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Q:- @ Define "Delta" and "Duty" and derive their relationship in MKS and FPS systems?

Ans- Delta :- it is defined as the depth of water (cm or in) that is required for the crops through out the base period is known as delta of the crop.

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 1 cumec water continuously during 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^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

$$V = (24 \times 60 \times 60 \times B)\, m^3 = 86400\, m^3$$

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

→ Total depth of water applied on this land.

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

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 D = Duty (acres/cusec)

Δ = Delta

B = Days

one cusec of water flowing continuosly for "B" days gives a depth of water "A" over an "D" acres.

Volume of water (ft^3/sec) in one day

$= 1 \times 24 \times 60 \times 60 = 86400\, ft^3/sec$

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Volume of water (ft^3/Sec) in B day

$= 1 \times 24 \times 60 \times 60 = 86400\,B\ ft^3 \rightarrow (i)$

$\because$ 1 Acre $= 43560\ ft^2$

putting in eq (i) $= 86400B/43560$

Volume of water (ft^3/Sec) in B day

$= 1.983\,B$ Acre-ft. $\rightarrow$ (ii)

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

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

(b) if wheat required about 9cm of water after every 35 days and the base period or crop period of wheat is 140 days Find out the delta of wheat?

Given data:-

water required for wheat = 9cm

No of days = 35day

B = 140 days

Required: $\Delta = ?$

By using ratio method

9cm = 35days

Δ = 140 days

$35\Delta = 9 \times 140$ days

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

$$\boxed{\Delta = 36\text{cm}}$$

(c) Explain indus water treaty?

Ans: 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 PM Nehru. it was brokened by the world Bank.

The indus water treaty deals with rivers indus and its tributaries which are classified 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 unrestricted use in India.
- India should let unrestricted flow of water from western rivers in 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 river indus water system to pakistan.

(c) A permanent indus commission was set up as a bilateral commission to implement and manage the treaty.

(d) Write significance 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 worked out.

if we know the crop area required to be irrigated along with their duties so we can work out the discharge required for designing the canal.

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

Q2:- (a) Explain a factor affecting consumptive Use?

Ans:- Factor affecting consumptive use are given below.

(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.

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② Humidity :- Evaporation is inversly proportional to humidity as at low humidity evoporation 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.

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 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.

⑤ Sunlight :- At days in Summer there is more Sunlight then usual so high evaporation occur when in winter there is low evaporation rate.

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(5):- Wheat is to be grown at a certain place the useful rainfall for the whole season is 10cm and its cumulative consumptive use is 40cm. Determine consumptive irrigation requirement (CIR) and field irrigation Requirement (FIR) if the water application efficiency is 80%.

Sol:-

Given data :-

Useful rainfall (cm) = 10cm

Water application efficiency = η_a = 80% = 0.8

cumulative consumptive use = Cu = 40cm

Required data:-

Field irrigation requirement (FIR) = ?

consumptive irrigation requirement (CIR) = ?

consumptive Irrigation requirement (CIR)

