CHAPTER 2

OBJECTIVES

At the end of this chapter, students should be able to:

â—† explain the meaning of irrigation.

â—† state different types of irrigation system.

â—† describe each type with its advantages and disadvantages.

â—† list importance and problems of irrigation system.

2.1 Introduction

Agricultural crops require adequate supply of water to produce optimal yield. The water requirement of any crop is the amount of water needed by the crop within a given period of time for its normal growth under field conditions. Water is the most important environmental factor that influences plant growth and production. However, water availability becomes insufficient for proper growth and development of crops, so there is the need to supply water to the plant through irrigation. Irrigation, therefore, is the supply of water artificially to crops by farmer to supplement insufficient water to crop production. It is an important operation in agriculture to enhance crop production especially during the dry season or in areas with low rainfall such as the Sahel savanna regions and deserts. Provision of irrigation facilities is fundamental to the efforts of the federal government to ensure national food security.

2.2 Meaning of Irrigation

Irrigation is the supply of water by the farmer to crops in order to supplement insufficient water to aid crop production. It is done to enable crops to grow and mature as well as to increase their yields. Irrigation makes intensive cropping possible in the semi-arid and arid regions. Irrigation makes it possible for crops to be planted two or three times in a year.

2.2.1 Characteristics of soil that can be irrigated

The soil

â must not be easily waterlogged.

â must be well drained, moderately structured and have medium-sized grains.

â must not be easily eroded.

â must not be too porous so as to prevent rapid water percolation.

â must not be too sloppy to avoid erosion.

2.2.2 Sources of irrigation water

â Rivers

â Lakes
â Streams
â Ponds
â Dams
â Boreholes
â Reservoirs
â Springs

2.3 Types of Irrigation System

Irrigation water can be applied to the farm either below or above the soil surface. There are three main types of irrigation.

2.3.1 Surface irrigation

This is an irrigation system whereby water is directed through surface channel to flow into the farm. Water is conveyed from the water source such as stream, river or dam to a farmland situated on gentle slope to permit water to flow into the farm. This method is further subdivided into the following types:

(a) Wild flooding: This is a system whereby water is allowed to flow freely from field ditches into the farm without bonds to check its flow. This is otherwise called uncontrolled flooding. It is practised in areas where water is in abundant supply and readily available

FIGURE 2.1 Wild flooding

(b) Border irrigation: This is otherwise called basin irrigation. It refers to the controlled flooding of farmlands. Flood water from a stream or other water sauces is channelled into the farmlands with bunds at intervals to control the water flow.

(c) Furrow irrigation: This is a type of controlled flooding whereby water is channelled through the furrows into the

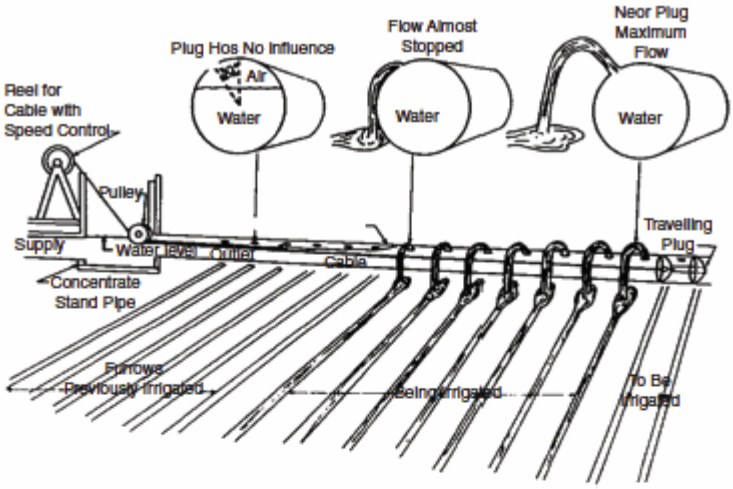

FIGURE 2.2 Border or basin irrigation

FIGURE 2.3 Furrow irrigation

farmland. As the water flows down or across the slope, some water seeps into the bottom and sides of the furrow to provide the desired wetting of the beds. This is commonly used for vegetable gardens.

2.3.1.1 Advantages of surface irrigation

â Surface irrigation is relatively cheap to put in place.
â It ensures even spread of water on the farmland.
â There is an economical and efficient use of water.
â It is easy to maintain.
â It can be used on large farms.
â The channel or canal could be used to raise fish.

2.3.1.2 Disadvantages of surface irrigation

â The water may be difficult to control.
â It is not ideal for hilly or undulating landscape.
â It cannot operate well in sandy soils.
â Not all the crops are flood-friendly.

