Duty and Delta of a crop:

Delta: A crop need a certain amount of water at fixed interval through out its base period. Depth of each watering: 5cm (2") - 10cm (4").

⇒ Def: The depth of water in cm and inches required for crop throughout the base period is called Delta of Crop.

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Duty of water (D): The duty of water is the relationship b/w the volume of water and the area of crop it matures.

volume of water is generally expressed by a Unit discharge flowing for a time of base period of the crop.

1 cu.m per sec or 1 cu.ft/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/cumecs or D acres/cusecs.

Relation b/w Duty and Delta:

Let D = Duty (hectares/cumecs)

Δ = Delta = A meters Base period

⇒ One cumec of water flowing continuously for "B" days gives a depth of water "A" over an area of "D" hectares.

⇒ volume of water @ $1m^3$ sec in one day = $1 * 24 * 60 * 60$

$= 86400 m^3$

⇒ volume of water @ $1m^3$ sec in "B" days = $1 * 24 * 60 * 60$

$= 86400 B \cdot m^3$

$= 86400 m^2 \cdot m$ —— (i)

As 1 Hectare = $10000 m^2$

$1 m^2 = 1104 H$

Then equation (i) becomes:

volume of water @ $1m^3 \cdot$ sec in "B" days = $86400 B m^3$

$= 86400 * 1104$ H-m

volume of water @ $1m^3 \cdot$ sec in "B" days = $8.64 * B$ H-m —— (ii)

Depth of water required by crop (A) = $8.64 * B/H$-m DHA

Hence $\Delta = \frac{8.64B}{D \cdot m} \Rightarrow \Delta = \frac{8.64B}{D \cdot cm}$

Relationship of Delta and Duty in FPS System:

Let Duty = D (Acres/cusecs)

Delta = A feet Base period = B days

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

Volume of water @ $1ft^3$ sec in one day = $1 * 24 * 60 * 60$

$= 86400\ ft^2 ft$ ——(i)

As $1 acre = 43560 ft^2$

$1 ft^2 = 143560$ Acre Then equation (i) becomes,

Volume of water @ $1ft^2$ sec in "B" days = $86400\ B \cdot ft^3$

$= 86400B * 143560$ Acre-ft

Volume of water @ $1 ft^3$ sec in "B" days = $1.983 * B$ Acre.ft (ii)

Depth of water required by a crop, A = volume Area A =

$1.983B \cdot Acre/ft \cdot D/Acre$

Depth of water required = $\Delta = 1.983 B/D.ft$

Q No:- 01

Part b):

Of wheat required about 9cm of water every 35 days and the base period of crop Period of wheat is 1110 days. Find out the delta for wheat?

Sol:

$B = 1110$ days

$\Delta = ?$

Water required for wheat = 9cm

No of Days = 35 days

By Ratio Method

$9cm = 35$ days.

$\Delta = 1110$ days.

$35\Delta = 1110 \times 9$

$$\Delta = \frac{1110 \text{ days} \times 9 cm}{35 \text{ days}}$$

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

Q No:-01
Part c)

Explain Indus water treaty?

The Indus water treaty (IWT) is a water distribution treaty between india and Pakistan signed on sept 19, 1960. The treaty was signed by President Ayub khan and PM J Nehru. It was brokered by the world Bank.

The indus water treaty deals with river indus and it's five 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 rivers shall be available for unrestricted 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.

Q:NO:01

Part d)

Write significance of duty of a crop.

- It helps 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 day 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.

Q No:. 02

Part:(a) :. Explain the factor affecting consumptive use.

Ans:

Factors effecting consumptive use.

- Temperature
- Humidity in air
- velocity of wind
- Soil topography
- Sunlight etc.

1. Temperatures:

consumptive use of water is directly affected by the temperature. At high temperature the plant tends to show dormancy while at low temperatures there is a devastated 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.

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) Sun light:.

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

Cumulative consumptive use (C_u) = 40cm

Required.

