NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

IRRIGATION WATER MANAGEMENT

(Acre)
CODE 449

DEFINITION

The process of determining and controlling the volume, frequency and application rate of irrigation water in a planned, efficient manner.

PURPOSE

- Manage soil moisture to promote desired crop response.
- Optimize use of available water supplies.
- Minimize irrigation induced soil erosion.
- Decrease non-point source pollution of surface and groundwater resources.
- Manage salts in the crop root zone.
- Manage air, soil, or plant micro-climate.
- Proper and safe chemigation or fertigation.
- Improve air quality by managing soil moisture to reduce particulate matter movement.
- 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 available and capable of efficiently applying water to meet the intended purpose(s).

CRITERIA

Impact to cultural resources, wetlands and Federal and state protected species shall be evaluated and avoided or minimized to the extent practicable during planning, design and implementation of this conservation practice in accordance with established National and Florida policy, General Manual (GM) Title 420-Part 401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26, National Planning Procedures Handbook (NPPH) Florida Supplements to Parts 600.1 and 600.6, National Cultural Resources Procedures Handbook (NCRPH), National Food Security Act Manual (NFSAM), and the National Environmental Compliance Handbook (NECH).

General Criteria Applicable to All Purposes

Irrigation water shall be applied in accordance with federal, state, and local rules, laws, and regulations. Water shall not be applied in excess of the needs to meet the intended purpose. Plans to utilize water resources may need to be approved or permitted by the appropriate Water Management District in accordance with Chapter 40-2 Florida Administrative Code (F.A.C.).

Measurement and determination of flow rate is a critical component of irrigation water management and shall be a part of all irrigation water management purposes.

The irrigator or decision-maker must possess the knowledge, skills, and capabilities of management coupled with a properly designed, efficient and functioning irrigation system to reasonably achieve the purposes of irrigation water management.

Develop an “Irrigation Water Management (IWM) Plan” to assist the irrigator or decision-maker in the proper management and

application of irrigation water. As a minimum, include the items listed in the **Plans and Specifications** section of this standard in the plan.

Irrigator Skills and Capabilities. Proper irrigation scheduling, in both timing and amount, control of runoff, minimizing deep percolation, and the uniform application of water are of primary concern. The irrigator or decision-maker shall possess or obtain the knowledge and capability to accomplish the purposes which include:

A. General

1. How to determine when irrigation water should be applied based on the rate of water used by crops and on the stages of plant growth and/or soil moisture monitoring.
2. How to determine the amount of water required for each irrigation, including any leaching needs.
3. How to recognize and control erosion caused by irrigation.
4. How to measure or determine the uniformity of application of an irrigation.
5. How to perform system maintenance to assure efficient operation.
6. The relationship between water application and soil surface and subsurface conditions, soil intake rates and permeability, crop root zones, and available water holding capacity.
7. How to manage salinity and shallow water tables through water management.
8. The capability to control the irrigation delivery.

B. Surface Systems

1. The relationship between advance rate, time of opportunity, intake rate, and other aspects of distribution uniformity and the amount of water infiltrated.
2. How to determine and control the amount of irrigation runoff.
3. How to adjust stream size, adjust irrigation time, or employ techniques such as “surge irrigation” to compensate for seasonal changes in intake rate or to improve efficiency of application.

C. Subsurface Systems

1. How to balance the relationship between water tables, leaching needs, and irrigation water requirements.
2. The relationship between the location of the subsurface system to normal farming operations.
3. How to locate and space the system to achieve uniformity of water application.
4. How to accomplish crop germination during dry periods.

D. Pressurized Systems

1. How to adjust the application rate and/or duration to apply the required amount of water.
2. How to recognize and control runoff.
3. How to identify and improve uniformity of water application.
4. How to account for surface storage due to residue and field slope in situations where sprinkler application rate exceeds soil intake rate.
5. How to identify and manage for weather conditions that adversely impact irrigation efficiency and uniformity of application.

Determine that irrigation water management is being practiced by evaluating the irrigator's knowledge and use of the principles of irrigation water management as described above. Irrigation water management shall be documented in writing.

Document the use of irrigation water management using Florida NRCS Form FL-ENG-449 or industry recognized methods.

