IQRA National University

Civil Engineering Department

MS Water Resources Engineering and Management

Irrigation Engineering and Practices

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Q.NO (01) **(20marks**

(a) Define "Delta" and "Duty" and write the significance of duty of crop.

Answer:

Duty and Delta are very basic definitions used in the calculation of irrigation water demand of the crops.

To put it simple, Duty is the area of land that can be irrigated with a unit volume of water supplied across the base period where as delta is the depth of water required to raise a crop over a unit area. is denoted by the symbol Δ.

Significance of duty of crop:

It helps us in designing an efficient canal irrigation system. Knowing the total available water at the head of a 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 worked out. Inversely, if we know the corps area required to be irrigated and their duties.

(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:

No. of required watering =140/35=4

The depth of water required each time = 10cm

Total depth of water required in 140 days = 4*10cm =40cm

Δ for wheat = 40cm Ans.

(c) Explain the factors affecting consumptive use.

Answer:

1. TEMPERATURE: The rate of consumptive use of water by crops in any particular locality is probably affected more by temperature, which for long-time periods is a good measure of solar radiation, than by any other factor. Abnormally low temperatures retard plant growth and unusually high temperatures may produce dormancy.

2. HUMIDITY: Evaporation and transpiration are accelerated on days of low humidity and slowed during periods of high humidity. During periods of low relative humidity, greater rate of use of water by vegetation may be expected.

3. WIND MOVEMENT: Evaporation of water from land and plant surfaces takes place more rapidly when there is moving air than under calm air conditions. Hot, dry winds and other unusual wind conditions during the growing period will affect the amount of water consumptively used. However, there is a limit in the amount of water that can be utilized. As soon as the land surface is dry, evaporation practically stops and transpiration is limited by the ability of the plants to extract and convey the soil moisture through the plants.

4. SOIL TOPOGRAPHY: If a soil is made more fertile through the application of manure or by some other means, the yields may be expected to increase with an accompanying small increase in use of water. However, an increase in fertility of the soil causes a decrease in the amount of water consumed per unit of crop yield.

5. SUNLIGHT: Although latitude may hardly be called a climatic factor, it does have considerable influence on the rate of consumptive use of water by various plants.

Q.NO (02) (20marks)

(a) What are the principal causes and ill effects of water logging?

Answer:

1. Intensive Irrigation: If max. area of land is irrigated, percolation of water takes place. This causes the rise of Water Table. Extensive irrigation (irrigation spread over wider regions) to be followed to avoid water logging.

2. Seepage of water from adjoining high lands.

3. Seepage of water through canal reservoirs.

4. Impervious obstruction: water seeping below the soil moves horizontally. It may find obstruction & Water Table may rise.

5. Inadequate surface Drainage: Storm water & excess of irrigation water should be removed. If proper drainage is not provided water percolates to rise water table.

6. Excessive Rains: Causes temporary water logging. - No drainage causes permanent.

7. Submergence due to floods: Continued floods causes the growth of water-loving plants which obstruct natural surface drainage & increase the water-logging.

8. Irregular & flat topography: In depressions, the drainage is poor, water detention is more. The percolation increases the water table.

effect of waterlogging:

Waterlogging lowers oxygen levels in the root zone, which reduces plant growth. Waterlogging increases the reduction potential of the soil and changes the chemical equilibrium of many elements which then enter the soil-water solution in their ionic forms.

(b) Describe the anti-water logging measures?

Answer:

Irrigation without proper drainage sometimes increases the total water held in a soil profile to an extent of causing poor drainage. This is controlled through reduction of excessive water inflow into the soil as follows:

1. Lining of canals and water courses: It reduces seepage of water.

2. Reducing intensity of irrigation: Only small portion of land should receive canal water in one particular season. . Remaining areas can receive water in next season by rotation.

3. By introducing crop rotation: High water requiring crop should be followed by one requiring less water, and then by one requiring almost no water. Example: Rice followed by wheat and then by cotton.

4. Optimum use of water: Certain amount of water gives the best result. Less or more water reduce the yield. Cultivators should be educated so that not to use more water. Revenue should be charged on the basis of quantity of water rather than the area of land.

5. Improving natural drainage of area: water should not be allowed to stay in one area. - Natural flow is provided by bush and jungle cutting.

6. Pumping or Tube wells or Vertical Drainage: Lift irrigation should be introduced to use GW. Canal irrigation may be substituted by tube well irrigation.

7. Economical use of water according to need.

8. Adoption of sprinkler method of irrigation. Only predetermined amount of water is supplied to land No percolation losses from water courses

(c) Explain the methods adopted to reclaim saline soils?

There are three ways to manage saline soils**.**

First, salts can be moved below the root zone by applying more water than the plant needs. This method is called the leaching requirement method**.**

The second method**,** where soil moisture conditions dictate, combines the leaching requirement method with artificial drainage**.**

Q.NO (03) (20marks)

(a) How does Kennedy's theory differ from Lacey's theory for the design of irrigation canals.

No	Kennedy's theory	Lacey's theory
1	It states that the silt carried by the flowing water is kept in suspension by the vertical component of eddies which are generated from the bed of the channel.	It states that the silt carried by the flowing water is kept in suspension by the vertical component of eddies which are generated from the entire wetted perimeter of the channel.
2	Relation between 'V' & 'D'.	Relation between 'V' & 'R'.
3	Critical velocity ratio 'm' is introduced to make the equation applicable to diff. channels with diff. silt grades.	Silt factor 'f' is introduced to make the equation applicable to diff. channels with diff. silt grades.
4	Kutter's equation is used for finding the mean velocity.	This theory gives an equation for finding the mean velocity.
5	This theory gives no equation for bed slope.	This theory gives an equation for bed slope.
6	In this theory, the design is based on trial and error method.	This theory does not involve trial and error method.
7	All channels which are not silting or scouring is in regime	Lacey differentiated between initial and final regime

(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?

$$Q = 30\ Cumecs \quad M = 0.56mm$$

1: $f = 1.76m^{0.5}$ $\quad f = 1.760.56^{0.5} = 1.317$

2: $v_m = \left(\frac{Qf^2}{140}\right)^{1/6}$ $\quad v_m = \left(\frac{30\ x\ 1.317^2}{140}\right)^{1/6} = 0.848\ m/sec$

3: $R = \frac{5}{2} \cdot \left(\frac{v^2}{f}\right)$ $\quad R = \frac{5}{2} \cdot \left(\frac{0.848^2}{1.317}\right) = 1.37m$

4: $P = 4.75\sqrt{Q}$ $\quad P = 4.75\sqrt{30} = 26.02m$

5: $s = \frac{f^{5/3}}{3340\ Q^{1/6}}$ $\quad s = \frac{1.317^{5/3}}{3340\ 30^{1/6}} = 0.0002687 \cong 0.0003 = \frac{3}{10000}$

6: $A = \frac{Q}{v_m}$ $\quad A = \frac{30}{0.848} = 35.38\ m^2$

Q.NO (04) (20marks)

Write notes on the following:

Field Capacity: is the amount of soil moisture or water content held in the soil after excess water has drained away and the rate of downward movement has decreased. This usually takes place 2–3 days after rain or irrigation in pervious soils of uniform structure and texture.

permanent wilting point: the permanent wilting point is the point when there is no water available to the plant. ... At this limit, if no additional water is supplied to the soil, most of the plants die. The moisture content at the permanent wilting point varies with soil texture.

Canal Head Regulator: Any structure constructed to regulate the. discharge, full supply level or velocity in a canal is known as a. regulator work. This is necessary for the efficient working and. safety of an irrigation channel.

under 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.