

- the cumulative crop water use,
- the available water-holding capacity of the soil for the crop rooting depth,
- the current root zone soil moisture status (includes first or “pre” irrigations as well as moisture from rainfall),
- the current crop/forage growth stage,
- planned deficit irrigation
- calculated salt leaching requirement,
- the distribution uniformity of the irrigation system, and
- the water table contribution.

For adjustable rate systems (such as variable rate irrigation center pivots), base the application rate of irrigation water on:

- the volume of water to be applied,
- the frequency of irrigation applications, soil infiltration and permeability characteristics, and
- the capacity of the irrigation system.

For surface irrigation, apply irrigation water at a rate that achieves an acceptable distribution uniformity (DU) and that minimizes irrigation-induced erosion.

Additional Criteria to Decrease Degradation of Surface and Groundwater Resources

Plan irrigation water application rates and volumes that minimize transport of sediment, nutrients and chemicals to surface waters and groundwater.

Schedule the application of nutrients and chemicals to avoid excess leaching below the root zone to the groundwater and excess runoff to surface waters.

Do not conduct fertigation or chemigation operations if rainfall that may produce runoff or deep percolation is imminent. Limit application of chemicals or nutrients to the minimum length of time required to deliver them and flush the pipelines. Limit the irrigation application amount to the amount necessary to apply the chemicals or nutrients to the soil depth recommended by the manufacturer. Base the timing and rate of application on the NRCS approved pest, herbicide, or nutrient management plan.

Ensure that the irrigation and delivery system is equipped with properly designed and operating valves and components to prevent backflows into the water source(s) and/or contamination of groundwater, surface water, or the soil.

Additional Criteria to Manage Salts in the Crop Root Zone

Ensure the irrigation application volume provides an appropriate salt balance in the soil profile.


Schedule leaching events for periods when chemigation is not occurring and residual nitrate and other chemicals in the root zone is minimal.

Additional Criteria to Manage Air, Soil or Plant Micro-Climate

The irrigation system must have the capacity to apply the required rate of water for cold or heat protection as determined by the methodology contained in NEH, Part 623, Chapter 2, Irrigation Water Requirements.

Additional Criteria Applicable to Reduce Energy Use

Provide analysis to demonstrate reduction of energy use from practice implementation.

Calculate the reduction of energy use as the average annual or seasonal energy reduction compared to previous operating conditions.
CONSIDERATIONS
Consider the following when planning irrigation water management:

The effect of crop water stress varies based on plant stage. Some crops can be water stressed at times of the year without reducing quality or yield thereby reducing water demand.

Crop residue and soil surface storage can increase effective precipitation and reduce soil surface evaporation.

When irrigation water is not available on demand and the intervals between irrigations cause water stress, consider increasing the wetted area, amending the soil with organic material to increase soil water holding capacity, or incorporating an irrigation reservoir to allow more frequent irrigations.

There is a potential for spray drift and odors when applying agricultural and municipal waste waters. Timing of irrigation should be based on prevailing winds to reduce odor. In populated areas irrigating at night should be considered.

Overspray from end guns should not reach public roads.

Modify equipment and/or soil amendments such as polyacrylamides and mulches to decrease erosion.

The water quality can impact the crop quality and plant development.

The water quality can impact the soil’s physical and chemical properties, such as soil crusting, pH, permeability, salinity, and structure.

Avoid traffic on wet soils to minimize soil compaction.

Schedule salt leaching events to coincide with low levels of residual soil nutrients and pesticides.

Manage water so it does not drift or come in direct contact with surrounding electrical lines, supplies, devices, controls, or components that would cause shorts in the same or the creation of an electrical safety hazard to humans or animals.

The effect of the electrical load control/interruptible power schedules, repair and maintenance downtime, and harvest downtime may change the IWM Plan.

Improvements to the irrigation system may increase the distribution uniformity or application efficiency of irrigation water applications.

PLANS AND SPECIFICATIONS
Application of this standard may include job sheets or similar documents that specify the applicable requirements, system operations, and components necessary for applying and maintaining the practice to achieve its intended purpose(s).

The Irrigation Water Management (IWM) Plan will contain, at a minimum:

- An irrigation system layout map showing the main pipeline(s), irrigated area, soil moisture sensor locations and depths (if used), and soils.
- The methods used to measure or determine the flow rate or volume of the irrigation applications.
- Documentation of the scientific method used for scheduling the timing and amount of irrigation applications.
- The seasonal or annual planned water application volumes by crop.
- The management allowable depletion (MAD) and depth of the managed crop root zone for each crop.
- An estimate of the irrigation system distribution uniformity, based on testing, evaluation, or observation.
- The specific soil moisture monitoring objectives, if soil moisture sensors are used. Indicate how data from the soil moisture sensor locations and depths will be considered to make field-wide irrigation decisions.
• Information on how to recognize irrigation induced erosion and how to mitigate it.
• Recordkeeping documents for the irrigator to use during operation and management.

OPERATION AND MAINTENANCE
Include a maintenance checklist to ensure the system performance is optimum.

The irrigator will document all irrigation water management activities with adequate records. At a minimum:

• Record each irrigation event, including the amount or depth of water applied and the date of application, and
• Record the data from the method(s) used for determining the timing and amount of the irrigation event.

Other necessary O&M items are addressed in the physical component standards considered companions to this standard.

REFERENCES
