

Q1) Define microirrigation / irrigation. Describe drip and sprinkler irrigation give their advantages and disadvantages.

Ans → Irrigation :- Application of water to soil to supply moisture essential for crop growth is called as irrigation

microirrigation :- it is the one of the latest method of irrigation which is increasing which is becoming increasingly popular in which water scarcity and salt problems.

* classification of methods of irrigation *

1) Surface irrigation

वर्षावर्षाव

i) wild flooding - वाणी डगे वर्षाव

ii) Border :- (a) Straight (b) Contour (c) Broad bed furrow

iii) Basin :- (a) Ring (b) Contour (c) Rectangular

iv) Furrow :- (a) Deep furrow (b) corrugulation

सुरकुचा पाडी

2) Sub-surface irrigation :-

हार्थव

i) corrugated pipes - दाया पडले

ii) Rain gun - कडाचाली वलय भाग

iii) Rotating head

3) Sprinkler irrigation :-

विथन

i) Rotating head

ii) profeting head

4) Drip irrigation or trickle / microirrigation.

* Sprinkler Irrigation *

i) This method consists of application of water to soil in the form of spray, is some what as rain

ii) In sprinkler irrigation water is pumped under pressure, carried through high pressure from main pipeline to the area to be irrigated and let out through.

iii) The system comprise four parts :-

Ⓐ Power generator Ⓑ Pump

Ⓒ Pipe line Ⓓ Sprinkler nozzle.

iv) Components of sprinkler irrigation system are :-

Ⓐ Pumping set Ⓑ main line Ⓒ lateral line

Ⓓ sprinkler heads Ⓔ Debris screen

Ⓕ Destilting basins Ⓖ Booster pumps

Ⓗ Take off valves Ⓖ Flow control valves.

* Advantages

i) It ensures uniform distribution of water.

ii) Surface runoff and percolation loss eliminated.

iii) Best for sandy soils, undulating & steep slope soils.

iv) protect crops against frost and high temp.

v) more land is available for cropping.

vi) Drainage problem eliminated.

* Disadvantages

i) Initial cost is very high.

ii) Require high skill operator.

iii) Water distribution may be affected by wind.

iv) High evaporation losses.

v) Higher power requirement.

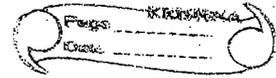
vi) Not suitable for jute & rice.

vii) Can both be used in heavy soils.

viii) stable water supply is needed.

accompanied

poly vinyl chloride



* Drip irrigation *

- i) In this method irrigation is accompanied by using small diameters plastic lateral lines with device called emitters or droppers at selected spacing.
- ii) The system applied water slowly to keep the soil moisture within the desired range for plant growth.
- iii) The main components of drip irrigation system are mainline, sub mains, laterals and emitters. The emitters are made up of PVC (poly vinyl chloride).
- iv) The ancillary components include a valve, pressure regulator filters, pressure gauge, fertilizer application components etc.

* Advantages *

- i) very high irrigation efficiency.
- ii) Salty water can be applied.
- iii) Increase the yield range from 20% to 100%.
- iv) No water loss through evaporation, percolation, runoff etc.
- v) Fertilizers can be applied.
- vi) Limited weed growth
- vii) Reduces salinity hazards.

* Disadvantages *

- i) High initial cost.
- ii) Regular frequent maintenance.
- iii) Salt accumulation near plant
- iv) Only suitable for high value and widely spaced crop.

Field crop in evapotranspiration

② Define water use efficiency and explain the measures to improve water use efficiency. Factors affecting it crop management practises.

Ans :- water use efficiency :- It is the ratio of crop yield (y) to the amount of water deleted by the field crop in evapotranspiration.

