

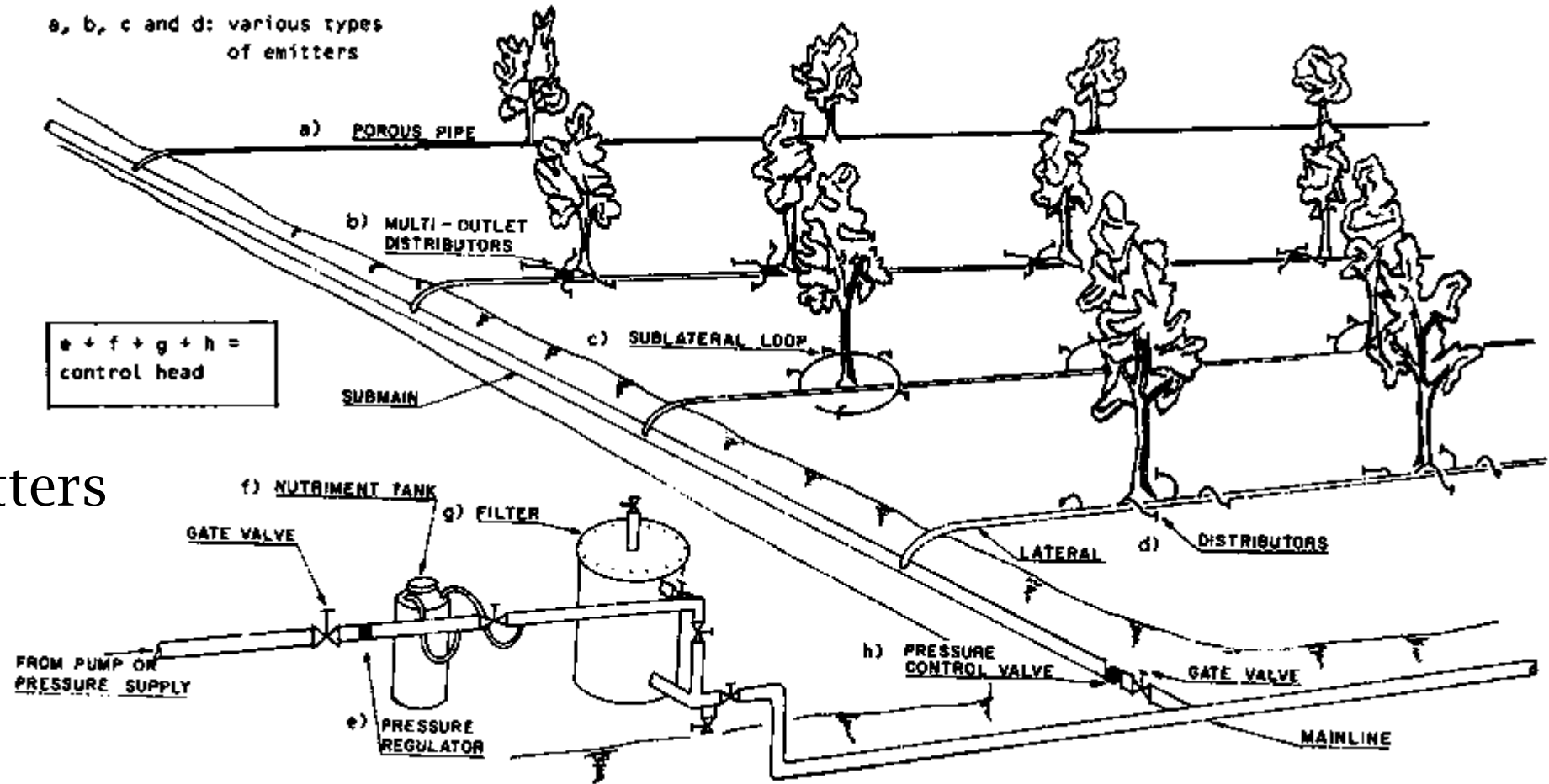


# Micro Irrigation Systems - Design

Sprinkler and Micro irrigation Systems

# Components of Drip Irrigation System

- Pumping set
- Filters
- Mainlines
- Sub-main
- Laterals
- Drippers/emitters



<https://slideplayer.com/slide/13173599/>

# Components of Drip Irrigation System

## Pumping Set

- To create a pressure about 2.5kg/sq.cm to regulate the amount of water to be supplied

## Filter Unit

- To filter the water in order to remove the suspended impurities from the water.



