Name M. Mustafa

ID 7866

SECTION B

SEMESTER 6^{th}

TECHNOLOGY Civil Engg

Paper Irrigation Engineering

IQRA NATIONAL UNIVERSITY

Peshawar Hayatabad.

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(1) (a) **Delta:**

Total depth of water required for crop for its complete nourishment throughout the base period is called Delta, of the crop.

Expression:

Delta is expressed in "cm" or "inches."

Duty of water:

It is the relationship between the volume of irrigation water required during the entire period and the area of the crop irrigated.

$$Duty = \frac{acres}{Cusec} = \frac{Area\ (m^2)}{Volume\ (m^3)}$$

Relationship:

let Δ = Total depth of water supplied.

D = Duty of this crop, $\frac{\text{hectares}}{\text{cumec}}$

B = Base period of this crop, days.

MKS:

Volume of water applied to irrigate D hactares of land for 1 sec = 1 m^3

then volume of water applied for 1 day = $1 \times 60 \times 60 \times 24 \; m^3$

$\Rightarrow 86400 \; m^3$

Similarly volume of water applied for B days (V) = $(86400 \times B) \; m^3$

land area Irrigated (A) = $D \times 10^4 \; m^2$

$\Rightarrow 10000 \, D m^2$

Total depth of water applied on

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on this land

$$\Rightarrow \frac{\text{Volume}}{\text{Area}} \Rightarrow \frac{86400\ B}{10^4 D}\ m$$

$$\Rightarrow 8.64 \frac{B}{D}\ m$$

→ Delta

$$\Delta = 8.64 \frac{B}{D}\ m$$

⇓

This depth of water is called Delta

and D is the duty in ha/cumec

FPS:

$$\Delta = 1.98 \frac{B}{D}\ ft$$

[foot pound second system]

where Δ is in ft and D is in Acres/cusec

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1-(b) Given Data:

water requirement = 9 cm

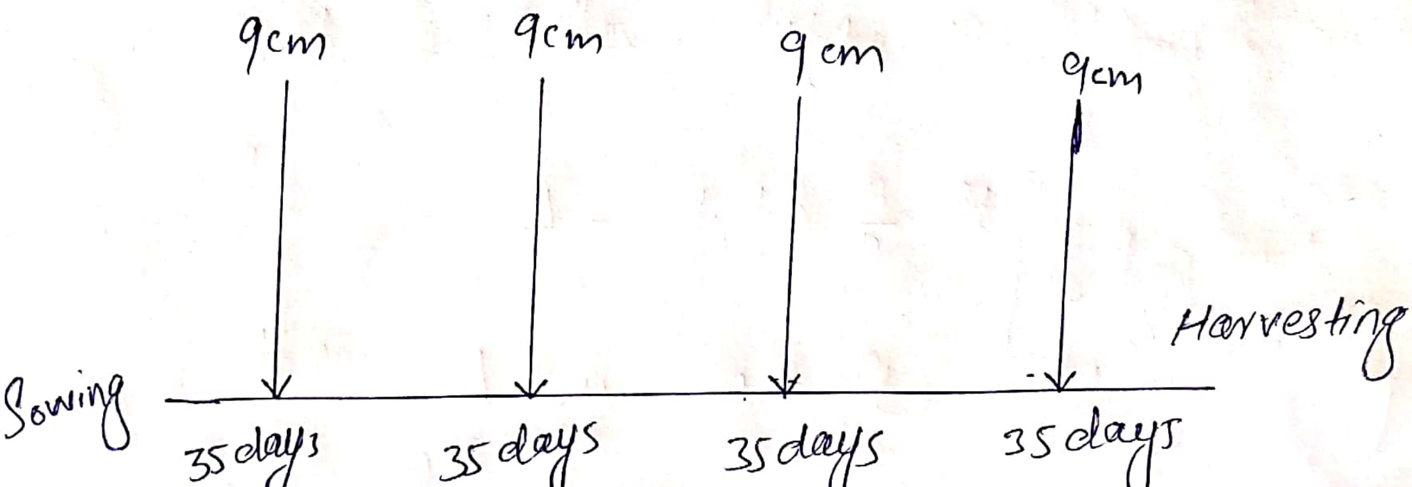
Intervals (days) = 35 days

Base period = 140 days.

Required:

Delta of wheat = ?

Solution:



9 cm ⟶ 35 days

Δ ⟶ 140 days

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

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

Hence Delta for wheat is 36 cm.

Hence the delta for wheat is 36 cm.

1-(c) INDUS WATER TREATY:

- (*) The Indus river system which is the lifeline of Pakistan, and western India, comprises the river indus and its five (5) main tributaries namely jhelum, chenab, Ravi, Beas and Sutlej.
- (*) India and Pakistan signed the Indus water treaty on september 19, 1960, which consist of 12 articles and 8 appendices.
- (*) The treaty defines the principles for sharing water of the Indus

river system between the two Countries.

