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Question-1

→ a) Define "Delta" and "Duty" and derive their Relation in MKS and FPS System:

Ans:→ DELTA:

. The delta defined as "It is total depth of water required by a crop during the entire period the crop is in the field.

. Denoted by symbol "Δ"

⇒ Delta (Δ) = $\frac{\text{Total quantity of water required (hectare-meter}}{\text{Area of land on which crop in growing.}}$

Example:

If a crop requires 10 waterings at an interval of 20 days with each watering of depth 19.5cm Then delta

$\Delta = 10 \times 19.5 = 195\text{cm}$

→ Duty:

. Duty represents the irrigating capacity of a unit water.

. It relation between the Area of a crop irrigated and the quantity of irrigation water required during crop growth.

Example:

If 5cumec of water is required for a crop sown in an Area of 5000 hectares.

$$\text{Duty} = \frac{5000}{5} = 1000 \text{ hectares/cumec}$$

→ Relationship in MKS:

Let,

→ Duty = D(hectares/cumes)

→ Delta = A meters Base period = B days

* By definition.

One cumec of water flowing continously for "B" day given depth of water "A" over an Area of "D" hectares.

→ volume of water /m^3sec in one day =

$1 \times 24 \times 60 \times 60 = 86400 \, m^3$

→ volume of water $1 m^3$ sec in "B" days =

$1 \times 24 \times 60 \times 60 = 86400 B m^3 = 86400 m^3 m \longrightarrow (i)$

As,

1 hectare = $10000 m^2$

$1 m^2 = 1104 H$

Then, Equation (i) becomes:

→ volume of water $1 m^3$ sec in B days = $86400 B m^3 =$

$86400 B \times 1104 H \cdot m$

Volume of water $1 m^3$ sec in B days =

$8.64 \times BH \cdot m$ — (ii)

Depth of water Required by Crop, A = Volume

Area A = $8.64 \times B \cdot m$ DH A = $8.64 \times BD m$

In F.P.S System:

We,

DUTY = D (Acres/Cusecs)

DELTA = A feet Base period = B days

By definition:

→ One cusec of water flowing continuous for "B" days given depth of water "A" over an Area of "D" acres

→ volume of water water $1 ft^3$ sec in one day =

$1 \times 24 \times 60 \times 60 = 86400 ft^3$

→ Volume of water 1 ft^3 sec in "B" days =

$1 \times 24 \times 60 \times 60 = 86400 B ft^3 = 86400 ft^2 ft$ → (i)

As. 1 Acre = 43560 ft^2, 1 ft^2 = 143560 Acre

Then Equation becomes.

. volume of water = 86400 B × 143560 Acre-Ft

. volume of water 1 ft^3 sec in "B" days = 1.983 B Acr.ft

Then

→ depth of water required by Crop, A =

volume Area A = 1.983 B Acre-Ft, D Acre A =

1.983 × B D ft.

b) Q7 wheat requires about 9cm of water after every 35 days and the base period of wheat is 140 days. Find out the delta for wheat

→ **Given data:**

→ water Requirement of wheat = 9cm

→ Days Interval = 35 days

→ Base period = 140 days

→ Delta of wheat Δ = ?

→ **SOLUTION:**

Given that, 35 days = 9cm

140 days = Δ

Cross multiplication

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

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

C) Explain Indus water Treaty.

→ INTRODUCTION:

- Indus river origination in the Tibetian plateau the vicinity of lake Mansarover, runs across through the Ladakh Region of J&K towards Gilgit-Baltistan and Then it flows southerly direction along the entire length of Punjab, Pakistan to merge with Arabian sea near the port city of Karachi.
- It is the longest river of Pakistan and 21st largest river of world in terms of annual flow
- Its left bank Tributary is Chenab and has its own 4 Tributaries namely the Jhelum, the Ravi, the Beas, the Sutlej.

- Its right bank Tributaries are the Shyrok, the gilgit, the kabul, the Gomal, the kurram.
- Around Two-Third of water supplied for irrigation and in homes comes from the Indus and associated Rivers.

