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Ex-4.3 Mane (40)

Find out the water requirement of tomato having spacing of 30cm x 45cm x 60cm Pan evaporation of the region is 7 mm/day. Assume crop factor & pan factor.

Sol^n:-

Given data

Water r

Crop area = 30 cm x 45 cm = 0.30m x 0.45m

PE = 7 mm/day

Pc = 0.7

Kc = 0.8

Water requirement = Crop area x PE x Pc x Kc

= 0.30 x 0.45 x 7 x 0.7 x 0.8

= 0.53 lit/day/plant

Ex-4.4 Mane (40)

Calculate the quantity of water requirement in m^3/ha/day for banana using following data.

- Spacing between the plants & row = 1.5 x 1.5 m^2
- Pan evaporation = 10 mm/day
- Pan factor = 0.70
- Crop coefficient = 1.0
- % wetted area = 60

Sol^n:-

Water requirement = Crop area x PE x Pc x Kc x % of wetted area

= 1.5 x 1.5 x 10 x 0.70 x 1.0 x 0.6

= 9.45 lit/day/plant

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1 - Plant 9.45 lit/day

No. of plant = $\frac{\text{Area}}{\text{Crop area}}$

$= \frac{10,000}{1.5 \times 1.5}$

$= 4445$

So,

Quantity of water per ha = No. of plants × water required per plant/day

$= 4445 \times 9.45$

$= 42,000$ lit/day/ha

$= 42\ m^3$/day/ha

EX-4.5 Mane (141) Determine the water requirement per m^2 per row of the crop having pan evaporation of the region as 8 mm/day with crop coefficient as 0.7 & % wetted area covered by the foliage is 50 %.

Water requirement = Crop area × PE × Pc × Kc × % of wetted area (Pc: Assume)

$= (1 \times 1) \times 8 \times 0.7 \times 0.7 \times 0.5$

$= 1.96$ lit/m^2/day

Ex-4.6 Mane (41)

Calculate the water requirement of gerbera whose spacing is 30cm x 30cm with pan evaporation is 10 mm. assume crop factor as 1 & canopy factor 1.

Sol^n:-

Water requirement = Crop area × PE × Pc × Kc × wetted area

$= 0.3 \times 0.3 \times 10 \times \overset{0.8}{1} \times \overset{1}{0.8} \times 1$

$= 0.72$ lit/day/plant

Head loss occur due to friction

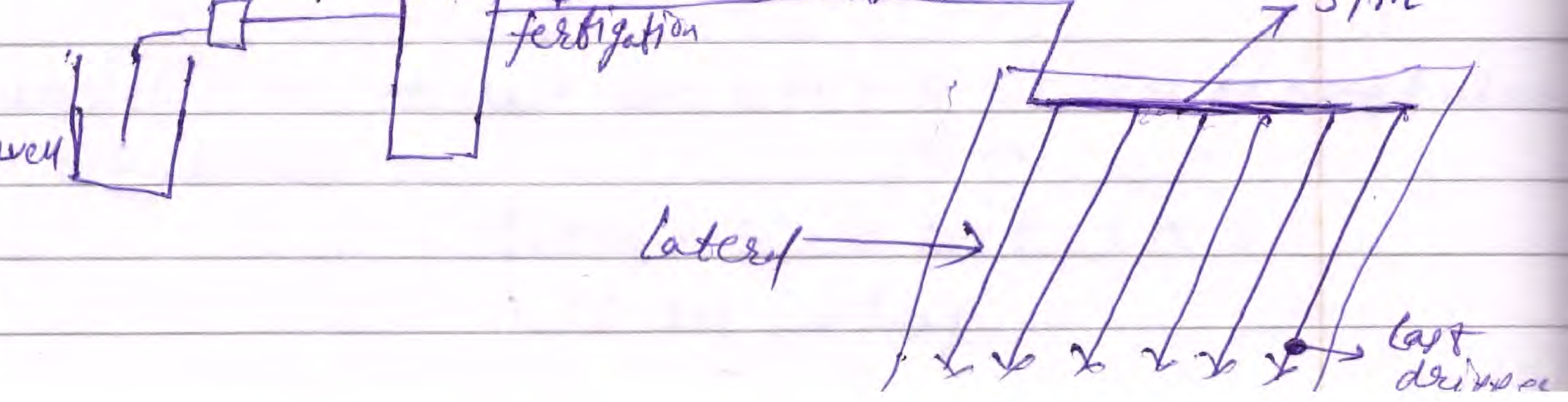
Lateral head loss Calculation

- The diameter of lateral is usually selected such that the difference in discharge between two extreme (લેટરલ્સ, લેટરલ શરૂ પહેલું અને છેલ્લું ડ્રીપર) emitters operating simultaneously should not exceed 10%.
- For 10% variation in the flow, the pressure head difference between emitter should not exceed 10 to 15% of the average operating head.
- Where long path emitters are used & 20% of for turbulent flow emitters.
  - e.g. : a typical operating pressure of 10 m (1 Kg/cm^2) permits a head difference of 1 to 1.5 m for long path emitters & 2 m for turbulent flow emitter.

$10m = 1\ Kg/cm^2$ →
- 1 to 1.5 m → long path emitters
- 2 m → turbulent flow emitters

S/m = sub-main

- The max. difference in pressure due to head loss, occurs between the control point at the inlet & the last emitter of the last lateral.
- The allowable head loss for level area should be divided between the lateral & S/m line



$$\Delta H_l = 0.55\ \Delta H_s$$
$$\Delta H_{sm} = 0.45\ \Delta H_s$$

where, ΔH_l = head loss in lateral (m)
ΔH_{sm} = head loss in S/m (m)
ΔH_s = Allowed difference in pressure head in S/m & lateral (m)

Pressure head ∝ friction head loss

→ The William-Hazen formula used for calculation of head loss

$$\Delta H_l = K \left(\frac{Q_l}{C}\right)^{1.852} \times D_l^{-4.87} (L + L_e) \times F$$

ΔH_l = Head loss in lateral (m)
K = Constant = 1.21×10^{10}
Q_l = flow rate in the lateral (lps)
C = friction coefficient for continuous section of pipe & depends on pipe material (William-Hazen constant)
D_l = inside dia of lateral (mm)
F = Outlet factor
L = lateral length (m)
L_e = Equivalent length
= Increase in length of lateral due to connections of emitters
= No. of emitters × factor

Note:- If L_e is not given then $L + L_e$ can be assumed as equal to L.

→ The factor depends on additional length of lateral or extension tube used for emitters.

→ The equivalent length (Le) suggested by Karmeli & Keller (1975)

→ The equivalent length (Le) per emitter = 0.1 – 0.6 on-line
= 0.3 – 1.0 inline

Ex-4.8 Mane (53) Calculate the frictional head loss through a lateral of drip system for following conditions

- No. of emitters = 50
- Emitter discharge = 4 lph
- William-Hazen constant = 120
- Lateral diameter = 16 mm
- Lateral length = 50 m
- Outlet factor = 0.36
- Lateral equivalent length per emitter = 0.35 m

Solⁿ:- We know that the head loss in lateral is given by Hazen-William equation

$$\Delta H_l = K \left(\frac{Q_l}{C}\right)^{1.852} \times D_l^{-4.871} \times (L + L_e) \times F$$

Here

$K = 1.21 \times 10^{10}$

Q_l = No. of dripper in lateral × Dripper discharge

= 50 × 4 (lph)

$= 50 \times \frac{4}{3600}$ lps = 0.055 lps