2.3.2 Overhead or sprinkler irrigation

This is an irrigation system whereby water is supplied to the crops from above the ground surface using mechanical devices. The device is called a sprinkler. Water is channeled through pipes to the farm and sprayed through the nozzle of the sprinkler evenly on the crop.

2.3.2.1 Components of the sprinkler

A sprinkler system consists of a pump, the main pipeline, the laterals, the risers, the sprinkler heads, nozzles and the nozzle control valves.

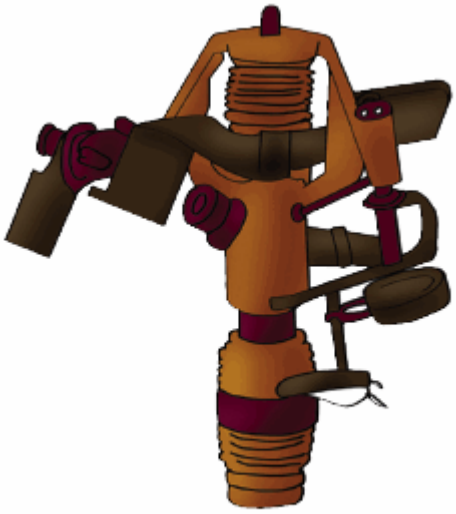

FIGURE 2.4 A sprinkler system

There are three common types of sprinkler as follows:

(a) Portable sprinkler system: This is designed to be moved from one field to another, either manually or mechanically. It has portable main lines, laterals and pumping plants.

FIGURE 2.5 A portable sprinkler

FIGURE 2.6 A semi-portable sprinkler

(b) Semi-portable system: This consists of main pipelines buried underground, portable laterals and sprinklers and a fixed pumping plant.

(c) Solid set sprinkler system: This is the system where every component is fixed. It is a permanent system where the main lines are buried underground and the lateral lines and sprinkler heads remain fixed. It is commonly used in orchards.

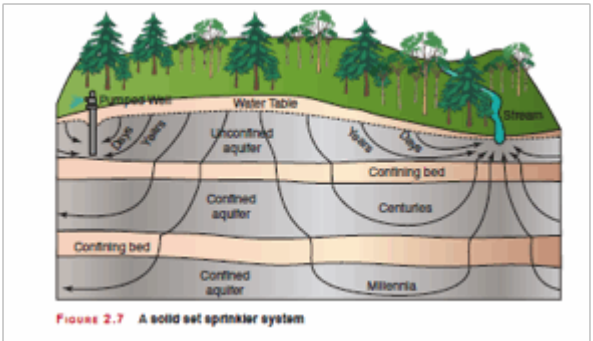

FIGURE 2.7 A solid set sprinkler system

2.3.2.2 Advantages of sprinkler irrigation

â Water can be controlled and regulated, thus reducing water wastage.

â It allows the application of fertilizers and herbicides along with the irrigation water.

â The system can be used for arable and permanent crops.

â It is useful for seedlings in the nursery.

â It is ideal for irrigation in the semi-arid and arid areas.

â Salinity is reduced.

2.3.2.3 Disadvantages of sprinkler irrigation

â Strong winds may affect the even distribution of water on the crops.

â The cost of purchase and installation of sprinkler irrigation equipment is very high.

â It requires high power source to produce and maintain the high pressure for pumping water into the pipes. It is not suitable for sloppy landscapes.

â There is high cost of maintenance and repair.

â Sprinkler equipment may obstruct free movement of human and machines on the farmland.

â Sea or ocean water is not ideal as the salt can cause rusting or decay of the pipes.

2.3.3 Underground irrigation

This is also called trickle irrigation or drip irrigation. A pipe is buried under the ground and holes are bored on the pipe. Water trickles out through the holes into the soil and this water is allowed to flow in predetermined quantities.

2.3.3.1 Advantages of underground irrigation

â It is a very efficient method and does not cause waterlogging.

â Ideal for soils with high infiltration and low water-retention capacity.


FIGURE 2.8 Underground irrigation

â It reduces soil water evaporation.

â It supplies adequate quantity of water to different roots according to their depth in the soil.

â It is the most suitable method for semiarid and arid regions where water is not always available.

