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Sec :- "A"

Subject :- Irrigation

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1) Define "Delta" and "Duty" and derive their relationship in MKS & FPS system-

Delta of Water:-

→ 1 cubic.m per sec or 1 ft^3/sec of water for B days matures D hectares or acres of land. then the duty of water for that particular crop is D hectare/cumees or D acres/sueses

Relationship b/w Duty & Delta in FPS system.

let

D = Duty (acres/cuecs)

Δ = A feet base period = B day by def.

One Cusec of water flowing Continously for "B" days gives a depth "A" over an "D" acres.

Volume of water (ft^3/sec) in one day = 1 x 24 x 60 x 60
= 86400 ft^3/sec

Volume of water (ft^3/sec) in B day = 1 x 24 x 60 x 60
= 86400 B ft^3 (i)

1 Acre = 43560 ft^2

1 ft^2 = 143560 Acre

Putting in eq (i) become

= 86400 B x 43560 Acre-ft

Volume of water = 1.983 B Acre ft - (ii)

Volume (ft^3/sec) in B day

Depth of water required by crops

$$= \frac{1.983 \times B_f}{D}$$

Relationship b/w Duty & Delta in MKS systems:-

→ let there be a crop of base period B days. let one cumec (m^3/sec) of water be applied to this crop on the field for B days.

→ Now the volume of water applied to this crop during B days = V

$$V = (24 \times 60 \times 60 \times B)\, m^3$$

$$= 86400\, m^3$$

→ By defination of duty, $1 m^3$ of water supplied for B days matures D hectares of land. This quantity of water (V) matures D hai of land $10^4 B\, m^2$ of area.

→ Total depth of water applied on this land

$$= \frac{\text{Volume}}{\text{Area}} = \frac{86400}{10^4 D} = \frac{8.64\, B}{D}\ m$$

Therefore $D = 8.64 B/Dm = 864 B/D$ cm

D is duty in hacter / cumec.

(1 D) If Wheat required about 9cm of water every 35 days and the base period or Crop period of Wheat is 140 days. Find out the delta for Wheat?

Sol:- $B = 140$ days

$D = ?$

Water required for wheat = 9cm

No of Days = 35 days

By Ratio Method

$9cm = 35$ days

$\Delta = 140$ days

$35\Delta = 140 \times 9$

$$\Delta = \frac{140 \text{ days} \times 9cm}{35 \text{ days}}$$

$\Delta = 36$ cm.

Q1/cp:- Explain Indus Water Treaty?

"Indus Water Treaty:-"

The Indus Water treaty (IWT) is a water distribution treaty between India and Pakistan signed on Sep 19, 1960 - The treaty was signed by President Ayub Khan and PM J. Nehro - It was brokered by the World Bank

The Indus Water treaty deals with river indus and its five tributaries which are classified into two categories:

Eastern River	Western Rivers
Sutlej	① Jhelum
Beas	② Chanab
Ravi	③ Indus

According to the treaty, all the water of eastern rivers shall be available for unrestrict use in india.

India should let unrestricted flow of water from western reiver to Pakistan.

The treaty allocated 80% of water from the six-river Indus water system to Pakistan.

Gram, Mustard Potatoes.

Kharif:- 1th April to 30st September in summer.

Kharif Crops:- Kharif Crops are Rice Bajra Jawar Maize Cotton.

Rabi & Kharif Ratio:- The area is irrigated for Rabi Crops generally more than that for Kharif Crops generally more than that for Kharif Crops The Ratio of proposed areas is to be irrigated in Kharif Season to that in Rabi Season is called as Rabi & Kharif ratio. The ratio is [1:2] that is Kharif area is one half of that Rabi area.

Define and explain the following terms

Field Capacity:- When all gravity water has drained down to water tables a by surface soil. This water which can not be easily drained under the action of gravity.

b) "Permanent wilting point:-" It is defined as the minimum amount of water in the soil that the plant requires ~~to this or any~~ not to will. If the soil water content decreases to this or any lower point a plant wilts and no longer recover its turgidity which placed in a saturated atmosphere for 12 hours.

c) "Available & readily available moisture Content:-"

"Available Moisture Content:-"

The difference in moisture content of the soil between field capacity and parmanent wilting is termed the available moisture. Available Moisture can be expressed as percentage moisture PW, as percentage PV or as depth d.

d) "Optimum Utilizatim of water:-"

"Readily available moisture Content:-"

It is the water that a plant can easily extract from the soil. RAW is the soil moisture held between field capacity and a nomialed refill point for unrestricted growth. In this range of soil moisture plant are neither waterlogged or water stressed.