$= C_u - R_c$

$= 40 - 10$

CIR = 30 cm

Field Irrigation Requirement (FIR) = $\frac{CIR}{\eta_a}$

$= \frac{30}{0.8}$

FIR = 37.5 cm

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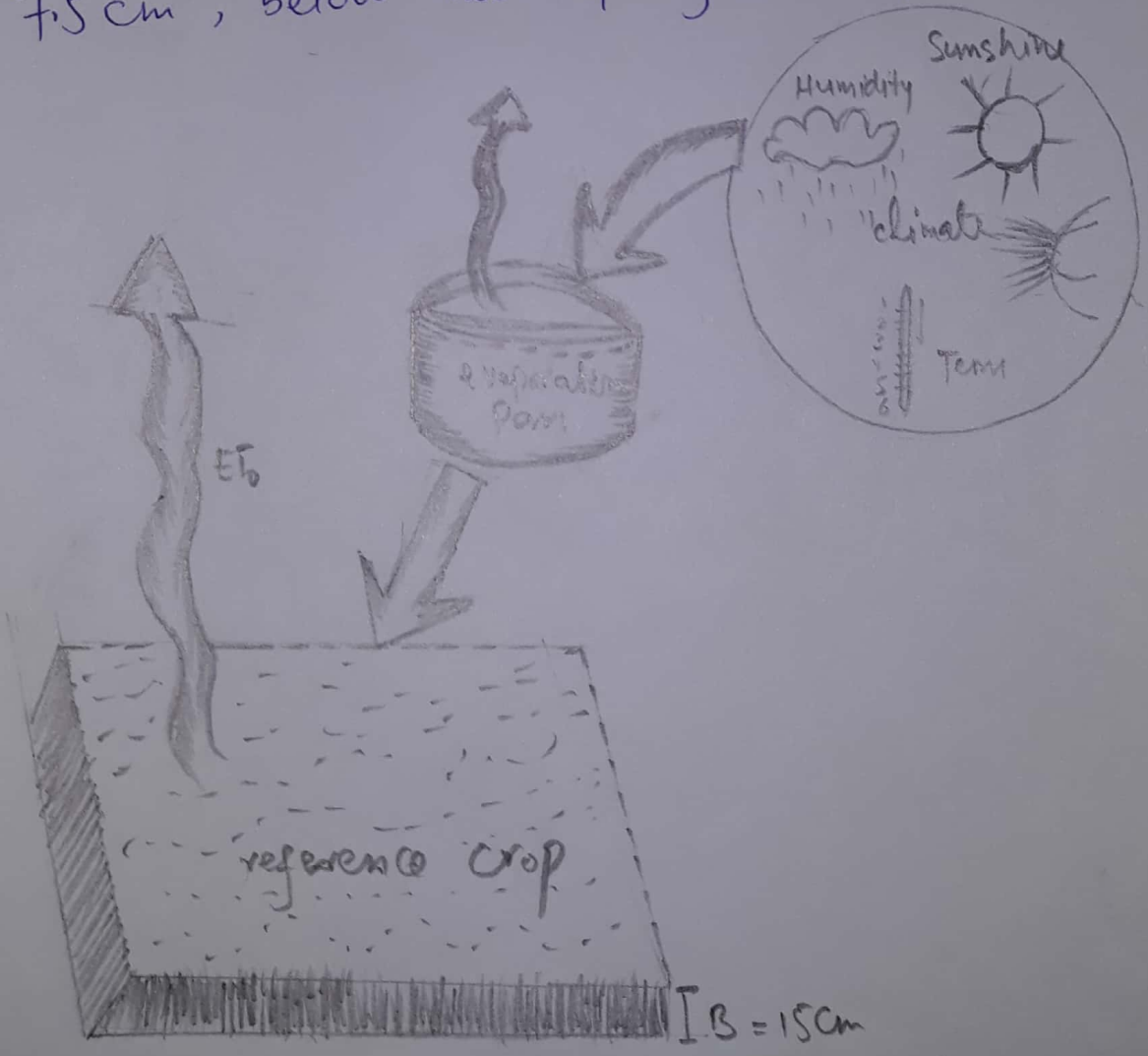
© Explain class A pan evaporation (EP) measurement with the help of Diagram.

Ans:- Class A pan Evaporation (EP) measurement :-

EP can be experimently determined directly measuring the quantity of water evaporated from this standared class A pan. This pan is 1.0m in dia 0.25 cm 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 7.5 cm, below the top of the 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 = Coefficent for wind velocity.

(d) Explain crop Season (Rabi and Kharif) and Kharif Rabi Ratio.

(1) Rabi :- Ist oct to 31th March - winter

Rabi crops :- Rabi crops are wheat, Barley Grain, Mustard

(2) Kharif :- Ist April to 30 Sep in Summer

Kharif crops :- Kharif crops are Rice Bajra, Jawar, maize, cotton.

Rabi and Kharif ratio :- The area is irrigated from rabi crops generally more ~~than~~ than that for Kharif crops generally more than that Kharif crops.

The ratio of proposed areas is to be irrigated in Kharif Season to that in Rabi Season is called as rabi and kharif ratio The ratio is [1:2] that is Kharif area is one half of that Rabi area.

Q3:- (a) Field capacity :- When all gravity water has drained down to water tables by surface soil. This water which can not be easily drained under the action of gravity.

Period of drainage = 2-5 days
FC is measured after 2 or 5 days

(i) capillary water :- The water in which easily extract by plant in capillary action.

(ii) Hygroscopic water :- The water in which can be easily extract in by capillary action by effect of chemical bonds.

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(5) Permanent wilting point :- The minimum amount of water of water in the soil that the plant requires 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 hrs.

(c) Available and readily available moisture contents :-

The difference in moisture content of the soil b/w 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 utilization of water :- it is a Readily available moisture content: water that a plant can easily extract form the soil. Raw is the soil moisture held b/w field capacity a nominated refill point for unrestricted growth. In this range of soil moisture plant are neither waterlogged or water stressed.

Optimum utilization of water: The yield increases with water can reaches a certain maximum value and thom fall down. The quantity of water at which the yield is maximum is called optimum utilization of water depth. Therefore the optimum utilization of water means getting maximum yield with any amount of water.