* Crop management practises to improve WUE *

1) Time, depth and sowing pattern :-

i) Timely sowing ensures proper temp. and other soil physical conditions favouring optimum crop growth. Delayed sowing exposes the crops to greater competition with weeds.

ii) Depth of sowing is important factor, seeds sown near the surface suffer from lack of moisture as the soil dries quickly by evaporation. Deep down seeds take longer time to emerge & seedlings are weak.

iii) Plant population affects the WUE indirectly that influences crop yield.

2) Reduction of evapotranspiration :-

⊙ Use of Antitranspirants :- Any substance, than an application to the surface of plant reduces transpiration is termed as "antitranspirant". Substance like Acetic Acid, Kaoline reduce transpiration by inhibiting stomatal opening.

⊙ Use of growth retardants :- Certain chemicals like cycocel and phosphon when applied to plants reduce their height and vegetative growth.

⊙ Use of mulches :- mulches are mainly used for soil-water conservation, soil erosion control but they influence factors like temp, weed competition, disease and pests infection, availability of nutrients and organic matter content of soil and there by influence crop growth.

2) Use of shelter belts :- Taller shelter belts traps hot winds reducing evaporation and transpiration from cropped area.

3) Soil moisture supply :- Limited amount of water can be best way to obtain maximum crop water use efficiency by irrigating the crops at their critical growth stages.

4) Method of irrigation :- Field water use efficiency is generally always higher with sprinkler and drip irrigation than surface methods of irrigation.

5) Fertilizer application :- WUE of crops invariably increases with the application of fertilizers on deficient soils in under adequate soil moisture conditions as they increase crop yield.

6) Weeds and their control :- Weeds compete with crop plants for moisture, food nutrients and light. Hence crop yield is reduced due to weed infestation. Therefore control of weeds is essential to reduce the losses of ET through weeds and increase WUE.

7) Insect, pest and disease :- Use of the maintenance of good drainage and use of chemical pesticides for the control of pest and disease along with other management practices is essential for harvesting a good yields and increase in WUE.

* Factors affecting WUE *

- 1) Climate conditions
- 2) Crop species.

③ What are different methods of soil moisture estimation why it is necessary

④

Ans :- * Methods of soil moisture estimation *

Ans

A] Direct method

B] Indirect method.

A] Direct method :-

- i) Gravimetric method
- ii) Volumetric method
- iii) Methyl alcohol method
- iv) Calcium carbide method
- v) Spirit spirit burning method
- vi) Infrared balance method

B] Indirect method :-

- i) Use of Tensiometer
- ii) Gypsum block
- iii) Pressure membrane apparatus
- or Pressure plate method
- iv) Neutron moisture meter
- v) Feel and appearance of soil.

* Essentiality of Soil moisture estimation / objectives

- 1) To find out the availability of soil water to plants.
- 2) To work out available water storage capacity of soil.
- 3) To determine optimum soil water regimes, depletion patterns and consumptive use for various crops.
- 4) To find out suitable time for irrigation.
- 5) To calculate the amount of irrigation water needed to recharge the root zone.

* Biological classification of water *

- 1) Unavailable water
- 2) difficultly available water
- 3) desirably available water
- 4) super flows water

Ques :- classify the soil water on the basis of physical forces and mode of retention.

Ans :- Classification of soil water

- 1) Hygroscopic water
- 2) Capillary water :- i) Inner ii) Outer
- 3) Gravitational water
- 4) Water vapour

* Capillary water :- i) This is the water held by force of surface tension around soil particles and in capillary spaces.
ii) Capillary water is rather loosely held between 31 atm to $\frac{1}{3}$ atm tension and is capable of movement within soil. The nutrients are dissolved in it and therefore it is most useful water for plants.

iii) It is divided into two parts :- a) Inner b) Outer.
Inner capillary water :- It is the part of capillary water which is nearer to the hygroscopic water. It is tightly held and moves very slowly than outer capillary water.

Outer capillary water :- It moves readily from place to place. It is the most useful water for plants because of its very quick availability.