# Components of Drip Irrigation System

## Mainlines

- It is a Distribution system in drip irrigation. Rigid PVC and high density polyethylene pipes are used as main pipes to minimized corrosion and clogging
- Pipes of 65 mm  $\emptyset$  and with pressure rating of 4 to 10 kg/sq. cm

## Sub-main

- It is usually connected to the main lines through a control valve assembly
- The function of its to distributes water uniformly to a number laterals



# Components of Drip Irrigation System

## Drippers and Emitters

- It is fitted to a drip irrigation lateral and intended to emit water in the form of drops or continuous flow at emitter rates not exceeding 15 liters/hr
- Drippers function as energy dissipaters, reducing the inlet pressure head in the lateral, which generally range from 0.3 to 1.5 atmospheres



# Design of Drip Irrigation System

## Data Collection

- Types of soil
- Infiltration characteristics of soil
- Types of crop
- Consumptive use of water by crops
- Water quality
- Climate condition
- Availability of funds
- Contour map

# Design Procedure

- Prepare on inventory of available resources & operating conditions
- Determine the water requirement to be met by the drip system
- Determine the appropriate type of system
- Determine the type and design of emitters
- Determine the capacity of pumping system
- Decide on the economic sizes of the pumping system
- Determine the maximum and minimum operating pressure and the minimum efficiency required
- Determine the appropriate filtering system
- Determine the requirement of the fertilization system
- Plan field evaluation
- Prepare drawings, specification, cost ,schedules, installation, operations, maintenance.

# Emitter Selection

- The efficiency Of Drip irrigation system depends mainly on the selection of the type of emitter and its design.
- Characteristic of emitter that influence the efficiency of irrigation system is Discharge rate
- Critical items in emitter selection are the % area wetted( $P_w$ ) and the emitter reliability .
- The density of emission points required to obtain  $P_w \geq 33\%$  .



# Emitter Selection

Manufacturing Variation in Emitter:

- $C_v = s/q$   
 $= (q_1^2 + q_2^2 + \dots + q_n^2 - nq^2)^{0.5} / q(n - 1)^{0.5}$

$C_v$  = emitter coefficient of manufacturing variation,

$q_1, q_2, \dots, q_n$  = individual emitter discharge rate values,

N = Number of emitter in sample

Q = Average discharge rate of the emitters sampled,

S = Standard deviation of the discharge rates of the sample.

# Emitter Selection

## Recommended ranges of $C_v$

- Emitter coefficient of manufacturing variation

<b>&lt;0.05</b>	<b>Excellent</b>
<b>0.05 to 0.07</b>	<b>Average</b>
<b>0.07 to 0.11</b>	<b>Marginal</b>
<b>0.11 to 0.15</b>	<b>Poor</b>
<b>&gt; 0.15</b>	<b>unacceptable</b>

# Discharge of Drippers

- $q = kh^x$

q = discharge of drippers (volume per time)

P = operating pressure (force/area)

X = constants for specified emitters

# Irrigation Water Requirements

- $V_m = K_C \times K_P \times C_c \times E_p \times A$

$V_m$  = monthly irrigation water requirement

$K_c$  = crop coefficient

$C_c$  = Canopy factor

$K_p$  = Pan evaporation factor (0.8)

$E_p$  = normal monthly evaporation

$A$  = area to be irrigated (m<sup>2</sup>)

# Capacity of the Drip Irrigation System

- $Q = V_d \times T(n_a \times t)$   
     $Q$  = capacity of the drip system  
     $V_d$  = Daily water requirement  
     $T$  = irrigation interval days  
     $n_a$  = water application efficiency  
     $t$  = duration
- $Q_p = Q/n$   
     $Q_p$  = Discharge per plant  
     $n$  = number of plant

Number of laterals required:

- For vegetable crops - 1 lateral for each slope.
- For orchards - 1 to 2 per each row

Number of drippers per plant:

- $(\% \text{ total area shaded by the tree} \times \text{area per tree}) / (\text{effective area wetted by a single emitter})$

# Area Irrigated by the Dripper

- Area irrigated by a dripper

- $A_i = \frac{(L \times S \times P)}{100 \times N_e}$

$A_i$  = area irrigated

L = spacing between adjacent plant row

S = spacing between emission points

P = % cropped area to be irrigated

$N_e$  = number of drippers at each emission point

!!!-Thank you-!!!