INDUS River:

→ Total Length = 3180 km
→ Basin Area = 1.165 million-sq-
→ discharge = 6600m cu/s
→ Countries = India and Pakistan
→ Sources = Tibetan plateau, Gar river, Senge Zangbo

INDUS WATER TREATY:

- It is the eastern distribution Treaty between India and Pakistan, brokered by the World Bank.
- Treaty Signed on 19 Sep. 1960 by India Prime Minister Jawahar lal Nehru and Pakistan president of Ayub khan.

. According to the agreement, control over the 3 eastern river, the Beas, the Ravi and the Sutlej was given to India and 3 western river, the Indus, the Chenab, the Jhelum to Pakistan.

d) Write Significance of Duty of a Crop:

→ SIGNIFICANCE OF DUTY:

→ Its helps in designing efficient canal irrigation system - knowing the main Total available water at the head of the main canal and the overall duty for the crop required to the irrigation in different seasons of the year. The area which can be irrigated can be worked out. Inversely, if we know the crops are required to be irrigated and their duties, we can work out the discharge required for designing the channel.

Q02: a) Explain the factor affecting consumptive use.

Ans: The following factor effecting consumptive use of water by a crop.

→ 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 relation, than by any other factor.

→ Wind Moment:

Evaporation of water from land and plant surface 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.

→ Humidity:

Evaporation and Transpiration are accelerated on days of low humidity and slowed during periods of high humidity. During periods of low humidity, greater rate of use water vegetation may be expected.

→ Quality of water:

The quality of the water supply may have an appreciable effect on consumptive use. Whether or not plants actually Transpire more or less if water is highly saline may be debatable.

→ Soil Fertility:

If a soil is more fertile through the application of manure or by some other mean. The yield may be expected to increase with an accompanying small increase in use of water. And an increase in fertile of soil cause a decrease in the amount of water consumed per unit of crop yield.

b) wheat is to ------ efficiency is 80%

- Given data:
  - → Water Application Efficiency = 80% = 0.8
  - → Useful Rainfall (R_e) = 10cm
  - → Cumulative Consumptive. (C_U) = 40cm

- Required:
  - ① Consumptive Irrigation Requirement (FIR) = ?
  - ② Consumptive Irrigation Requirement (CIR) = ?

- SOLUTION:

As we know that

① → $CIR = C_U - R_e$

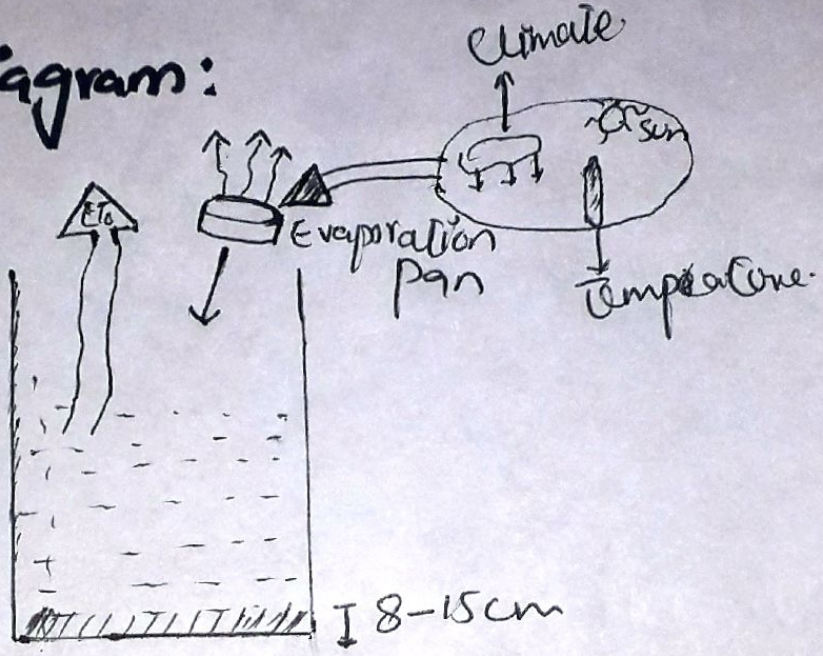
$= 40 - 10 = 30cm$

② → $FIR = \frac{CIR}{\eta_a} = \frac{30}{0.8} = 37.5cm$

C) Explain Class A Pan Evaporation (EP) measurement with help of diagram.