Guidance for determining irrigation water requirements is contained in National Engineering Handbook (NEH), Part 623, Irrigation, Chapter 2 and NEH, Part 652, Irrigation Guide, Chapter 4.

System Capability. Ensure that the irrigation system is capable of applying water uniformly and efficiently and provides the irrigator with adequate control over water application.

Additional Criteria to Manage Soil Moisture to Promote Desired Crop Response

Apply the following principles for various crop growth stages:

- Base the volume of water needed for each irrigation plant available water-holding capacity of the soil for the crop rooting depth, management allowed soil water depletion, irrigation efficiency and water table contribution.
- Base the irrigation frequency on the volume of irrigation water needed and/or available to the crop, the rate of crop evapotranspiration, and effective precipitation.
- Base the application rate 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.
- Make appropriate field adjustments for seasonal variations and field variability.

Additional Criteria to Optimize Use of Water Supplies

Manage limited irrigation water supplies to meet critical crop growth stages.

When water supplies are estimated to be insufficient to meet even the critical crop growth stage, require the irrigator or decision-maker shall modify plant populations, crop and variety selection, and/or irrigated acres to match available or anticipated water supplies.

On high water table soils, manage the water table at a level that will allow the maximum storage of rainfall and provide the required moisture to the plant.

Additional Criteria to Minimize Irrigation Induced Soil Erosion

Application rates shall be consistent with local field conditions for long-term productivity of the soil. On soils that are susceptible to irrigation induced erosion, the irrigation system should be operated so that the application rate is less than the basic soil infiltration rate.

Reduce soil erosion caused by wheel tracks of center pivot systems by using residue management, cover crops, terraces, diversions, critical area treatment, grassed waterways and/or other conservation practices.

Additional Criteria to Decrease Non-Point Source Pollution of Surface and Groundwater Resources

Apply water at rates that minimize transport of sediment, nutrients, and chemicals to surface waters and that minimize transport of nutrients and chemicals to groundwater.

The potential for nutrient losses is high if excess irrigation water is applied. Weather conditions must be considered before nutrients are applied. Nutrients should not be applied when rainfall is imminent.

The amount of nutrients to be applied must be determined according to the production level of the crop, the soil nutrient status, and the plant nutrient status. The scheduling of nutrient application should coincide with the irrigation cycle in a manner that will not leach nutrients below the root zone. The nutrient management plan shall be followed in the timing and rate of nutrient application. Nutrient applications shall be administered in accordance with the requirements of Florida NRCS conservation practice standard Nutrient Management, Code 590.

Net irrigation application should not exceed the available water holding capacity of the soil within the root zone.

Additional Criteria to Manage Salts in the Crop Root Zone

Increase the irrigation application volume by the amount required to maintain an appropriate salt balance in the soil profile.

Base the requirement on the leaching procedure contained in the National Engineering Handbook (NEH) Part 623, Chapter 2 and NEH, Part 652, Chapters 3 and 13.

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

Ensure the irrigation system shall has 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.

Ensure the irrigation system is capable of uniformly applying the required rate of water

application based on the anticipated minimum temperature, maximum wind speed, and relative humidity.

Begin water application when the temperature is above the critical temperature of the crop being protected. Stop water application when the wet bulb temperature is above the critical temperature of the crop being protected. Account for the wind speed's increase in evaporative cooling when determining application period.

Follow criteria contained in the Water Management District Rule 40-2 F.A.C. in the use of water for freeze protection.

Additional Criteria for Proper and Safe Chemigation or Fertigation

Apply chemigation or fertigation in accordance with all local, state and federal laws.

Schedule nutrient and chemical application to coincide with the irrigation cycle in a manner that will not cause excess leaching of nutrients or chemicals below the root zone to the groundwater or to cause excess runoff to surface waters.

Do not apply chemigation or fertigation if rainfall is imminent. Limit application of chemicals or nutrients to the minimum length of time required to deliver them and flush the pipelines. Limit irrigation application amount to the amount necessary to apply the chemicals or nutrients to the soil depth recommended by label. Base the timing and rate of application on the pest, herbicide, or nutrient management plan developed in accordance with Florida NRCS conservation practice standards, Nutrient Management, Code 590, or Pest Management, Code 595.

