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| Semister | 06 |
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Q No1 a)

Ans Delta :-

The depth of water in cm or inches required for the crop through out the base period is called Delta of the crop.

For example: If a crop requires about 12 watering at an interval of 10 days, and a water depth of loam If the area under the crop is A hectares, the total quantity will be 1.20 X. A = 1.2 A hactare-Ometres in a period of 120 days.

Duty:

The term duty means the area of land that can be irrigated with unit volume of irrigation water. Duty represents the irrigating capacity of a unit. It is the relation the between the area of a crop irrigated and the quantity of irrigation water required during the entire period of the growth of that crop.

For example: If 3 cumecs of water Supply is required for a crop sown in an area of 5100 hectares, the

duty of Irrigation Water will be $\frac{5100}{3}$ = 1700 hectares / cumecs, and the discharge of 3 cumecs will be required throughout the base period.

## Mathematical Relation Between Duty, Delta In M.K.S System

Let,

Duty = D (hectares / cumecs)

Delta = A meters Base period = B days

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

Volume of water @ $1 m^3$ sec in one day = $1 \times 24 \times 60 \times 60 = 86400\ m^3$

Volume of water @ $1 m^3$ Sec in "B" days = $1 \times 24 \times 60 \times 60 = 86400B\ m^3$
$= 86400\ m^2 m \rightarrow (i)$

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 $A = 8.64 \times BH \cdot mDHA$
$= 8.64 \times BDm$

In F.P.S System:

Let,

Duty = D (Acres / Cusecs)

Delta = A feet Base period = B days

One Cusec of water flowing continously for "B" days gives a depth of water "A" over an area of "D" acres,

Volume of water @ $1 ft^3$ sec in one day $= 1 \times 24 \times 60 \times 60 = 86400^3$

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 i becomes,

Volume of Water @ 1 $ft^3$ sec in "B" days = 86400 B $ft^3$

= 86400 B x 14350 Acre-ft Volume of Water @ 1 $ft^3$ sec in "B" days = 1.983 x B Acre-ft → (ii)

Depth of Water required by Crop A = Volume Area A = 1.983 B Acre-ftD Acre A = 1.983 x BDft.

b) If Wheat requires about 9 cm of Water after every 35 days and the base period or crop period of Wheat is 140 days. Find out the delta for Wheat?

Sol:- Given:

Water requirement of Wheat = 9cm

Days Interval = 35 days

Base Period = 140 days

Required = Delta (Δ) = ?

35 days = 9cm

140 days = Δ

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

Δ = **36 cm**

C) Explain Indus Water Treaty.

Ans Indus Water Treaty: The Indus Water Treaty is a water distribution treaty between India and Pakistan signed on September 19, 1960. The treaty was signed by the then Prime Minister Jawaharlal Nehru and Pakistan's President Ayub Khan. It was brokered by the World Bank.

Indus Water Treaty Simplified:

The Indus Waters Treaty deals with river Indus and its five tributaries which are classified in 2 categories.

Eastern Rivers:

1 Sutlej
2 Beas
3. Ravi

Western Rivers:

1 Jhelum
2 Chenab
3. Indus

According to 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.

- It doesn't mean that India can't use western rivers water. The treaty says that India can use

the water in western rivers in "non-consumptive" needs. Here non consumptive means we can use it for irrigation, storage and even for electricity production.

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

- A Permanent Indus Commission was set up as a bilateral commission to implement and manage the treaty.
- Though Indus originates from Tibet, China has been kept out of Treaty.

Summary

India has never used our rights on western rivers under the Indus water Treaty, we can make use of the waters of western rivers for irrigation, storage, and even for producing electricity, in the manner specified. If we just do what we are entitled to under the Treaty, it would be enough to send jitters through Pakistan it would

be a strong Signal without doing anything drastic.

D) Write Significance of Duty of a crop.

Ans Significance of Duty of 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 for all crops required to be irrigated in different Seasons of the year, the area which can be irrigated can be worked out.

- Inversly if we know the creep area required to be irrigated and their duties, we can work out the discharge required for designing the Canals.

$$Q = A/D$$

$$A = QD$$

QNo2 Explain the factors affecting consumptive use?

Ans It is the quantity of water used by the vegetation growth of a given area. It is the amount of water required by a crop for its vegetated growth to evapotranspiration and building of plant tissues plus evaporation from soils and intercepted precipitation. It is expressed in terms of depth of water, Consumptive use varies with temperature, humidity, wind speed, topography, sunlight hours, method of irrigation, moisture availability

Temperature :-
If the temperature is high than more water will be required for the crop production

Humidity in air :-
If the humidity in air is more than less water required for the crop production

Velocity of Wind :- If the velocity of wind is more than more water is required for the crop production

Soil Topography :- If the soil is soft than less water is required and if the soil is hard than more water is required for crop production.

Sunlight :- If the sunlight is very quick than more water required for the crop production.

b) Wheat is to be grown at a certain place, the useful rainfall for the whole season is 10 cm and its comulative consumptive use is 40cm. Determine consumptive irrigation requirement (CIR) and Field Irrigation Requirement (FIR) if the water application efficiency is 80%.