- On April 1, 1948, India stopped the supply of water to Pakistan from every canal flowing from India to Pakistan.
- Pakistan protested and India finally agreed on an interim agreement on May 4, 1948.
- The agreement was not a permanent solution: therefore Pakistan approached the world Bank in 1952 to help settle the problem permanently.
- Negotiations were carried out b/w two countries through the offices of World Bank, and agreement was signed b/w Pakistan and India in september 1960.

This agreement is known as Indus water treaty. This treaty divided the use of rivers and canals b/w two countries Pakistan obtained rights for three rivers

PAKISTANI RIVERS:

(I) Indus (II) Jhelum (III) chenab

INDIAN RIVERS:

(I) Ravi, (II) Beas (III) Sutlej.

⇒ Three multipurpose dams were built Warsak Dams, Mangla Dams, and Terbela Dams.

⇒ Five Barrages and a gated Siphon were also constructed under this treaty.

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(1) (d) Significance of duty of crops:-

- Duty of crops represents the irrigation capacity of a unit
- It helps in designing efficient canal irrigation system.
- ⟹ knowing the total available water at the head of main canal and overall duty for all crops required to be irrigated in different season of the year, the area which can be irrigated can be worked out.
- knowing crop area and duty we can workout the discharge required for the design of canal

$$A = QD$$

$$\Rightarrow Q = A/D$$

(2) (a) Factors Effecting Consumptive use.

(i) Temperature.
(ii) Humidity of air
(iii) Velocity of wind.
(iv) Sunlight
(v) Soil Topography.

(i) Temperature:

Temperature effects directly the consumptive use. If there is greater temperature then there will be more evaporation and increase in evaporation leads to more consumptive use

Temperature ↑↑ Evaporation ↑↑ → CU ↑↑

(ii) Humidity in Air:

If there is more humidity in air then consumptive use will be less because due to more humidity evaporation is decreased and consumptive also decreases due to Less evaporation

(iii) **Velocity of Wind:-**

If the velocity of wind is more then usual there will be higher consumptive use.

(iv) **Sunlight:**

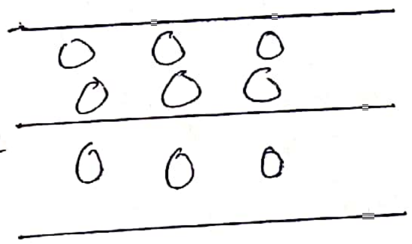
Sunlight effect the consumptive use in a way that if there is sunlight of higher intensity for greater period of time then there will be higher evaporation resulting in more consumptive use.

(v) Soil topography:—

Soil topography also effects the consumptive use. In high permeable soil consumptive use is also high while in low permeable soils, consumptive use is also low.

High permeable soil

greater void size



easy evaporation

Cu ↑↑

low permeable soil

less void size

i.e less evaporation

CU ↓↓

Q(2)(b) Given Data

Useful rain = 10 cm

commulative consumptive use = 40 cm

water application efficiency = 80%

Required:

Consumptive Irrigation Requirement (CIR) = ?

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Field Irrigation Requirement (CIR) = ?

Solution:

Consumptive Irrigation Requirement (CIR)

As $CIR = Cu - Re$

$CIR = (40 - 10)\ cm$

$$CIR = 30\ cm$$

Field Irrigation Requirement (FIR)

As $FIR = \frac{NIR}{\eta_a} \longrightarrow (A)$

First Finding NIR

$NIR = Cu - Re + \text{water lost in leaching}$

$NIR = (40 - 10 + 0)\ cm$

$$NIR = 30\ cm$$

put $NIR = 30\ cm$ in equation (A)

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$$FIR = \frac{30}{0.8} \Rightarrow \boxed{FIR = 37.5 cm}$$

Q(2)-(C) Class A Pan Evaporation (EP) Measurement:

Ep can be experimentally determined by directly measuring the quantity of water evaporated from the standard class a pan. The pan is 1 m in diameter, 25 cm depth and bottom is raised 15 cm above the ground surface. The depth of water is to be kept in a fixed range such that the water surface is at least 5 cm, and never more then 7.5 cm below the top of pan.

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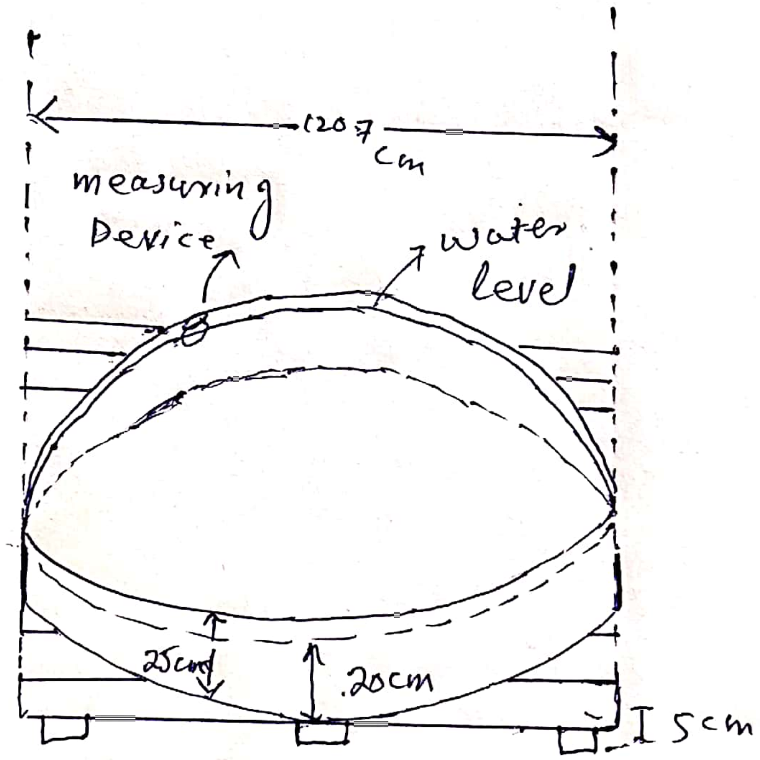
Diagram :-