Equip the irrigation and delivery system 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 Reduce Particulate Matter Movement

Apply sprinkler irrigation water at a rate and frequency sufficient to reduce the wind erodibility index (I Factor) of the soil by one group. Guidance for estimating and adjusting the I Factor is contained in National Agronomy Manual (NAM), Part 502, Wind Erosion.

Additional Criteria Applicable to Reduce Energy Use

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

Reduction of energy use is calculated as average annual or seasonal energy reduction compared to previous operating conditions.

CONSIDERATIONS

Consider the following items when planning irrigation water management:

- Give consideration to managing precipitation effectiveness, crop residues, and reducing system water losses.
- Consider potential for spray drift and odors when applying agricultural and municipal waste waters. Base timing of irrigation on prevailing winds to reduce odor. In areas of high visibility, consider irrigating at night.
- Consider potential for overspray from end guns onto public roads.
- Consider equipment modifications and/or soil amendments such as polyacrylamides and mulches to decrease erosion.
- Consider the quality of water and the potential impact to crop quality and plant development.
- Consider quality of irrigation water relative to its potential effect on 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.
- Consider the effects that irrigation water has on wetlands, water related wildlife habitats, riparian areas, cultural resources, and recreation opportunities. Irrigation may affect the temperature of water resources that could cause undesirable effects on aquatic and wildlife communities.
- Management of nutrients and pesticides.
- Schedule salt leaching events to coincide with low residual soil nutrients and pesticides.

- Manage irrigation water in such a manner as to 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.
- Give consideration electrical load control/interruptible power schedules, repair and maintenance downtime, and harvest downtime.
- Consider improving the irrigation system to increase distribution uniformity or application efficiency of irrigation water applications. An irrigation system evaluation should be performed to determine if the irrigation system meets the minimum uniformity as specified in the applicable NRCS conservation practice standard for irrigation. Procedures for evaluating irrigation systems are contained in the NEH, Part 652, Irrigation Guide and the NEH, Part 623, Irrigation. Where the irrigation system does not meet the minimum uniformity, it should be modified to meet or exceed the minimum specified uniformity.
- Consider the effects irrigation water use may have on downstream flows or aquifers and the amount of water available for other water uses.
- Consider the effect irrigation may have on the salinity of soils, soil water and downstream water resources.

PLANS AND SPECIFICATIONS

An IWM plan will be developed site specifically for each irrigated field. Specifications for this practice shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. Specifications for this practice will be prepared for each field according to the criteria, considerations, and operation and maintenance described in this standard.

Record specifications using approved specification sheets, job sheets, narrative statements in the conservation plans, or other acceptable documentation specifying the applicable requirements, system operations, and components necessary for applying and maintaining the practice to achieve its intended purpose(s).

As a minimum, include the following in the plans and specifications for each field where IWM is applied:

- Location of site, crop(s), acreage where IWM is applied.
- Purpose(s) of irrigation water management.
- Timing of irrigation.
- Soil series and available water holding capacity.
- Method for measuring soil moisture.
- Method for adjusting irrigation to compensate for changes in the soil infiltration rate.
- Method for evaluating irrigation system uniformity.
- Method for measuring irrigation system application rate.
- Method for evaluating soil erosion.
- Method for adjusting the irrigation schedule(s) for chemical application.
- Method to determine if irrigation system is operating correctly.
- Method for recognizing excess runoff.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for use by the landowner or operator responsible for IWM. The O&M plan shall provide specific instructions for IWM applications to ensure proper management. As a minimum, the O&M plan items should include the following items as appropriate:

- Evaluating available field soil moisture
- Changes in crop evapotranspiration rates and changes in soil intake rate
- Adjusting the volume, application rate, or frequency of water application to achieve the intended purpose(s).

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

REFERENCES

Florida NRCS Conservation Practice Standard,
Nutrient Management, Code 590
Pest Management, Code 595
Florida Water Management District, Chapter 40-2 F.A.C.
National Agronomy Manual, Part 502, Wind Erosion
NEH Part 623, Irrigation, Chapters 2, 3, 13
NEH Part 652, Irrigation Guide
NRCS Form FL-ENG-449