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(Ans 1a) Define "Delta" and "Duty" and derive their relationship in MKS and FPS systems.

Delta :- It is defined as "The depth of water in cm or m that is required for the crops through out the Base period is know as delta of the crop.

⇒ Majorly, a crop needs specific volume of water in order to accommodate it's base period

Duty :- Duty of water is expressed as "The number of hectare of land that can be Irrigated for the full growth of the given crop by supplying 1cumec water continuously durring the entire base period of that crop.

Relationship b/w Duty and Delta in MKS system

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

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

$V = (24 \times 60 \times 60 \times B)\, m^3 = 86.400 m^3$

By definition of duty, $1 m^3$ of water supplied for B days matures D hactares of land. This quantity of water "V" matures D ha of land or $10^4 D m^2$ of area.

⇒ Total depth of water applied on this land

$$\frac{\text{Volume}}{\text{Area}} = \frac{86400\,B}{D(m)} = 864\,B/D \text{ cm}$$

Where Δ is in cm, B is in days

D is duty in ha/cumec

Relationship b/w Duty and Delta in FPS system.

Let Δ = Delta

D = Duty (acres/cusec)

B = Days

One cusec of water flowing continuously for "B" days gives a depth of water 'A' over an 'D" acres.

Volume of water (ft^3/sec) in one day = $1 \times 24 \times 60 \times 60 = 86400\, ft^3/sec$

Volume of water (ft^3/sec) in B day = $1 \times 24 \times 60 \times 60 = 86400\, B\, ft^3$ —(i)

$\therefore$ 1 Acre = $43560\, ft^2$

Putting in eqn (i) = 86400 B/43560

vol of water (ft^3/sec) in B day = 1.983 Acre-ft —(ii)

Depth of water required for crop = $\frac{1.983\,B\ ft}{D}$

$$\Delta = \frac{1.983\,B\ ft}{D}$$

(b) If wheat requires about 9cm of water after every 35 days and the base period or crop period of wheat is 140 days find out the delta for wheat?

Given Data

water required for wheat = 9cm

No of days = 35 day

B = 140 days

Required

$\Delta = ?$

By using ratio method

9cm = 35 days

Δ = 140 days

$35\Delta = 9 \times 140$ days

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

$$\Delta = 36cm$$

(c) Explain Indus water treaty?

⇒ The Indus water treaty (IWT) is a water distribution treaty b/w India and Pakistan signed on 19 sept, 1960.

The treaty was signed by president Ayub Khan and P.M J. Nehru. It was brokened by the world Bank.
The Indus water treaty deals with rivers Indus and it's five tributaries which are classfied into two categories

Eastern Rivers	Western Rivers.
① Sutlej	① Jhelum
② Beas	② Chenab
③ Ravi	③ Indus

⇒ According to the treaty, all the water of eastern river shall be available for unricted use in India.
⇒ India should let unrestricted flow of water from western rivers to Pakistan.
⇒ The treaty says that India can use the water in western rivers in "non-consumptive" needs.
⇒ The treaty allocates 80% of water from the six rivers Indus water system to Pakistan.
⇒ A Permenant Indus commission was set up as a bilateral Commission to implement and manage the treaty.

(d) Write significane of duty of a crop.

Ans It helps in designing efficient canal Irrigation system if we know the overall duty of all the crops required to be irrigated in different seasons of the year and the total available water at the head of the main canal, the area which can be irrigated and can be worded out.

If we know the crop area required to be Irrigated along with their duties so we can workout the discharge required for designing the canal

$$\Phi = A/D \quad ; \quad A = \Phi D$$

Q2(a) Explain the factors affecting consumptive use.

Ans Following are the factors affecting consumptive use.

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 devastated plant growth.

② **Humidity in air** Evaporation is inversely proportional to humidity as at low humidity eaporation rate is more while at high humidity evopation 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.

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 fertile of the soil causes a decreases in the amount of water concumed per unit of crop yield.

⑤ Sunlight

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

(b) Wheat is to be grown at a certain place the usful rainfall for the whole season is 10cm its cumalative consumption use is 40cm. Determine consumptive Irrigation requirment (CIR) and Field Irrigation Requirment (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 requirment (CIR) = ?

Solution

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

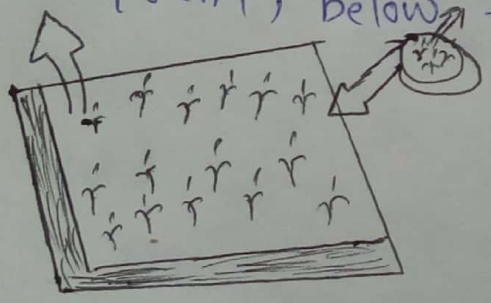
$FIR = \frac{CIR}{na} = \frac{30}{0.8} = 37.5cm$

(c) Explain class A plan evaporation (EP) measurement with the help of a diagram.

Ans Class A Plan Evaporation (EP) measurement :-

⇒ EP can be experimently determined directly measured 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.

$EP = 0.459\ R \cdot ct \cdot cw \cdot ch \cdot cs \cdot ce$

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

ct = coefficient for Temperature

cw = coefficient for wind velocity.

(d) (ii) Explain crop season (Rabi and Kharif) and Kharif Rabi Ratio.

RABI

"Rabi crops"

1th october to 31st March — winter

1- Rabi crops are wheat, Borley, Grom, Mustard potoles

② "Kharif"

1th April to 30st september in summer

③ "Knarif crops"

Kharif crops are Rice, Bajra, Jawar, Maize Cotton.

Rabi and Kharif Ratio :- The area is irragated for Rabi crops generally more then that for Kharif crops generally more than that for Kharif crops. The ratio of proposed area sais to be irrigated in Kharif season to that in Rabiseason to that in Rabiseason is called as Rabi and Kharif ratio. The ratio is [1 : 2] that is Kharif area is one half of that Rabi area.

Qno3 Define and explain the following terms.

(a) Field capacity :- when all gravity water has drained down to water tables, by surface soil a cetain amount of water is retained by surface soil. This water which can't be easily drained under the action of gravity and is called F.C.

b) Permanent wilting Point (P.W.P)

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) Available and readily available moisture"

Available moisture content

The difference in moisture content of the soil between field capacity and permanent wilting is termed the available moisture. Available moisture can be expressed as percentage moisture PW as Percentage PV or as depthed.

(d) Optimum utilization 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 b/w field capacity and a nominated refill point for unrestricted growth. In this range of soil moisture point are neither waterlogged or water stresed.

(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 yeild is maximum is called the optimum water depth Therefore the optimum water depth. Therefore the optimum utilization of water means getting maximum yield with any ~~men~~ amount of water.