USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

IRRIGATION WATER MANAGEMENT

CODE 449
(Reported by Ac.)

DEFINITION

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

PURPOSES

Irrigation water management may be applied for one or more of the following purposes:

1. To manage soil moisture to promote desired crop response;
2. To optimize use of available water supplies;
3. To minimize irrigation-induced soil erosion;
4. To decrease non-point source pollution of surface and groundwater resources;
5. To manage salts in the crop root zone;
6. To manage air, soil, or plant micro-climate;
7. To manage chemigation;
8. To manage substrate moisture conditions to promote optimal growth of containerized nursery plants.

CONDITIONS WHERE PRACTICE APPLIES

This practice is applicable to all irrigated lands and systems.

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

CONSIDERATIONS

Consideration should be given to managing precipitation effectiveness, crop residues, and reducing system losses.

Consider modifying plant populations, crop and variety selection, and irrigated acres to match available or anticipated water supplies.

Consider ways to improve an irrigation system to increase distribution uniformity or irrigation water application.

To decrease the potential for erosion, consider equipment modifications and/or soil amendments such as polyacrylamides and mulches or increased surface residue.

Consider the quality of irrigation water and the potential impact to crop quality and plant development. Quality of irrigation water should also be considered relative to its potential effect on the soil's physical and chemical properties, such as soil crusting, pH, permeability, salinity, and structure.

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

Avoid traffic on wet soils to minimize soil compaction.

Consider the effects that irrigation water may have on wetlands, wildlife habitats, riparian areas, cultural resources, and recreational opportunities.

Consider potential for spray drift and odors when applying agricultural or municipal wastewaters.

Irrigation water should be managed 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.

Consideration should be given to electrical load control/interruptible power schedules, repair and maintenance downtime, and harvest downtime.

Consider the need for other management practices such as residue management, nutrient management, and pest management.

CRITERIA

General Criteria Applicable to All Purposes

All work shall comply with federal, state, and local laws, rules, and regulations. Water shall not be applied in excess of the needs to meet the intended purpose.

Guidance for determining irrigation water management requirements is contained in the NRCS National Engineering Handbook (NEH), Part 623, Irrigation Guide, Chapter 2. Additional information is found in NEH, Part 652, Chapter 9.

Limited irrigation water supplies shall be managed to meet critical crop growth stages. On high water table soils, the water table shall be managed at a level that will allow the maximum storage of rainfall and provide the required moisture to the plant.

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 shall be operated so that the application rate is less than the basic soil infiltration rate as recommended in the NEH, Part 652, Irrigation Guide.

The following principles shall be applied for various crop growth stages:

1. The volume of water needed for each irrigation shall be based on plant available water holding capacity of the soil for the crop rooting depth, management allowed soil water depletion, irrigation efficiency, and water table contribution;

2. The irrigation frequency shall be based on the volume of irrigation water needed and/or available, the rate of crop evapotranspiration, and effective precipitation;

3. The application rate shall be based 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.

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

Water application shall be at rates that minimize transport of sediment, nutrients, and chemicals to surface waters and that minimize transport of nutrients and chemicals to groundwater.

If nutrients are applied, a Nutrient Management Plan shall be developed for the irrigation system. The plan shall be followed for the timing and rate of nutrient application. Net irrigation application shall not exceed the available water holding capacity of the soil within the root zone.

Additional Criteria to Manage Salts in the Crop Root Zone

The irrigation application volume shall be increased by the amount required to maintain an appropriate salt balance in the soil profile. The requirement shall be based on the leaching procedure contained in the NEH, Part 623, Irrigation Guide, Chapter 2.

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

The irrigation system shall 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, Irrigation Guide, Chapter 2.

Additional Criteria for Chemigation

The scheduling of nutrient and pesticide application shall coincide with the irrigation cycle in a manner that will not cause excess leaching of nutrients or pesticides below the root zone to the ground water or cause excess runoff to surface waters.

Weather conditions must be considered before applying chemicals. Chemigation shall not be applied if rainfall is imminent. Chemigation shall be accomplished in the minimum length of time needed to deliver the chemicals and flush the pipelines. Application amounts shall be lim-

ited to the minimum amount necessary to apply the chemicals to the soil depth recommended by label.

The pest and/or nutrient management plan, as applicable, shall be followed concerning the timing and rate of application.

Additional Criteria to Manage Substrate Moisture Conditions to Promote Optimal Growth of Containerized Nursery Plants

The physical properties of a container substrate shall be measured each time the amounts and types of components used to compose a substrate are changed.

Table 1. Recommended physical characteristic values for nursery container substrates after irrigation and drainage.

Parameter	Value
Total Porosity	50 to 85% volume
Air Space	10 to 30% volume
Container Capacity	45 to 65% volume
Available Water	25 to 35% volume
Unavailable Water	25 to 35% volume
Bulk Density	0.19 to 0.70 g/cc

A substrate with a high proportion of coarse particles has a high air space and a relatively low water holding capacity, thus making leaching of pesticides and nutrients more likely to occur.

Irrigation scheduling shall be based upon plant demand and not scheduled using a daily time clock. Irrigation schedules can be determined by container weight, color or feel of substrate, or indicator plants (i.e., plants used to indicate moisture stress). Substrate moisture sensors or amount of water vapor evaporated from an evaporation pan may also be calibrated to plant demand.

The volume of water passing through a container at each irrigation shall not exceed 25 percent of the water applied to the substrate surface. Increasing irrigation frequency and decreasing the irrigation amount can be used to reduce the amount of water, nutrients, and pesticides exiting the container.

SPECIFICATIONS

An irrigation water management (IWM) plan shall be prepared for use by the owner or others responsible for operating the system. The IWM plan shall be in accordance with this standard, and shall describe the requirements for applying the practice to achieve its intended purpose(s).

OPERATION AND MAINTENANCE

There are no operation and maintenance (O&M) aspects applicable to this standard. Necessary O&M items are addressed in the physical component standards associated with this standard.

SUPPORTING DATA AND DOCUMENTATION

The following is a list of the minimum data and documentation to be recorded in the case file:

1. Documentation of site visits on CPA-6 assistance notes. Include dates of site visits, name or initials of the person who made the visit, specifics as to what was inspected, all alternatives discussed, decisions made, and by whom;

2. Plan map of the managed site, including treatment areas;

3. A copy of the IWM plan, including job sheets or similar documents that specify the requirements for applying the practice in each field or treatment unit. The IWM plan shall include the following, as applicable:

   a. Timing of irrigation;

   b. Method for measuring soil moisture;

   c. Method for measuring irrigation system application rate;

   d. Method for adjusting irrigation to compensate for changes in the soil infiltration rate;

   e. Method for evaluating irrigation system uniformity;

   f. Method for evaluating soil erosion;

   g. Method for adjusting the irrigation schedule(s) for nutrient and/or pesticide application;

   h. Method for recognizing excess runoff.

REFERENCES

1. University of Delaware, Cooperative Extension Service. *Delaware Irrigation Handbook.*

2. USDA, Natural Resources Conservation Service. *National Engineering Handbook, Part 652, Irrigation Guide*.