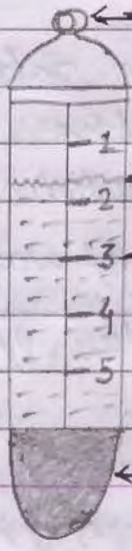
4.) Floating Pan

- A sunken Pan is a float in a lake using drum floats is called floating pan
- It is also called as US Geological ~~Survey~~ survey floating pan
- Its Pan Coefficient (Cp) ranges from 0.70 - & average value is 0.80

5.) Piche evaporimeter

- It is 30-cm long graduated tube & open end covered by a dry paper
- It is usually kept suspended in a S son screen
- The tube is filled with water & tur upside down so that the water slowly the paper & evaporates
- The loss of water from a tube is mult by Pan Coefficient (Cp) of 0.7 to get th actual evaporation from field
- The values obtained from piche evaporir measurement is higher than the actual e



Pan Coefficient (C_p)

$$C_p = \frac{\text{Lake evaporation}}{\text{Pan evaporation}} = 0.67 - 0.82$$

Actual evaporation (AE)

$$AE = C_p \times \text{Pan evaporation}$$

- The following are the monthly Pan evaporation data (Jan-Dec) at Krishnarajasagara in a certain year in cm.

16.7	14.3	17.8	25.0	28.6	21.4
16.7	16.7	16.7	21.4	16.7	16.7

The water spread area in a lake nearby in the beginning of Jan. in that year was 2.80 km^2 & at the end of December it was measured as 2.55 km^2. Calculate the loss of water due to evaporation in that year. Assume $C_p = 0.7$

Soln:-

Average area of lake can be found out by one formula

$$A_{avg.} = \frac{1}{3}\left(A_1 + A_2 + \sqrt{A_1 \times A_2}\right)$$

$$= \frac{1}{3}\left(2.80 + 2.55 + \sqrt{2.80 \times 2.55}\right)$$

$$= \frac{1}{3}\left(2.80 + 2.55 + 2.67\right)$$

$$= \frac{1}{3}\left(8.022\right)$$

$$= 2.674 \ km^2$$

- Annual evaporation = 16.7 + 14.3 + 17.8 + 25 + 28.6 + 21.4 + 16.7 + 16.7 + 16.7 + 21.4 + 16.7 + 16.7

= 228.7 cm

- Volume of water (V) = Area (A) × depth (d) × C_p

= $2.674 \times 10^6 \ (m^2) \times 2.287 \ (m) \times 0.7 = 4.28 \times 10^6$

Compute the daily evaporation from a class A pan if t amounts of water added to bring the level to the fixed point are as follows:

Day	1	2	3	4	5	6	7
Rainfall (mm)	14	06	12	08	0	05	06
Water added or removed (mm)	-5	03	0	0	07	04	03

What is the evaporation loss of water in this wee from a lake (surface area = 640 ha)? Take $C_p = 0.75$

Soln :-

Given data

$$A = 640 \text{ ha} = 640 \times 10^4 \text{ m}^2$$

Total Pan evaporation = Rainfall $\pm$ water

$$= (14-5) + (6+3) + (12+0) + (8+0) + ($$
$$+ (5+4) + (6+$$
$$= 9 + 9 + 12 + 8 + 7 + 9 + 9$$
$$= 63 \text{ mm}$$

Actual Pan evaporation (AET) = C_p × Pan evaporation

$$= 0.75 \times 63$$
$$= 47.25 \text{ mm}$$

Volume of water loss from lake (V) = Area (A) × depth

$$= 640 \times 10^4 \times 47.25 \times$$
$$= 30240 \times 10^1 \text{ m}^3$$
$$= 30.240 \times 10^4 \text{ m}^3$$
$$= 30.240 \times 10^4 \text{ (m}^2\text{-m)}$$
$$= 30.240 \text{ ha-m}$$

$1 \text{ ha} = 10^4 \text{ m}^2 = 10{,}000 \text{ m}^2$

⇒ Transpiration (T)

- It is the process in which the water leaves (सोडते, त्याग देते) from living plant due to photosynthesis (प्रकाश-संश्लेषण) process & reached to atmosphere is called transpiration (T)
- It is measured by Phytometer

- In phytometer method a closed container fill up by earth & sealed to prevent the flow of water
- The water added artificially up to the complete growth of plant & it is measured
- The transpiration loss is given by

$$T = (M_1 + M) - M_2$$

Where, M_1 = Intial mass of instrument
M_2 = Final mass of instrument
M = Mass of added water
T = Transpiration loss

TRANSPIRATION RATIO

- It is the ratio of the mass of water transpired by the plant during full grow period to the production of dry matter of that plant

$$T.R. = \frac{\text{Mass of water transpired by the plant}}{\text{Mass of dry matter}}$$

- T.R. of wheat ranges from 300-600 (Avg.-450)
- T.R. of Rice ranges from 600-800 (Avg.-700)

⇒ Evapotranspiration (ET)

- It is the process in which the water leaves from living plant (transpiration) & from adjacent (आसपास) soils (evaporation) is called & reached to the atmosphere is called evapotranspiration (ET)

$$ET = \text{Evaporation} + \text{Transpiration}$$
$$ET = E + T$$

⇒ Consumptive use (Cu)

- It can be defined as the amount of water used in the evapotranspiration (ET) & the water used by the plants for metabolic process to build up the plant tissues (ऊतकों)

Note:- The amount of water used in metabolic process is less compared to evapotranspiration so both the terms evapotranspiration & Consumptive use (Cu) are considered as same due to insignificant of water used in metabolic process.