Ans:

Diagram:



Explination:

Evaporation can be experimentally determined by directly measuring the quantity of water evaporated from this standard class a pan. This pan is 1m in diameter 25cm deep and the bottom is rasid 15cm above the ground surface. The depth of water is to the kept in fixed range such that the water surface is 7.5cm, below the top of pan.

d) Explain Crop seasons (Rabi and kharif) and kharif Rabi Ration.

Ans:

→ Kharif Crop:

. Kharif Crop are domesticated plants like Rice That are cultivated and harvested in India, Bangladesh during The indian subcontinent mounsoon season which lasts from June To November depending on The Area.

. Monsoon rains may begin as early as may in some parts of The indian subcontinent and crops are generally harvested from 3rd week of September To October.

. Rice, maize, cotton and Sorghum are The major Khrif Crops in India

→ Rabi Crops

. Rabi Crops are agricultural Crops That are sown in winter and harvested in The spring in Pakistan and India.

. It is The Spring harvest (also known as The winter crop)

- The opposite of rabi crops, its growth before the kharif crops.
- Gram, Mustard, wheat, banana, Lemon, Grapes etc are Rabi Crops.

→ Kharif - Rabi Ratio

- Generally the area of rabi-Crops are more than kharif crops.
- The Ratio of proposed Area, to be irrigated in kharif season to that in the Rabi season is called kharif-Rabi ratio.
- This ratio is generally 1.2 i.e kharif area is one half of the rabi Area.

Q3: Define and Explain the following Terms.

a) Field Capacity:

→ "The content of water on a mass or volume basis, remaining in a soil 2 or 3 days after having been wetted with water and after free drainage is negligible."

→ The moisture content of soil 48 hours after saturation and subsequently being

allowed To drain.

- Field Capacity also been Considered To be.
  - 0.33 bars (33 kPa) in USA or
  - 0.1 bars (10 kPa) in the UK.

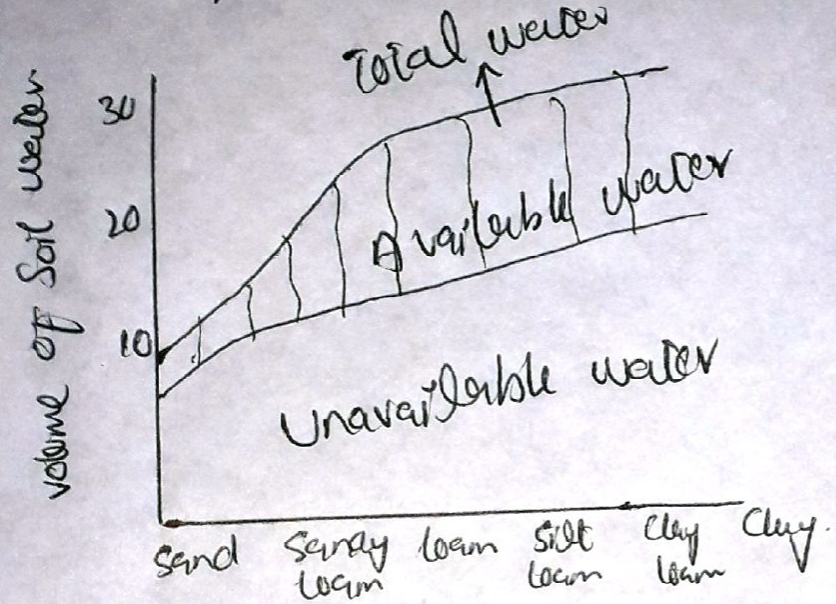
b) Permanent wilting point:

- It is define as "The minimum amount of water in the soil that the plant requires not to wilt".
- If the soil water content decreases To this or any lower point a plant wilts and can no longer recover its Turgidity when placed in a saturated atmosphere for 12 hours.

c) Available and readily available moisture contents:

- Soil moisture content near the wilting point not radily available To the plant.
- Hence the term readily available moisture has been used To refer To. The portion of the available moisture that portion of available that most

easily extracted by plant, Approximately 75% of the available moisture



d) optimum utilization of water:

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