(d) "Optimum Utilization of water :-"

The yield increases with water can reaches a certain maximum value and then falls down - The quantity of water at which the yield is maximum is called the optimum water depth - Therefore the optimum utilization of water means getting maximum yield with any amount of water -

A permanent Indus Commission was set up as a bilateral Commission to implement and manage the treaty -

Write Significance of Duty of a Crops.

Significance of Duty of a Crops :-

It help in designing efficient canal irrigation system - Knowing the total available water at the head of the main canal and the overall duty of 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 crop area required to be irrigated and their duties, we can work out the discharge required for designing the canal -

(Q2 a) Explain the factor affecting Consumptive use. (7)

Ans:- Factor affecting Consumptive use are given below:

1) Temperature
2) Humidity in air
3) Velocity of wind
4) Soil topography
5) Sunlight etc

1) "Temperature:-" Consumptive use of water is directly affected by the temperature. At high temperature the plant tends to show dormancy while at low temperature there is a deviated plant growth.

2) "Humidity:-" Evaporation is inversely proportional to humidity as at low humidity evaporation rate is more while at high humidity evaporation is slowed down.

3) "Velocity:-" Evaporation rate is more when there is more velocity as air is moving faster so there will be more evaporation, if the velocity of wind is low then rate of evaporation is also low.

"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 increases in use of water. However an increase in fertile of the soil causes a decreases in the amount of water consumed per unit of crop field.

"Sunlight:-"

At days in summer there is more sunlight then usual so high evaporation occurs when in winter there is low evaporation rate.

Wheat is to be grown at a certain place the usefal rainfall for the whole season is 10cm its Cumalative Consumption use is 40cm. Determine Consumptive irrigation requirement (CIR) & Field Irrigation Requirement (FIR) if the water application effiency is 80%.

Given data:-

Usefull Rainfall (cm) = 10

Water application Efficency (na) = 80%
= 0.8

Cumalative Consumptive use (Cu) = 40cm

Required:-

Field Irrigation Requirement (FIR) = ?

Consumptive Irrigation requirement (CIR) = ?

Solution:-

$CIR = Cu - Re = 40 - 10 = 30\,cm$

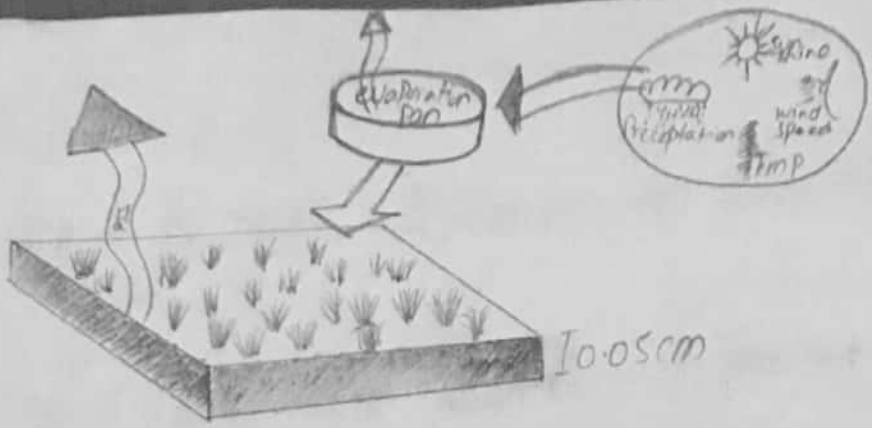
$FIR = \frac{CIR}{Ea}$

$= \frac{30}{0.8} = 37.5\,cm$

Explain Class A Pan Evaporation (EP) measurement with the help of Diagram.

"Class A plan Evaporation (EP) Measurement."

EP can be experimently determined directly measuring the quantity of water evaporated from this standered class a pan. This pan is 1.0m in dia, 25cm deep and bottom is raised 15cm above the ground surface. The depth of water is to be kept in a fixed range such that the water surface is at least 5cm, and never more then 7.5cm, below the top of pan.



A pan evaporation EP can also determined by using the Christiansen formula which states.

$Ep = 0.459\ R.Ct.Cw.Ch.Cs.Ce$

R = extra-Terrestrial radiation is the same unit as Ep in cm or mm

Ct = Coefficent for temperature

Cw = Coefficant for wind velocity.

Explain Crop Season (Rabi & Khorif) & Khorif Rabi Ratio.

"RABI:" 1st October to 31st March - winter

"Rabi Crops:" Rabi Crops are Wheat, Barley

(d) "Optimum Utilization of water :-"

The yield increases with water can reaches a certain maximum value and then falls down - The quantity of water at which the yield is maximum is called the optimum water depth - Therefore the optimum utilization of water means getting maximum yield with any amount of water -