Class A Pan Evaporation

Q-(2) (d) Crop Seasons:

(i) Rabi-: 1st October to 31 ~~oct~~ March - winter.

(i) Rabi Crops:-

Rabi crops includes, wheat, Barley, Gram, Mustard, Potatoes

(ii) Kharif :- 1st April to 30 september - summer.

Kharif Crops:

Rice, Bajra Jawar Maize cotton.

Kharif Rabi Ratio:

Ratio of the proposed areas to be irrigated in Kharif season to that in Rabi season is called Kharif Rabi Ratio

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The area to be irrigated for Rabi crops generally more than that for Kharif crops. ~~Thus~~

⇒ This ratio is generally 1:2

i.e Kharif area is one half of Rabi area

Q(3) - (a) Field Capacity (F.C):-

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 F.C.

Period of drainage = 2–5 days

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FC is measured after 2 or 5 days.

Field capacity : (i) Capillary water

(ii) Hydroscopic water.

(i) Capillary water:-

Water attached to soil by surface tension, which can ~~be~~ easily be extracted by plants by capillary action

(ii) Hydroscopic water:.

Water attached to soil by chemical bonds, which cannot be extracted by plants by capillary

Field Capacity = (weight of water retained in a certain volume of soil)/weigt of same volume of soil) x100.

Consider 1 m^2 area of soil, d m depth of root zone.

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Volume of soil = d x 1 cu.m

If γ kg/cu.m = density of soil = specific wt of soil. then wt of d-cum of soil = γ d Kg if F is field capacity

F = Wt of water retained in unit area of soil / γd weight of water retained in unit area of soil

= Fγd kg/cu.m. Wt of water retained in unit area or volume

$= W d_1 = γ d F$

d_1 = depth of water stored in root zone = $γd \cdot F/w$ = kg/sq.m / kg/cu.m.

w = specific wt of water = kg/cu.m

P.T.O

Q(3)

(b) **Permanent Wilting Point:-**

is defined as 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 and can no longer recover its turegidity when placed in a saturated atmosphere for 12 hr.

Q(3) (c) **Available and readily available moisture content:-**

⇒ The diffence in the moisture content of the soil b/w field capacity (F.C) and permanent wilting is termed as available moisture it is expressed as percentage moisture and percentag P.V

P.T.O

⇒ 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

Q3- (d) **Optimum Utilization of water:**

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

⇒ If a crop is sown and produced under absolutely identical conditions using different amounts of water depths, The yield is field to vary. The yield increases with water, reaches a

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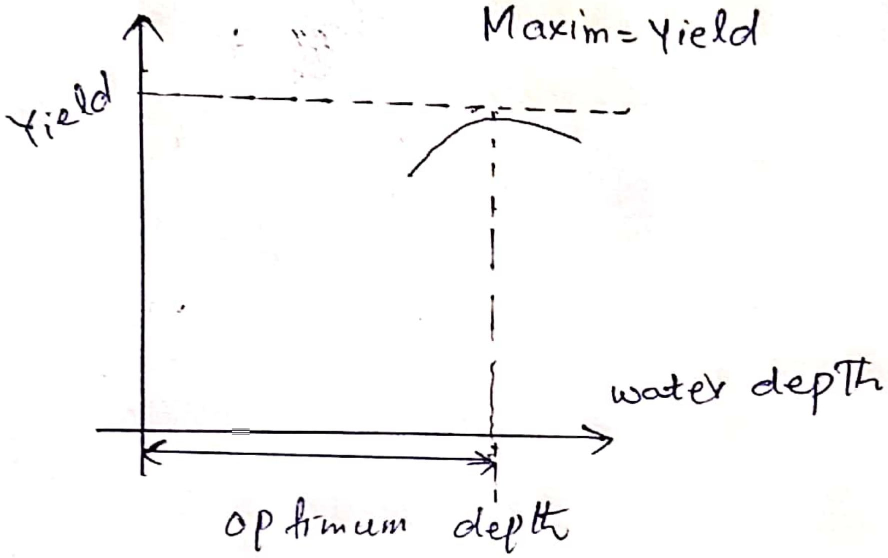
certain maximum value and then falls down.

Graph:-



The End.