Name	Usama Ayaz
ID	6977
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Qno1:-)

Ans a) Duty:-

It is the total area irrigated by a unit discharge running continuously during the base period & its unit is area/cumec

It is irrigated capacity of unit of water. Thus duty gives the relation b/w volume of water & area of the crop.

Delta:- It is the total depth of water required by a crop during the entire period the crop in the field & is denoted by "Δ"

Relationship b/w delta & Duty:-

In MKS System:-

D = Duty in hectares/cumec

Δ = total depth of water supplied in meter

B = Base period in days.

If we take a field of area "D" hectares water supplied to the field corresponding to the water depth Δ meters will be

$$\Delta \times D \text{ hectares meter} = \Delta \times D \times 10^4 \text{ cubic meter} \quad (1)$$

Again for the same field of D hectares, one cumec of water is required

to flow during the entire base period, Hence water supplied to this field is;

$$= (1) \times (B \times 24 \times 60 \times 60) m^3 \quad -(2)$$

Equating (1) & (2) Equation.

$$D \times \Delta \times 10^4 = B \times 24 \times 60 \times 60$$

$$\Delta = \frac{B \times 24 \times 60 \times 60}{D \times 10^4} = 8.64 \frac{B}{D} \text{ meter}$$

Δ is in meter.

B is in days

D is in sq. meter.

In FPS System;-

let Duty = D(Acres / cusecs),

Delta = A feet Base period = B days by definition 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 oneday = $1 \times 24 \times 60 \times 60$

$= 86400 ft^3$

volume of water $1 ft^3$ sec in B.days =

$1 \times 24 \times 60 \times 60 = 86400 ft^3$ — (1)

As 1 Acre = $43560 ft^2$ $1 ft^2 = \frac{1}{43560}$ acre then, equation 1 becomes

Volume of water 1 ft^3 sec in "B" days = 86400 ft^3

= 86400 x 143560 Acre ft volume of water 1 ft^3 sec in "B" days = 1.983 B Acre ft

(iii)

Depth of water required by crop A = $\frac{\text{Volume}}{\text{Area A}}$

= 1.983 B Acre-ft / D Area A

= 1.983 x B/D ft.

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

where Δ is in feet

B in days

D in Acres / cusec.

(No2)

Ans b) Given:-

water requirement of wheat = 9 cm

Days interval = 35 days

Base period = 140 days

Required:-

Delta of wheat (Δ) = ?

Solution:-

35 days = 9 cm

140 days = Δ

By cross multiplication

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

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

Qno 1)

Ans (c) Indus water treaty;-

History;-

The indus water treaty is a water distribution treaty b/w india & Pakistan sign on sep 19, 1960. The treaty was sign by prime minister Jawaharlal Nehro & Pakistan president Ayub khan. It was brokered by the world bank.

Points;-

The indus water treaty deals with river indus indus & its five tributaries which are classified in 2 catagories.

Eastern river;-

Sutlej
Beas
Ravi

western river;-

Jhelum
chenab
Indus.

(i) According to the treaty, all the water of eastern rivers shall be available for unrestricted use of india.

(ii) India should let unrestricted flow of water from western rivers to Pakistan.

(iii) At doesn't mean that india can't use western rivers. The treaty says that india can use western river in non consumptive needs. Here non consumptive mean we can use it for irrigation, storage & even for electricity production (But india has not fully utilized this provision so far)

(iv) The treaty allocates 80% of water from the six river water system to Pakistan.

(v) A permanent indus commision was set up as bilateral commision to implement & manage the treaty.

(vi) Though indus originates from Tibet, china has been kept out of the treaty.

Qno1)

Ans(d) Significance of Duty:-

(i) At helps in designing efficient canal irrigation system. knowing the total available water at the head of the main canal & the overall duty for all the crop required to be irrigated in different seasons of the year, the area which can be irrigated can be worked out.

(ii) Inversly if we know (6) the crop area required to be irrigated & their duties we can workout the discharge required for designing the canal.

Qno2)

Ans a) Factor affecting consumptive use of water:-

1) Precipitation:-

The amount & rate of Precipitation may have some minor effect on the amount of water consumptively used during any summer.

2) Temprature:-

The rate of consumptive use of water by crops in any particular locality is probably affected more by temprature which for long-time periods is a measure of solar radiation, than by any other factor.

3) Humidity:-

Evaporation & transpiration are accelerated on days of low humidity & slowed during periods of high humidity. During periods of low relative humidity, greater rate of use of water by vegetation may be expected.

4) Soil Fertility:- 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.

5) Plant pests & Disease:- Where plant pests & disease seriously affect the natural growth of the plants. It is reasonable to assume that the transpiration will like wise decrease

Qno2)

Ans b) Given data:-

useful rainfall (cm) = 10

water application efficency (ηa) = 80%.

= 0.8

commulative consumptive use (Cu) = 40cm

Required:-

FIR = ?

CIR = ?

solution:-

By formula

consumptive irrigation requirement

$CIR = Cu - Re$

$= 40 - 10$

$CIR = 30$ cm.