Field irrigation Requirement (FIR) = ?

Consumptive irrigation requirement (CIR) = ?

→ $CIR = C_u - R_e$

$= 40 - 10 = 30$ cm

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

Q:No:: 02

Part:- C) Explain class A Pan Evaporation (EP) measurement with the help of a diagram.

Ans::

CLASS A PAN EVAPORATION (EP) MEASUREMENT:

·EP

can be experimentally determined by directly measuring the quantity of water evaporated from this standard class a pan. This pan is 1.0m in diameter, 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 or never more than 7.5cm, below the top of pan.

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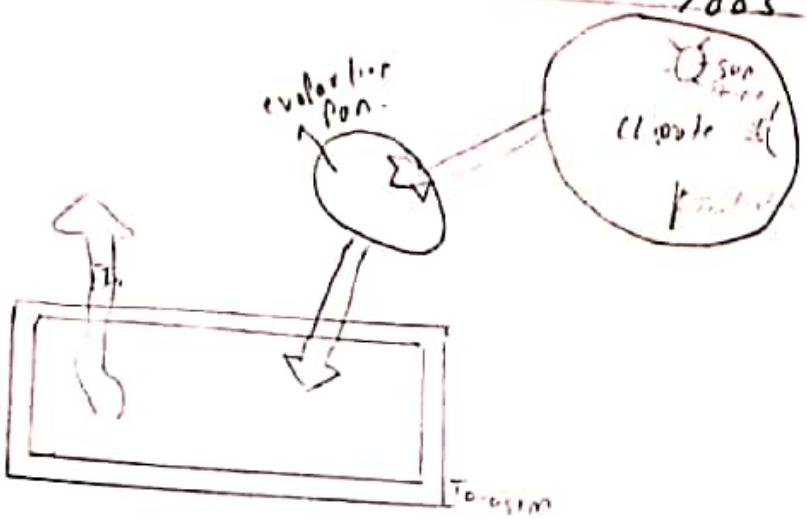

- The Pan evaporation EP can also determined by using the Christiansen formula which states.

$EP = 0.459\ R.Ct.Cw.Ch.Cs.Cc$

R = extra-Terrestrial radiation in the same units as EP in cm or mm

Ct = Coefficient for temperature

Cw = Coefficient for wind velocity.

Q: No:- 02

Part d) Explain crop seasons (Rabi and kharif) and kharif Rabi Ratio

Anc:

1) "RABI":

1st October to 31st March - winter.

"Rabi crops":

Rabi crops are wheat, Barley Gram Mustard Potatoes.

Q:03

Define and explain the following terms

Ans:.

Part a) Field capacity:

When all gravity water has drained down to water table. a certain amount of water is retained by surface soil. This water which cannot be easily drained under the action of gravity.

Part b)

Permanent wilting Point:

It is defined as the minimum amount of water in the soil that the plant requires not to will. If the soil water content decrease to this or any lower Point a plant wilts and no longer recovery its turgidity which placed in a saturated atmosphere for 12 hours.

Part c)

Available and readily available moisture contents:

a) 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 expresied as Percentage Moisture PW. as

Percentage PV or as depth.

b) "Readily Available Moisture content":

It is the water that a plant can easily extracted from the soil Row is the soil moisture held between field capacity and a nominated refill point for unrestricted growth. in this range of soil moisture plant are neither waterlogged or water stressed.

Q1. No:.03

Part d)

Optimum utilization of water:

The yield increase with water can reaches a certain maximum volne 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 mean getting maximum yield with any amount of water.

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2) khorif:

1th April to 30st in summer

"khorif crops:

khorif crops are Rice Bajro Jawar Maize cotton.

"Robi & khorif Ratio:"

The area is irrigated for Robi crops generally more than that for khorif crops generally more than that for khorif crops. The ratio of proposed areas, is to be irrigated in khorif season to that in Robi season is called as Robi & khorif ratio. The ratio is [1:2] that is khorif area is one half of that Robi area.