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Q 01 (A):- Define "Delta" and "Duty" and write the significance of duty of crop.

Answer:-

delta:- The total depth of water required to raise a crop over a unit area of land is usually called delta. The depth of water in cm or inches required for the crop through out the base period is called Delta of the crop.

Duty of water:-

The term duty means the area of land that can be irrigated with unit volume of irrigation water. Quantitatively, duty is defined as the area of land expressed in hectares that can be irrigated with unit discharge, that is, 1 cumec flowing throughout the base period, expressed in days. Imagine a field growing a single crop having a base period B days and a Delta Δ mm which is being supplied by a source located at the head (uppermost point) of the field

significance of duty of crop

Duty helps in designing efficient canal irrigation system. Knowing the total available water at the head of the main canal and the overall duty for all the crops required to be irrigated in different seasons of the year, the area which can be irrigated can be calculated. Inversely if we know the crop area required to be irrigated and their duties, we can work out the discharge required for designing the canal.

Q.NO (01) (b) :-Wheat requires about 10cm of water after every 35 days and the base period or crop period of wheat is 140 days. Find out the delta for wheat?

Solution:

Assuming the base period to be representing the crop period, as per usual practice, we can easily infer that the water is required at an average interval of 35 days up to a total period of 140 days.

This means that 5(140/35) no. of watering are required 35 days

The depth of water required each time = 10 cm.

Hence, Δ for wheat = 50 cm. Ans.

Q.NO (01) (C) :- Explain the factors affecting consumptive use.

Answer:-

following are the factors which are affecting consumptive use:-

•Sunlight

•humidity in air

•Velocity Of Wind

•Assignment

•Temperature

•Soil Topography

Q 02 (A):- What are the principal causes and ill effects of water logging?

Answer:- The main causes of waterlogging can be grouped into two categories:

(i) Natural, and
(ii) (ii) Artificial.

Topography, geological features and rainfall characteristics of an area can be the natural causes of waterlogging. Introduction of surface water irrigation facilities disturbs the balance between natural outflow and inflow of a ground water reservoir. This forms the artificial cause of waterlogging. Besides, defective methods of cultivation, defective irrigation practices and blocking of natural drainages are also included in the artificial causes of waterlogging.

Following are the adverse effects of waterlogging:

- Absence of soil aeration
- Difficulty in cultivation operations
- Weed growth
- Accumulation of salts.

In addition, the increased dampness of the waterlogged area adversely affects the health of the persons living in that area.

(i) Absence of Soil Aeration:

In waterlogged lands, the soil pores within the root zone of crops are saturated and air circulation is cutoff. Waterlogging, therefore, prevents free circulation of air in the root zone. Thus, waterlogging adversely affects the chemical processes and the bacterial activities which are essential for the proper growth of a plant. As a result, the yield of the crop is reduced considerably.

(ii) Difficulty in Cultivation:

For optimum results in crop production, the land has to be prepared. The preparation of lnd (i.e., carrying out operations such as tillage, etc.) in wet condition is difficult and expensive. As a result, cultivation may be delayed and the crop yield adversely affected. The delayed arrival of the crop in the market brings less returns to the farmer.

(iii) Weed Growth:

There are certain types of plants and grasses which grow rapidly in marshy lands. In waterlogged lands, these plants compete with the desired useful crop. Thus, the yield of the desired useful crop is adversely affected.

(iv) Accumulation of Salts:

As a result of high water table in waterlogged areas, there is an upward capillary flow of water to the land surface where water gets evaporated. The upward moving water brings with it soluble salts from salty soil layers well below the surface.

These soluble salts carried by the upward moving water are left behind in the root zone when this water evaporates. The accumulation of these salts in the root zone of the soil may affect the crop yield considerably.

Q 02 (b):- Describe the anti-water logging measures.

ANSWAR :- anti-water logging measures.

The main cause of waterlogging in an area is the introduction of canal irrigation in the area. It is, therefore, better to plan an irrigation scheme in such a way that the land is prevented from getting waterlogged.

(i) Limiting the intensity of irrigation,

(ii) Provision of intercepting drains,

(iii) Keeping the full supply level of channels as low as possible,

(iv) Encouraging economical use of water,

(v) Removing obstructions in natural drainage,

(vi) Rotation of crops,

(vii) Running of canals by rotation, etc.

Combined use of surface and subsurface water resources of a given area in a judicious manner is called conjunctive use of water. During dry periods, the use of ground water is increased which results in lowering of the water table. The use of surface water is increased during wet season. Because of the lowered water table, ground water reservoir receives rainfall supplies through increased percolation. Utilization of water resources in this manner results neither in excessive lowering of the water table nor in its excessive rising. Conjunctive use of surface and subsurface water serves as a precautionary measure against waterlogging. It helps in greater water con-servation and lesser evapotranspiration losses, and brings larger area under irrigation.

Q 02 (c):- Explain the methods adopted to reclaim saline soils

ANSWAR:-

The following technologies can be followed to reclaim the saline soil.

1. Scraping

It is removal of the salts that have accumulated on the soil surface mechanically. It has limited success and may temporarily improve crop growth.

2. Leaching

This is the **most effective** management technique for removing salts from the root zone of soils. Stagnation of fresh water can dissolve the salts in the field. Now this water with dissolved salts can be drained out from the field. This way salts can be leached from the salt affected field. Leaching should preferably be done when the soil moisture content is low and the groundwater table is deep. Leaching during the summer months is less effective because large quantities of water are lost by evaporation. If adequate fresh water is not available, less saline water (EC 0.25 dS/m) also can be used.