* Gravitational water :- i) It is the part of soil water that moves freely in response to gravity and drains out of the soil.

ii) The water excess from capillaries start moving as free water through the macropores and it is called gravi. water

iii) It is superfluous and as such is of no use to plants

iv) When the downward movement of g. water is more some plant nutrients are leached out and when it is low it will adversely affects the creation of soil.

v) It is held by at or atmospheric tension.

5) Define and enlist soil moisture constants

Ans :- soil moisture constants :-

The terms which are used for study soils water and its availability are known as soil moisture constants.

* Types of soil moisture constants *

- 1) oven dry weight
- 2) Air dry weight
- 3) Hygroscopic coefficient
- 4) wilting point
- 5) field capacity
- 6) maximum capillary capacity
- 7) maximum water holding capacity
- 8) moisture equivalent

6) Define drainage and give its types

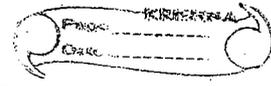
Ans :- drainage :- Removal of excess gravitational water from the soil by artificial means to enhance crop production.

* Types of drainage *

- 1) Surface drainage :- Removal of excess surface water from the open drains are dug along the borders of field.
- 2) subsurface drainage :- Underground drains soil rather than the surface. They takeout only excess water.
- 3) Bio-drainage :-> Plantation of high water consuming trees like eucaly.
- 4) Close drains :-
- 5) Tile drains
- 6) mole drains

seldom

luxuriantly - जमीने विलो



* Effects of bad drainage on soil & plants *

A) on soil मिट्टी पर

- 1) It favours soil erosion.
- 2) Soil become water logged resulting in insufficient supply of O_2 to plant roots and beneficial bacteria.
- 3) Denitrification of occurs because of competition for N by soil-microorganisms.
- 4) Badly drained soils warm up very slowly, these are called as "cold soils".
- 5) Granulation seldom occurs in water logged soils and it results in poor tilth.
- 6) Soils become salty due to accumulation of salts on surface.
- 7) Land becomes marshy and unfit for cultivation.

B) on plants

- 1) Poor growth :- Seed germination is delayed, leaves of plant becomes yellow in colour & plant growth is stunted.
- 2) Shallow rooting :- Root development in poorly drained soils is shallow. This causes a sudden deficiency of water and plant may wilt.
- 3) Suffocation of plant roots :- There may be suffocation of plants roots and sterrivation of plants because the roots can not supply adequate nutrients to the plants. संकोच
- 4) Application of fertilizers would go waste as the crop can not grow luxuriantly.
- 5) There may be more incidence of insect, pests and disease e.g. boll shedding in cotton and rot in sugarcane.

7) Give the causes of water logging.

*

- Ans :-
- 1) Heavy Rainfall and over irrigation
 - 2) Flooding (झर) of rivers during storms, cyclones.
 - 3) Seepage from the reservoirs, canals.
 - 4) Low elevation near sea ingress of sea water.
 - 5) Overland flow from adjacent area.
 - 6) Impervious (अक्रिय) stratum (थर) below top layer abstract seepage.
 - 7) Inadequate drainage
 - 8) Flat topography
 - 9) Poor irrigation management
 - 10) Obstruction of natural drainage (अवरोध)
 - 11) Unsuitable cropping pattern.

ir

s

q

n

wi

* Short Note :- functions of water.

*

8) Que → Give the role of water in plant. Give strategies for utilization of poor quality water.

1)

Ans :- Role of water in plants

- 1) Water is the main constituent of protoplasm or cytoplasm present in the cell. 2)
- 2) All physiological processes of plant are directly or indirectly influenced by water status of soil. 3)
- 3) Important constituent of plant tissue. 80% in herbaceous plants and over 50% in wood plants. 4)
- 4) Water is universal solvent. Several plant nutrients dissolve in it. It facilitates movement of these materials from cell to cell. 5)
- 5) Essential for growth and development of plant from germination to maturity.
- 6) Essential for growth of microorganisms, decomposition of organic matter and all chemical and biological activities.
- 7) Main constituent in the process of photosynthesis.