â Fertilizers can also be applied along with the water

2.3.3.2 Disadvantages of underground irrigation

â The cost of installation of pipes is very high
â There is the risk of blockage of the holes in the pipes by the soil particles or the roots of trees and shrubs growing around
â Salinated or sea water is not good for this system
â It requires high technical knowledge

2.4 Importance of Irrigation

â It supplies water which is essential for plant growth.
â It provides a form of insurance for the crops against short periods of drought.
â It keeps the soil and the atmosphere sufficiently cool, thereby ensuring a favourable environment for plant growth.
â It helps to wash away or dilute excess or unwanted salt in the soil.
â It sometimes serves as a means for supplying some water-soluble plant nutrients to the crops.
â It keeps the soil sufficiently soft for ease of tillage operations.
â Irrigation flood helps to control weeds, such as in swamp rice field flooding.
â It makes farmers independent of the weather and carry out their work with more security and efficiency.
â Different crops can be cultivated when practising irrigation.
â It makes early planting possible and increases the yield of crops.
â It provides opportunity for organized agriculture in arid areas.
â It makes planting of crops possible all year round.

2.5 Problems of Irrigation System

The following problems are associated with irrigation:
â High cost of purchase and installation
â High cost of maintenance of the system especially the sprinkler irrigation system
â Not suitable for all land terrain
â Inadequate trained personnel to man irrigation systems both operations and maintenance
â Irrigation can prevent use of farm machinery, that is, it hinders free movement of farm machines and implements
â It obstructs free human movement and hand operations on the farm
â Sufficient water source in streams, rivers and lakes or dams is a problem – low volume of water can affect irrigation
â Too much dissolutions of salts in irrigated water hinder proper crop growth
â Irrigation encourages build-up of pests and diseases from dry surroundings which invade and damage crops in irrigated lands
â Pollution of irrigated water with dangerous chemicals may be toxic or harmful to crops or animals
â Irrigation converts good agricultural soil to waterlogged soil if not properly practised
â Irrigation system is profitable only if used on high-value crops

Activities

1. Visit a river basin development authority or dams and irrigation projects in your locality and observe how a farm is being irrigated and also the system of irrigation employed.

2. Carry out a simple irrigation project on your plot in the school farm.

SUMMARY

Irrigation is the artificial application of water to the soil to supplement insufficient rainfall.

â—† It is aimed at increasing the soil water content to an optimum level for crop growth.

â—† Water can be applied to the farm either below or above the soil surface.

â—† The three main types of irrigation are surface irrigation, overhead or sprinkler irrigation and underground irrigation.

â—† Irrigation is very important because

âœ§ it softens the soil.

âœ§ makes early planting possible.

âœ§ improves crop yield.

âœ§ helps to cool the soil and atmosphere.

âœ§ makes farmers to be less dependent on rainfall.

â—† Problems or disadvantages of irrigation:

âœ§ It is very expensive.

âœ§ It encourages pests and diseases.

âœ§ It makes movement of farm machinery difficult.

âœ§ It may cause pollution of the environment.

REVISION QUESTIONS

Essays

1. (a) Define the term irrigation.

(b) Mention three types of irrigation.

(c) Give five reasons why irrigation schemes are necessary in Nigeria.

(d) State any five problems associated with irrigation.

2. Describe the different types of surface irrigation systems.

3. Describe the types of sprinkler system irrigation and state four advantages and three disadvantages of sprinkler irrigation.

4. (a) State three methods of irrigating a small nursery.

(b) Enumerate three factors to be considered in the choice of each of

(i) surface irrigation method

(ii) sub-surface irrigation method.

(c) State two advantages of sub-surface irrigation.

5. (a) State four problems associated with overhead irrigation.

(b) State two similarities and three differences between sprinkler and surface irrigation

Objective Questions

1. The appropriate irrigation method for upland rice field is

(a) sprinkler.

(b) drip.

(c) flooding.

(d) underground.

2. Irrigation water is passed underneath the soil through

(a) sprinkler.

(b) canals.

(c) drips.
(d) pipes.

3. The problems associated with farm irrigation do not include
(a) high cost of irrigation equipment.
(b) increase in soil pH.
(c) continuous supply of irrigation water.
(d) build-up of pests on farms.

4. The application of water to sub-soil through perforated pipes is known as
(a) flooding.
(b) sub-surface irrigation.
(c) channel irrigation.
(d) overhead irrigation.

5. Flood irrigation is mainly used in
(a) arid area.
(b) tropical area.
(c) sloppy area.
(d) savanna area.

6. The method of irrigation suitable for use on a steep slope is
(a) sprinkler.
(b) furrow.
(c) flood.
(d) shadoof.

ANSWERS

1. a 2. d 3. c 4. b 5. a 6. d