

IRRIGATION

IRRIGATION AND ITS METHODS

IRRIGATION

It is defined as the artificial application of water to soil for the purpose of supplying water essential to plant growth

OBJECTIVES OR PURPOSES OF IRRIGATION

- To supplement the water available from rainfall
- To contribute to the soil moisture available from ground water
- To supply moisture essential for plant growth.
- To provide crop insurance against short duration droughts
- To make nutrients available to plants
- To soften the soil for agricultural practices
- To leach or dilute salts in the soil
- To increase bacterial activities in the soil
- To cool the soil and atmosphere, thereby making more favourable environment for plant growth.

SOURCES OF IRRIGATION WATER

There are three sources of irrigation water in Pakistan

Precipitation

The source of all water supplies is atmospheric precipitation i.e., rainfall, dew, fog/mist, hail and snow. Amongst those the major source of water available for agriculture is rain. Rainfall should have the following characteristics.

Amounts should be sufficient to replace moisture depleted from the root zone.

Frequency should be often enough to replenish the soil moisture before plants suffer from lack of moisture

Intensity should be low enough so that water can be absorbed by the soil. However, distribution and intensity of rainfall is so erratic that successful crop husbandry is not possible with rain alone.

2.) Surface water

It covers all the river water from where its direction is changed by constructing headworks, dams and through it in canals which take it to place of necessity. The basic source of surface water is precipitation in the form of rainfall or snowfall. Surface water also includes flood water. As flood passes over the surface of land, water is absorbed by the soil and stored for subsequent use by crop plants. Agricultural production along both sides of major rivers is wholly dependent upon flood water.

3.) Ground water

Ground water is lifted to the soil surface through wells and tubewells. Upward movement of ground water by capillarity into the rootzone can be a major source of water for plant growth.

4.) Flood Water

Flood water is similar in some respects to irrigation water, but it is not supplied by man. As floods pass over the surface of the land, water is absorbed by the soil and stored for subsequent use by plants. In some regions agricultural product is wholly dependent upon flood water.

METHODS OF IRRIGATION

Methods of irrigation vary in different parts of the world, and on different farms, within a community, because of differences in soil, topography, water supply, crops and customs. However, irrigation water is applied to land by following methods:

1. Surface Irrigation

- a. Uncontrolled or "wild" flooding
- b. Controlled flooding
 1. Border flooding
 2. Check flooding
 3. Basin flooding
- c. Furrow irrigation.

Sub-Surface or Sub-Irrigation.

Controlled by lateral supply ditches

Uncontrolled, from excess application of water to adjacent of

Sprinkler Irrigation

SURFACE IRRIGATION

In this method water is applied directly to the soil surface in a form of sheet from a channel located at the upper reach of the field. In surface irrigation water may be applied as

Uncontrolled or wild flooding

Water is applied from field ditches (water channels) without any ridges or to guide flow of water or restrict its movement. Supply ditches are built in the field. It is practised largely where irrigation water is abundant and inexpensive, and lands have such irregular surface that other methods are impractical.

Controlled flooding

In this method irrigation water is turned into blocks, from field ditches. This method is practised where land, water and labour is expensive. In controlled flooding water is applied in the following ways

Border method

The land is divided into a number of long parallel strips called borders that are separated by low earthen ridges (bunds). The border strip has a uniform gentle slope in the direction of irrigation. The function of the parallel ridges is to guide a sheet of flowing water as it moves down the slope. Each strip is irrigated independently by diverting a stream of water from the channel at the upper end of the strip. The water spreads and flows down the strip in a sheet confined by the border ridges. The irrigation stream must be large enough to spread over the entire width between the border ridges without overtopping them. When the advancing water front either reaches the lower end, or a few minutes before the stream is cut off. There are not specific rules governing this decision; only the irrigator's experience enables him to supply the correct amount of water to each border. As borders are laid along the general slope of the field, it is called straight border irrigation.

The length and width of a border are adjusted keeping in view the size of the available water supply, soil type and slope of land. In Pakistan, irrigated land is usually divided into acres with dimensions of 220 x 198 feet. The width of a border strip can thus be 10-50 feet. A smaller size is more efficient in water saving.

Suitability

1. It is best suited to soils which permit the required land leveling at a reasonable cost.
2. Most suitable to soils having moderately low to moderately high infiltration rates.
3. To irrigate all close-growing crops like wheat, barley, fodder crops and legumes. It is not suitable for rice which requires standing water during most parts of its growing season.
4. Best suited to large, mechanized farms since it is designed to produce long uninterrupted field lengths for ease of machine operations.

Advantages

1. Border ridges can be constructed economically with simple farm implements.
2. Labour requirement is less.
3. Uniform distribution and high water application efficiencies.
4. Large irrigation streams can be efficiently used.

2) Contour Border Irrigation (CBI)

Contour border irrigation is practised in hilly areas on land having a steep slope or undulating fields and where levelling is not feasible. In CBI, ridges are made across the slope so that field is divided into a series of strips on the approximate contour. Thereafter, each strip is precisely levelled and is called a contour. Thus, a number of steps (contours) are formed at successive elevations across the slope. Ridges of the contours are constructed high enough to contain heavy rainfall or irrigation water to ensure soil and water conservation.