* Poor quality irrigation water:

i) Any water for irrigation containing ingredients in inadequate portion that allows the spoiling health of soil as well as crop called as poor quality irrigation water.

ii) Water containing total dissolved salts more than 1.5 mmhos/cm is, & more than 3ppm boron, having SAR more than 18 is not suitable for crop.

iii) Quality of irrigation water is judge with three parameters :-

- Ⓐ Total salt concentrations
- Ⓑ Sodium Absorption Ratio
- Ⓒ Bicarbonate and boron content.

* Effects of poor quality irrigation water on plants & soil *

- 1) Affects the water uptake of plants and results in slow and reduced crop growth and yield.
- 2) Rate of water infiltration and permeability become poor.
- 3) Causes crusting of seed bed, water logging of surface soil.
- 4) Reduces available water capacity of soil.
- 5) It may greatly add the cropping difficulties through disease, salinity, weeds, O₂ supply and nutritional problems.

*
(9) Que :- What is scheduling of irrigation. Explain various approaches for it. (10)

Ans :- Scheduling of irrigation :- An

Irrigation scheduling is one of the important aspect of efficient management of irrigation. water for crop production and improving water use efficiency.

It is the one of the important aspect of efficient management of irrigation, water for crop production and improving water use efficiency. *

* Various Approaches *

1) Plant approach (2)

- a) General appearance of the crop
- b) Use of indicator plants (11)
- c) Critical growth stages of crop
- d) Leaf temp.
- e) Leaf water potential (3)
- f) Stomata resistance

2) Soil moisture approach (11)

- a) Feel and appearance of soil (d)
- b) Depletion of available soil moisture (soil water content) (11)
- c) Soil moisture tension (r)

3) Climatological approach (10)

- a) Cumulative pan evaporation (Christian method)
- b) IW/CPE Ratio
- c) Climatic computation of ET and WR (4)
- d) Irrigation indicator
- e) water budget method. (11)

Read All approaches.

Q10) What is water requirement. Describe factors affecting it. Approaches for determination.

Ans - Water Requirement :- water requirement of crop is quantity of water regardless of source, needed for normal crop growth and yield in a period of time at a place may be supplied by precipitation or by irrigation or by both.

* Factors affecting water requirement *

1) Soil type :- i) soil texture decides the rate of evaporation
ii) In coarse textured soil rate of evaporation is always higher as compared to fine textured soil.

2) Crop grown :- i) long duration crops with deep roots & high leaf area increases total water loss from soil.
ii) Dwarf strain crops requires less water as compare to the taller ones.

3) Climate :- i) Most climatic factors affects directly or indirectly on water requirement.

ii) High temp. and wind velocity increases moisture demand of atm, which increases ET rate.

iii) Hot and dry air flowing over surface at higher rates are always responsible for increasing water loss and increase more demand for soil moisture.

iv) water requirement of ^{same} crop is higher in arid or semiarid areas as compared to humid regions.

4) management practices :- i) management practices like weeding and hoeing can reduce water loss.

ii) whereas frequent irrigation to crop increases water losses from cropped area.

3) Approaches for determination of water requirement.

- 1) Transpiration Ratio
- 2) Depth-Interval approach
- 3) Soil-moisture depletion approach
- 4) Field experimentation
- 5) Climatological approach.

ⓐ various climatic parameters like temp, wind velocity, Relative humidity, evaporation are measured.

ⓑ Using this data and empirical formula, the ET, consumptive use is calculated.

ⓒ which helps to irrigate the crop as per demand.

Ques :- Explain evapotranspiration and factors affecting it.
Ans :- Evapotranspiration :- It is the total amount of water loss due to transpiration by crop and evaporation from the soil surface during a specified time from a particular area.