Photosynthesis process: When stomata (tiny openings, छोटे छिद्र) opens & air enters inside it then the chloroplasts contain in the leaf use the carbon dioxide (CO_2) from air along (-के साथ) with very small portion of water to produce their own food of carbohydrates is called photosynthesis.

- At a time of stomata opening the water came out & evaporated to the atmosphere

⇒ Potential Evapotranspiration (PET)

- It was defined by Thronwait (1948)
- It can be defined as when the sufficient moisture is freely available to completely meet the requirement of the vegetation fully covering an area then the resulting evapotranspiration is called the potential evapotranspiration (PET)
- It's depends more on climatogical factors

⇒ Actual Evapotranspiration (AET)

- It can be defined as when the evapotranspiration occurs in specific situation in the ~~field~~ real field then ~~the~~ is called actual evapotranspiration (AET)
- It's depends more on characteristics of soil & vegetation

⇒ Effective Rainfall (ER)

- The rainfall which is require to meet the evapotranspiration needs of the crop after satisfaction of all losses like ~~evapo~~ runoff, percolation etc. is called effective rainfall (ER)

⇒ Reference evapotranspiration (ET_o) Theoritical

- The evapotranspiration from hypothetical grass surface which has

⇒ Reference evapotranspiration (ET_o)

- The evapotranspiration from the surface covered by hypothetical (theoritical, માનેલું) grass crop which has 0.12 m (12-cm) height, 70 s/m surface resistance & 0.23 albedo is called reference evapotranspiration
- ET_o express the evaporating power of the atmosphere at a specific location & time
- It Consider only soil climatic Parameter
- It does not Consider crop & soil characteristics
- In short it is only based on climatic data

⇒ Consumptive Irrigation Requirement (CIR)

- It can be defined as the requirement of water to the crop as a Consumptive use but excluding (બાદ કરીને) effective rainfall, stored soil m.c. & ground water
- Generally, stored soil m.c. & ground water are not considered in Practical field so it can be written as

$$CIR = Cu - Re$$

(Re = Effective Rainfall, Cu = Consumptive use)

- પાકને Consumptive use માટે જે પાણીની જરૂર પડે (વપરાયું પાણી) તેમાંથી વરસાદ દ્વારા, કે ground water દ્વારા જે પાણી પાકને પુરુ પાડવું જોઈએ તે બાદ કરીને જે પાણી ખામામાં આપે તેને CIR કહેવામાં આવે છે.

ઉદાહરણ

- વરસાદ દ્વારા કે ground water દ્વારા જે પાણી પાકને પુરુ પાડવામાં આવ્યું હોય ત્યારે જે બાકી રહેતું પાણી આપવું પડે તેને CIR કહેવામાં આવે છે.

Note :- CIR & NIR both are same

⇒ Net Irrigation Requirement (NIR)

- The amount of water which are essentially (Evaporation) for crop after excluding rainfall plus the water required in leaching percolation is called net irrigation requirement

- So,

$$NIR = (Cu - Re + (Leaching + percolation))$$

Losses

⇒ Gross Irrigation Requirement

- It can be defined as the net irrigation requirement plus losses in water application & other losses

$$GIR = NIR + Losse$$

or

$$GIR = \frac{NIR}{\eta a} \Rightarrow \eta a = \frac{NIR}{GIR}$$

Suppose,

Depth of irrigation required = 8-cm

Field application efficiency = 75% = 0.75

So,

$$GIR = \frac{NIR}{\eta a} = \frac{8}{0.75} = 10.66\text{-cm}$$

→ જ્યારે 10.66-cm પાણી ખેતરમાં આપે ત્યારે 8-cm પાણી પાકને મળશે અને (10.66-8) 2.66-cm પાણી loss થશે.

⇒ Infiltration

- The downward-(
- The downward (vertical) movment of water into the soil at the ground surface is called infiltration (I)
- It replenishes/fill up the soil moisture deficiency. (24 hrs)

INFILTRATION RATE (I.R.)

- The maximum water rate which can be absorbed by the soil in any given condition at any time is called infiltration rate
- Following equations are used to calculate the infiltration rate

a- Horton's equation
b- Philip's "
c- Kostiakov "
d- Green-Amp "

- In practical field it can be measured by

a- Infiltrometer
  ~ Double-ring
  ~ Tube type
b- Rainfall simulator
c- Hydrograph analysis

⇒ Deep percolation

- The amount of water which can passes below the root zone of the crop & not useful for crop is called deep percolation
- Generally it is 20% or more of the total amount of applied water.

* Factors affecting consumptive use (Cu)

Do as yourself