2) Check Basin Irrigation

This system is quite common in Pakistan and many other countries and is the simplest of all methods of irrigation. In this method field is divided into smaller units (plots or beds) each having a nearly level surface. Low bunds (ridges) are constructed around the units, forming basins within which the

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Types of Artificial Sub-irrigation

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- ...here is no problem to control water

4. There is problem for the farmers to control irrigation water when the available irrigation streams are bigger
5. It does not suit to the crops that are sown by broadcast method
6. Long furrows result in deep percolation
7. In case of greater slope, there is excessive erosion near the upper end of the field

II. SUB-SURFACE OR SUB-IRRIGATION

In certain areas, the soil and topographic conditions are suitable for the application of water to soils directly under the surface. This process of irrigation is known as sub-irrigation. For successful sub-irrigation, an impervious sub-soil at a depth of 6 feet or more, a highly permeable loam and sandy loam surface soils, uniform topographic condition and moderate slopes are essential. Irrigation water is applied in shallow ditches about 3 feet wide and spaced 100 to 300 feet apart. Water sinks into the soil causing the water table to rise high enough to moisten the root zone soil by capillary action.

When a pipe system is placed in the soil well beneath the surface, the method is designed as artificial sub-irrigation. Water comes in the soil slowly and slowly through the openings in the under ground pipes, and distributed in the soil by the capillarity movement. The success of this method depends upon the favourable soil condition, which permit free lateral movement of water, relatively rapid capillary movement in the root zone soil very slow downward/movement in the sub-soil.

Advantages of Artificial Sub-irrigation

1. It is a permanent method of irrigation. Once pipes are placed in the soil then no further expenditure is required.
2. Evaporation losses of moisture are minimum.
3. There is no wastage of land.
4. There is no interference in tillage operation and movement of farm machinery.
5. Deep root system is encouraged.
6. Least injury to the soil structure, so once a mulch is produced, it remains effective for a longer period.
7. There is no problem to control water.

Advantages
Cost of pipe
Only possible
Sometimes.

OVERHEAD

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Advantages of Artificial Sub-irrigation

- Cost of pipes and placing them in the soil is high
- Only possible under favourable soil and climatic conditions
- Sometimes, the choking of openings of underground pipes takes place

OVERHEAD SPRAY OR SPRINKLING IRRIGATION

The method of applying water to the surface of soil in the form of spray, somewhat as in rain is known as sprinkling or overhead spray. Water is passed through a pipe which is allowed to come out from nozzles. Three general types pipe, perforated and rotating sprinklers are used.

Fixed nozzle pipe

Parallel pipes are installed about 50 feet apart and supported on rows of posts. Water is discharged at right angles perpendicularly from the pipe line.

Perforated sprinkler lines

These are used more extensively in orchards and nurseries. The pressures used are less than 35 pounds per square inch (Psi), and as low as 10 pounds per square inch. They do not cover a very wide strip.

The Rotating Sprinklers

These sprinklers are used very extensively. The main advantage of this type of sprinkler over other types is its ability to apply water at slower rate while using relatively large nozzle openings. The pressure for rotating sprinklers normally ranges from 30 psi for the smaller sprinklers to over 100 psi for the large rotating sprinklers.

Pressures

Sprinkler systems operate under a wide range of pressures from 5 psi to 100 psi. The desirable pressure depends upon the power costs, area to be irrigated, type of sprinkler used, sprinkler spacing and crops being irrigated. However, four ranges of pressure are common.

Low pressure: It ranges from 5 to 15 psi.

2. Medium pressure: It ranges from 15 to 30 psi
3. Intermediate pressure: It ranges from 30 to 60 psi
4. High pressure: It varies from 60 to 100 psi

Types of sprinkler system

1. Semi-permanent system
2. Portable system
3. Moving lateral lines
4. Gravity sprinkler system

Conditions favouring sprinkler irrigation

1. Soils should be too porous for good distribution of water by surface irrigation.
2. Shallow soils the topography of which prevents proper levelling for surface irrigation
3. Land having steep slopes and easily erodible soils.
4. Irrigation channels too small to distribute water efficiently by surface irrigation.
5. Labour available for irrigation is either not experienced in surface methods of irrigation or is unreliable
6. Land needs to be brought into production quickly

Advantages of Sprinkler irrigation over surface Irrigation

1. Water measurement is easier with sprinkler than surface method.
2. There is lesser interference for cultivation and other farming operations with sprinkler than surface irrigation.
3. Higher water application efficiency can normally be obtained by sprinkler irrigation.
4. When water for domestic use and for irrigation purposes comes from the same source, a common distribution line can frequently be used
5. For areas where less irrigation is required, sprinkler irrigation can be provided at a lower capital investment per acre of land irrigated than surface irrigation.
6. Frequent and small applications of water can be applied readily by sprinkler irrigation
7. Whenever water is delivered to the field under gravity pressure, the sprinkler irrigation is better and economical.