* Factors affecting ET *

Evapotranspiration is influenced by atmospheric factors, crop factor, soil factors, water factors.

1) Atmospheric factors :- Among the atmospheric factor radiation, precipitation, sunshine, wind velocity, temperature and relative humidity are important.

2) Soil Factor :- Depth of water table available soil moisture and amount of vegetative cover on the soil influences soil moisture. Plant morphology, crop geometry, plant cover, stomatal density and root depth are important in ET.

3) Crop factor :- Such as variety, growth stage, crop duration, plant population and growing season are the crop factors effects on ET. Soil factor such as texture, structure depth & topography, climatic factors such as temp. crop management practices such as tillage, fertilizer application, weeding etc.

4) Water factor :- frequency of irrigation and quality of water also have considerable effect on ET of crop.

(12) Ques :- Explain process of Active and passive absorption. Factors affecting water absorption.

Ans :- Active :-

Passive :-

* Factors affecting water absorption *

A] External environment :-

- Ⓐ Available soil moisture
- Ⓑ Concentration of soil solⁿ
- Ⓒ Soil Temperature
- Ⓓ Soil aeration

B] Internal environmental or plant factors :-

- Ⓐ Transpiration
- Ⓑ Absorbing root system
- Ⓒ Metabolism
- Ⓓ Root system.

13) Short Note

Ques :- Explain the term effective rain fall and describe factors affecting it

Ques
Ans

Ans → Effective rainfall :- i) portion of the rainfall which directly satisfies crop water need is called effective rainfall. It means useful or utilisable rainfall.

ii) Annual or seasonal effective rainfall is the part of the annual or seasonal rainfall which is useful directly or indirectly for crop production at the site where it falls.

i) Rai
Soi
ii) T
iii) A
mo

* Factors affecting effective rainfall *

- 1) Rainfall characteristics
- 2) Land slope
- 3) Characteristic of soil
- 4) Ground water characteristics
- 5) Management practises
- 6) Crop characteristics
- 7) Carry over soil moisture.

mo
mo
in
2) So
ii) T
iii) J
ra
iv) m

Ques 14) Define irrigation water management.

3) Ma
sta

Describe water management of wheat, cotton, groundnut.

sta

Ans :- Irrigation water management :-

ho i
ii) A
di

4) Wi
rair

ii) r

5) S. 4
rain

Ques (15) Describe water resources in India

Ans :- 1) Rain fall - 392 million hectre

2) South west monsoon

3) North east monsoon

4) Winter rain

5) Summer rains - 328 sq. m

1) Rainfall :- i) Natural rainfall has been most imp source of water for farming.

ii) The annual rainfall in India is about 1190 mm.

iii) About 75% rainfall occurs receives in four months of June to sept. 10-11% each in the month of March - May and Oct - Dec and 1-5% in February.

2) South West monsoon :- i) originated from Indian oceans.

ii) The rainfall received during the month of June - July

iii) It is responsible for 75-80% of total annual rainfall in the country.

iv) More than 90% rainfall is received during this period

3) North East monsoon :- i) During Oct - Nov cyclonic

storms form in the Bay of Bengal and when they

strike coastal A.P. and ~~the~~ commandal coast they

bring heavy rains to these areas.

ii) About 11% of total annual rainfall is received during this period.

4) Winter Rains :- i) Punjab, Assam, WB & JK receive rainfall during this period.

ii) About 4-5% rainfall is received in this period.

5) Summer Rains :- About 10-11% of total annual rainfall is received during this period.

16) Forces of holding water in soil.

Ques :- Retention of water in soil.

Ans :- Water in the soil is retained by means of the following three :-

(a) Adhesion

(b) Cohesion

(c) Soil collides.

(a) Adhesion :- i) Attraction between two dissimilar particles or molecules known as adhesion.

ii) Due to adhesion the water molecules get attached to the surfaces of soil particles and form thin film of water. They are tightly held to the ground particles.