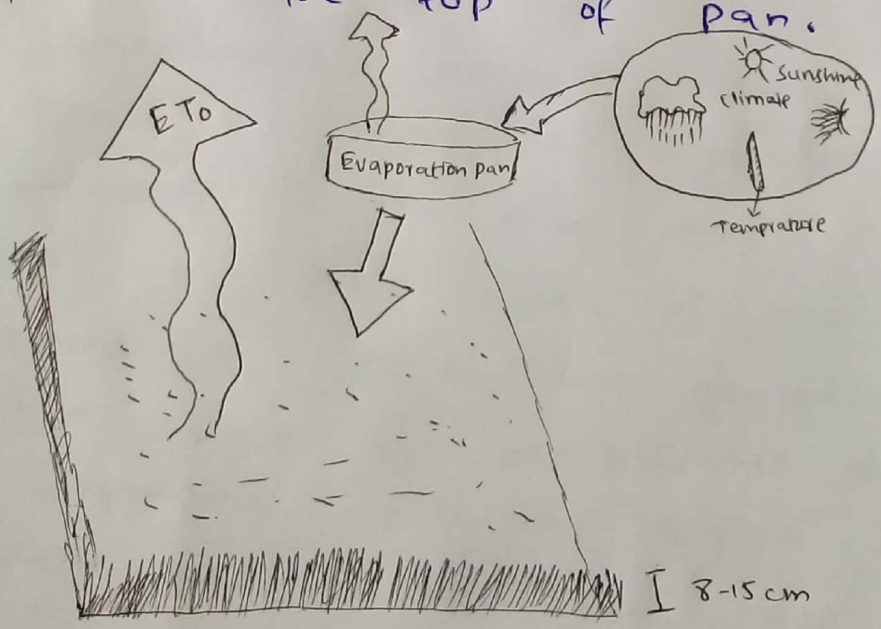
Field irrigation Requirement (FIR)

$= \frac{CIR}{\eta a} = \frac{30}{0.8} = 37.5$ cm.

Q no 2)

Ans c) 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 1m 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, & never more than 7.5cm, below the top of pan.



Q no 2)

Ans d) Rabi Crop :-

Rabi crops are agricultural crops that are sown in winter & harvested in the spring in india & pakistan. The term is derived from the

Arabic word for "spring" which is used in the indian subcontinent, where it is the spring harvest (also known as the winter crop). The opposite of rabi crops are the kharif crops which are grown after, the rabi & zaid crop are harvested one after another respectively.

Example:- Gram, Mustard, wheat, banana, guava, lemon Grapes.

Kharif crop:-

Kharif crop are domesticated plants like rice that are cultivated & harvested in india, Bangladesh during the indian subcontinent monsoon 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 & crops are generally harvested from 3rd week of semptember to october, again depending upon the reigion & the crops Rice, maize, sorghum & cotton are the major khrif crops in india.

Example:-

sugarcane, Maize, cotton, Rice, Millet etc.

Kharif Rabi ratio:-

The area to be irrigated for rabi crop is generally more than that for the kharif crop. 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 ie kharif area is one half of the rabi ~~crop~~ area.

Q no 3)

Ans a) Field Capacity:

It is the amount of soil moisture of water content held in the soil after excess water has drained away & the rate of downward moment has decreased. This usually takes place 2-3 days after rain or irrigation in pervious soil of uniform structure & texture

Ans b) Permanent Wilting point:

The minimum amount of water in the soil that the plant require not to wilt. If the soil water content decreases to this or any lower point a plant wilt & can no longer recover its turgidity when placed in a saturated atmosphere for 12 hours. The physical definition of the wilting point symbolically expressed as Φ_{pwp} or Φ_{wp}, is said by convention as the water content at -1500 kPa of suction pressure or negative hydraulic head.

Ans c) Available moisture content;

The difference in moisture content of the soil b/w field capacity & permanent wilting is termed as the available moisture. Available moisture can be expressed as percentage moisture PW, as percentage PV or as depth d.

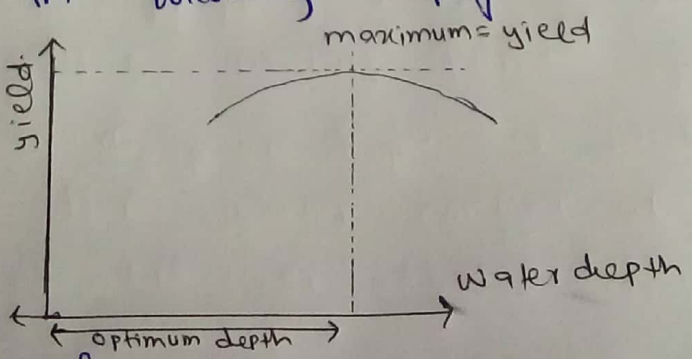
Readily available moisture content;

It is that portion of available moisture which is most easily extracted by plants & is approximately 75 to 80% available moisture.

Qno3)

Ansd) Optimum Utilization of water;-

If a crop is sown & produced under absolutely identical condition using different amounts of water depth, the yield is found to vary. The yield increases with water, reaches a certain maximum value & then falls down as shown in following fig.



The quantity of water at which the yield is maximum is called optimum water depth.