3. Drainage

Poor drainage condition leads to accumulation of rain water in low lying areas during rainy season. If it is not drained out properly the groundwater table is raised to less than 2 m within 5-10 years and result accumulation of salts due to evaporation from the surface. In general, the critical depth of water table ranges between 1.5 to 3.0 m to check the salinization. So drainage is necessary to prevent salinization.

4. Irrigation frequency

More frequent irrigations prevent the salt accumulation by keeping the soil at higher soil moisture content. So crops grow in saline soils must be irrigated more frequently.

5. Irrigation method

Sprinkler or drip irrigation is ideal method for irrigating frequently and with small quantity of water at a time. Leaching of soluble salts is also accomplished more efficiently when the water application rates are lower than the infiltration capacity of the soil and such a condition cannot be achieved by flood irrigation methods.

6. Proper use of irrigation water

Salt free or less saline (if salt free water is not available) water only to be used. Moisture should be kept at optimum field capacity to check the salt accumulation.

7. Management of soil fertility through proper fertilizer application

Generally saline soils are low in fertility status. Response of nitrogen is better when it is applied with green manures and green leaf manures such as dhaincha. However, excessive fertilization on a highly saline soil is of no value. Uses of acid forming fertilizer such as ammonia and amide form help to drop the pH level of soil.

8. Mulching

Soil salinization is particularly high when the water table is shallow and the salinity of groundwater is high. Mulching can reduce evaporation from the soil surface and encourage downward flow of soil water there by check the accumulation of salts on soil surface.

9. Placement of seed or seedling

Salts tend to accumulate at the raised portion of soil. So planting or seeding at sides or shoulder of ridges help them to emerge in saline soil.

Q.NO 03 (a):- How does Kennedy's theory differ from Lacey's theory for the design of irrigation canals.

ANSWAR:-

comparison between Kennedy's and Lacey's theories.

1. The basic concept regarding silt transportation is the same in both the theories. In both the theories it is stated that the silt remains in suspension due to vertical force of eddies.

2. Kennedy assumes that the eddies are generated on the bed only and hence he derives the formula for finding out critical velocity in terms of depth. 3. Lacey proposes that regime section is semi-circular ultimately and eddies are generated along the whole wetted perimeter. He drives formula for mean regime velocity in terms of hydraulic mean radius.

3:- Lacey states that as the shape of irrigation channel is fixed to a particular geometrical figure (generally trapezoidal) it cannot achieve final regime conditions and hence may be said to achieve initial regime. Kennedy assumes that when there is neither silting nor scouring the channel is in its regime.

4. Kennedy selects Kutter's formula for designing irrigation channel. But in Kutters formula value of N is arbitrarily fixed. Lacey has not fixed any value arbitrarily.

5. Kennedy has made use of term "CVR" (m) but he did not give any basis for calculating m. He simply states that it depends on silt charge and silt grade.

Lacey has introduced a term "silt factor" (f). He related f to mean diameter of the bed material and gave basis to calculate f. The formula is $f = 1.76 \sqrt{m_r}$

6. Kennedy gives no clue for calculating longitudinal regime slope. Lacey produced a regime slope formula.

7. Design based on Kennedy's theory can only be achieved after making trials. Of course Woods has simplified the procedure by giving normal design table which provides BID ratio

Q.NO 03 (B):- Design a regime channel for a discharge of 30 cumecs and mean diameter of the particle of 0.56 mm using Lacey's theory.

ANSWAR:-

GIVIN DATA:-

Q= 30 CUM

DIA= 0.56 MM

AS WE KNOW Where;

Vm + { Q F*2/ 140}^ 1/6

f = 1.76 M ^ 0.5

- f = Lacey's silt factor
- Q = Cumecs
- M= Mean dia in 'mm'

R =(5/2)* (V2/f)

F = 1.76 * 0.56 ^1/2

F= 1.317

Vm= { Q F*2/ 140}^ 1/6

Vm= 1.26

P = 4.75 √ Q

P= 24.64

$$S = \frac{f^{5/3}}{3340Q^{1/6}}$$

S= 0.0001778

Q.NO (04).

Write notes on the following:

a) **Field Capacity**
b) **Permanent wilting point**
c) **Canal Head Regulator**
d) **Under Sluices**

ANSWARS:-

A) Field Capacity: -

When all gravity water has drained down to water table, a certain amount of water is retained by surface soil. This water which can not be easily drained under the action of gravity and is called FIELD CAPACITY.
field capacity can be calculated if porosity and bulk density of the soil are known.
Field capacity can be estimated in the laboratory by applying a vacuum

B) Permanent Wilting Point :-

A plant can extract water from soil till a permanent wilting is reached. P.W.P is that water content at which a plant can no longer extract sufficient water for its growth and wilts up.
Water Available to plant = Field capacity-P.W.P water.

c) Canal Head Regulator :-

A structure which is constructed at the head of the canal to regulate flow of water is known as canal head regulator. It consists of a number of piers which divide the total width of the canal into a number of spans which are known as bays. The piers consist of number tiers on which the adjustable gates are placed.

D) Under Sluices: -

Under sluices Also known as scouring sluices. The under sluices are the openings provided at the base of the weir or barrage. These openings are provided with adjustable gates. Normally, the gates are kept closed. The suspended silt goes on depositing in front of the canal head regulator.

The under-Sluices are the openings which are fully controlled by gates, provided in weir wall with their crest at a low level. They are located on the same side as the off-taking canal.

Under sluices are also called scouring sluices because they help in removing the silt near the head regulators.

THANKS