(b) Cohesion :- i) Attraction between two similar particles.

ii) Cohesion is the attraction of water molecules for each other.

iii) When more water is added to moist soil the force of cohesion comes into action.

iv) The freshly added water molecules get attracted towards already present water mol.

(c) Soil collides :- i) Water is also retained by in soil due to soil collides like clay and humus particle.

ii) The soil collides absorbs water and get swollen.

iii) The water thus retained in the soil is called imbibitional moisture.

17) Q
Ans

e

f

x

1) S

2)

3)

4)

5)

6)

7)

8)

18

1)

SO

A

ii

ii

Di

Pl

ii

2)

S

ii)

iii)

them.

Q. Define infiltration. Explain factors affecting infiltration.
 Ans: Infiltration:- It refers to the downward entry or movement of water from surface into the soil.

* Factors affecting them *

- 1) Soil texture and structure
- 2) Compactness of soil surface
- 3) Initial soil moisture content
- 4) Porosity
- 5) Organic matter
- 6) Vegetative cover
- 7) Soil Temperature
- 8) Cultivation practices

(18) Short Notes

1) Fertigation :- It is process of application of water soluble solid fertilizer through drip irrigation.

- Advantages:-
- i) Eliminates work of spreading fertilizers
 - ii) Exact placement of fertilizers to root zone of crop.
 - iii) All types of nutrients can be given at a time.

Disadvantages :- i) Toxicity & contamination may take place while applying fertilizers.

ii) Only water soluble fertilizers are not suitable.

2) Gypsum block :- i) Used in indirect method of soil moisture estimation.

ii) They are made up of gypsum, nylon and pop.

iii) The gypsum blocks work on principle of conduction of electricity.

- 3) Bulk density :- i) It indicates the oven dry weight of a unit volume of soil ~~moist~~ inclusive of pore space expressed in g/cm^3 .
ii) Used for different soil chemical analysis tests.

7) C
18)
19e
COE

Drip

4) Objectives of irrigation :-

- A) It is needed for obtaining normal growth and higher yield of plant.
- B) Needed for metabolic processes of plant.
- C) Reduce soil temp. Increases soil moisture.
- D) Act as a medium for transport of nutrients.
- E) Required for easy germination.
- F) Wash out and leach out the salts in the soil.
- G) To facilitate seed bed preparation
- H) To soften hard pans and hard clods.

SUR
*
UP
2) T
3) C
4)
5)
C) R
7)
8) L

Drip

5) Tensiometer :- i) It measures soil moisture tension that is the force with which water is held by soil.

ii) At the time of installation the system is filled with water from the opening at the top and ~~the system~~ rubber corked.

iii) When setup in the soil, moisture from the cup moves out with drying the soil, creating a vacuum in the tube which is measured with gauge in when desired tension is reached the soil is irrigated.

9)
10)
11)
12)
13)
14)

6) Consumptive Use :- i) The term C_u is used to designate the losses due to ET and water used by the plants for its metabolic activities.

ii) It is usually expressed in meter per area or hectre.

iii) It is expressed over crop period) season/ per day and even per hm.

15) 1

1) Components of drip irrigation

Drip irrigation is a method of irrigation in which water is applied directly and more frequently at a slow rate in form of discrete or continuous drops through tubes, over or below soil surface near the root zone of the plant.

* Components *

- 1) Pump
- 2) Head
- 3) Control distribution system
- 4) Fertilizer tank
- 5) Filter :-
 - (a) gravel or sand filter
 - (b) screen mesh filter
 - (c) disc filter
- 6) main line
- 7) submain
- 8) laterals
- 9) Emitters or drippers
- 10) Control valves
- 11) flush valves
- 12) Air release
- 13) Non Return valve
- 14) pressure gauge
- 15) Grommet and take off
- 16) End caps
- 17) Fertilizing system.

8) Frequency of irrigation

9) Runway irrigation

10) Moisture extraction pattern