Sol:- Given:

Useful Rainfall = 10 cm

Water application Efficiency (na) = 80%
= 0.8

Commulative Consumptive use (Cu) = 40 cm

Required:-

Field Irrigation Requirement (FIR) = ?

Consumptive Irrigation Requirement (CIR) = ?

By Formula,

Consumptive Irrigation Requirement = Cu - Rc

= 40 - 10

CIR = 30 cm

→ Field Irrigation Requirement (FIR) = $\frac{CIR}{\eta a}$

$= \frac{30}{0.8}$

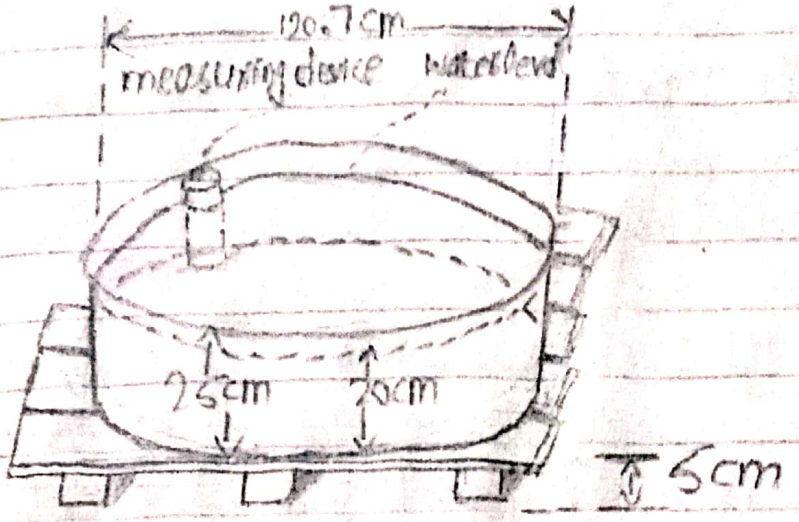
$= 37.5 cm$

C) Explain Class A Pan Evaporation Ep measurement with the help of diagram.

Ans:- Ep can be experimentally determine by directly measuring the quantity of water evaporated from this Standard Class a pan. This pan is 1.0m in diameter, 25cm dee and bottom is raised 15cm above 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 than 7.5cm, below the top of pan.

(14)

# Class A Pan Evaporation



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

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

R = extra

Ct = Coefficient for temperature

Cw = Coefficient for wind velocity

Ch = Coefficient for relative humidity

Cs = Coefficient for percent of possible Sunshine

Ce = Coefficient for elevation

d) Explain Crop Season and Kharif Rabi Ratio.

Ans CROPING Seasons

1 RABI - Ist octobar to 31st Mar
- Winter.

2 KhARIF - Ist April to 30st Septem

- Summer.

Kharif crops: Rice, Bajra, Jewar, Maize, Cotton.

Rabi crops: Wheat, Barley, Gram, Mustard, Potatoes.

Kharif Rabi Ratio :- The area to be irrigated for rabi crops generally more than that for kharif crops. This ratio of proposed areas to be irrigated in kharif season to that in Rabi season is called, kharif Rabi ratio. This ratio is generally 1:2 i.e kharif area is one half of Rabi area.

Q No 3 Define and explain the following terms

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 can not be easily drained under the action of gravity and is called Field Capacity.

Period of drainage = 2-5 days

FC is measured after 2 or 5 days.

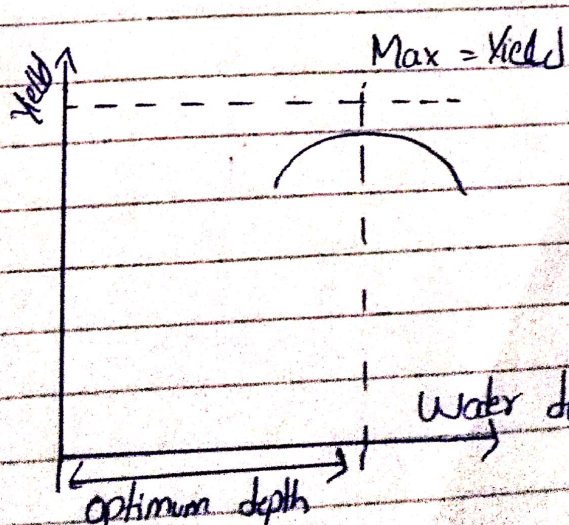
b) Permanent Wilting Point :- A plant can extract water from soil till a permanent wilting is reached. P.W.P is that water content at which a plant can no longer extract sufficient water for its growth and wilts up.

c) Available moisture Contents :- The range of available water that can be stored in soil and be

available for growing crops is known as available soil water moisture.

Readily Available Moisture :- It is that portion of available moisture which is most easily extracted by plants and is approximately 75 to 80% available moisture.

d) Optimum utilization of water :- If a crop is sown and produced under absolutely identical conditions using different amounts of water depths, the yield is found to vary. The yield increases with water, reaches a certain maximum value and then falls down as shown in following fig.



The quantity of water at which the Yield is maximum is called optimu Water depth.