

Introduction to Irrigation and Water Management

Introduction to Irrigation and Water Management
(Key concepts, objectives, and basic practices)

1. Why Irrigation Matters

- **Food security:** Provides reliable water to crops, stabilizing yields in regions with irregular rainfall.
- **Economic stability:** Increases farm profitability and supports rural economies.
- **Land utilization:** Allows cultivation on marginal lands and expands the area under high-value crops.
- **Climate resilience:** Mitigates the impact of droughts and extreme weather events.

2. Core Terminology

Term	Definition
Irrigation	Artificial application of water to soil or crops to meet their water needs.
Water Management	Planning, developing, distributing, and managing the optimal use of water resources.
Evapotranspiration (ET)	Combined loss of water from soil evaporation and plant transpiration.
Irrigation Efficiency	Ratio of water beneficially used by the crop to water applied (often expressed as a %).
Water Use Efficiency (WUE)	Crop yield produced per unit of water consumed (e.g., kg/ha/m ³).
Field Capacity	Maximum amount of water soil can hold after excess has drained away.
Wilting Point	Soil moisture level at which plants can no longer extract water, leading to wilting.
Deficit Irrigation	Deliberately applying less water than full crop demand to save water while limiting yield loss.

Introduction to Irrigation and Water

3. Types of Irrigation Systems Management

System	Main Features	Typical Efficiency*
Surface (Gravity) Irrigation – furrow, basin, border	Water flows by gravity over the field surface.	40–60%
Sprinkler Irrigation – center pivot, lateral move	Water discharged through nozzles, mimicking rainfall.	70–85%
Drip (Micro-irrigation) – surface or subsurface emitters	Water delivered directly to the root zone, low flow rates.	85–95%
Subsurface Irrigation – buried drip lines or porous pipes	Water applied below the soil surface, minimal evaporation.	90–98%
Flood Irrigation (a form of surface)	Entire field inundated; simple but low efficiency.	30–50%

*Efficiencies are typical ranges; actual performance depends on design, operation, and climate.

4. Water Management Planning Steps

1. Assess Water Resources

- Identify sources (rivers, reservoirs, groundwater, rainwater).
- Quantify reliable yield (annual/seasonal flow, recharge rates).

2. Determine Crop Water Requirements

- Use crop-specific ET (reference evapotranspiration) and crop coefficient (Kc).
- Calculate Net Irrigation Requirement (NIR):
$$[\text{NIR} = \text{ET}_c - \text{Effective Rainfall}]$$
- Adjust for soil water holding capacity (field capacity – wilting point).

3. Select an Appropriate Irrigation System

- Match system to **soil type, topography, crop, and water availability**.

Introduction to Irrigation and Water

Management

4. Design the Layout

- Determine lateral spacing, emitter flow rates, pump capacity, and distribution uniformity.

5. Implement Scheduling

- Choose a scheduling method:
 - **Time?