DRIP IRRIGATION AND FERTIGATION

DRIP IRRIGATION SYSTEM

INTRODUCTION

Drip irrigation refers to application of water in small quantity at the rate of mostly less than 12 lph as drops to the zone of the plants through a network of plastic pipes fitted with emitters. Drip irrigation in its present form has become compatible with plastics that are durable and easily moulded into a variety and complexity of shapes required for pipe and emitters.

MERITS

1. Increased water use efficiency
2. Better crop yield
3. Uniform and better quality of the produce
4. Efficient and economic use or fertiliser through fertigation
5. Less weed growth
6. Minimum damage to the soil structure
7. Avoidance of leaf burn due to saline soil
8. Usage in undulating areas and slow permeable soil
9. Low energy requirement (i.e.) labour saving
10. High uniformity suitable for automization

DEMERITS

1. Clogging of drippers
2. Chemical precipitation
3. Salt accumulation at wetting front

COMPONENTS AND ITS SELECTION FOR A TYPICAL DRIP IRRIGATION LAYOUT

HEAD EQUIPMENTS

a. Water source	-	Subsurface tank
b. Pump	-	Suction, monoblock pump, delivery non return valve, gate valve
c. Filter station	-	Sand filter, screen filter, manifold and pressure gauge
d. Fertiliser application	-	Fertiliser tank and ventury assembly

DISTRIBUTION SYSTEM

e. Conveyance line	-	Main line, sub main, gromet take off assembly, laterals, minor tubes and end caps.
f. Drippers	-	Pressure **corresponding** drippers (moulded/threaded type)
g, Valves	-	Non-return valve (NRV), Ball valves, Air release valve (ARV), flush valves
h. Water meter	-	If necessary

i. Water source

a. WATER SOURCE SUBSURFACE TANK

To minimise the energy requirement and also to get a uniform or constant level of water owing to the accumulation of bore wells in one pat1 of the irrigation regime; keeping in the effective hydraulic DIS design, it is necessary to construct a subsurface tank in an elevation point at the centre. The capacity of the tank is calculated from the water requirement of the crop, dripper capacity, type of soil etc.

b. PUMP

Pump/Overhead Tank: It is required to provide sufficient pressure in the system. Centrifugal pumps are generally used for low pressure trickle systems. Overhead tanks can be used for small areas or orchard crops with comparatively lesser water requirements.

1. **Filters**: The hazard of blocking or clogging necessitates the use of filters for efficient and trouble free operation of the microirrigation system. The different types of filters used in microirrigation system are described below.

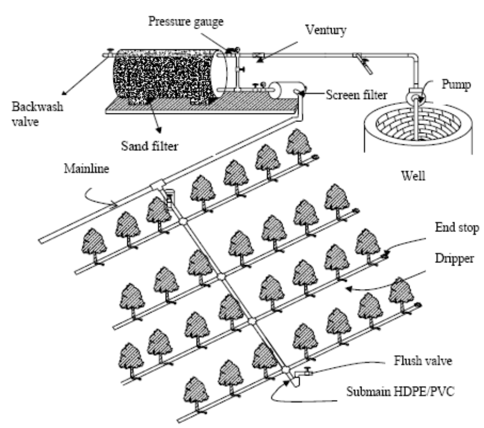


Fig. 1.1 Components of Microirrigation System

a) **Gravel or Media Filter**: Media filters consist of fine gravel or coarse quartz sand, of selected sizes (usually 1.5 – 4 mm in diameter) free of calcium carbonate placed in a cylindrical tank. These filters are effective in removing light suspended materials, such as algae and other organic materials, fine sand and silt particles. This type of filtration is essential for primary filtration of irrigation water from open water reservoirs, canals or reservoirs in which algae may develop. Water is introduced at the top, while a layer of coarse gravel is put near the outlet bottom. Reversing the direction of flow and opening the water drainage valve cleans the filter. Pressure gauges are placed at the inlet and at the outlet ends of the filter to measure the head loss across the filter. If the head loss exceeds more than 30 kPa, filter needs back washing. Fig. 1.2 shows different types of media filters.

Fig. 1.2 Different types of Media filters

b) **Screen Filters**: Screen filters are always installed for final filtration as an additional safeguard against clogging. While majority of impurities are filtered by sand filter, minute sand particles and other small impurities pass through it. The screen filter, containing screen strainer, which filters physical impurities and allows only clean water to enter into the micro irrigation system (Fig. 1.3). The screens are usually cylindrical and made of non-corrosive metal or plastic material. These are available in a wide variety of types and flow rate capacities with screen sizes ranging from 20 mesh to 200 mesh. The aperture size of the screen opening should be between one seventh and one tenth of the orifice size of emission devices used.

Fig.1.3 Screen filter showing steel wire mesh strainers

c) **Centrifugal Filters**: Centrifugal filters are effective in filtering sand, fine gravel and other high density materials from well or river water. Water is introduced tangentially at the top of a cone and creates a circular motion resulting in a centrifugal force, which throws the heavy suspended particles against the walls. The separated particles are collected in the narrow collecting vessel at the bottom. Fig.1.4 shows different types hydro cyclone/centrifugal filters.

Fig.1.4 Hydro cyclone filter

d) **Disk Filters**: Disk filter (Fig. 1.5) contains stacks of grooved, ring shaped disks that capture debris and are very effective in the filtration of organic material and algae. During the filtration mode, the disks are pressed together. There is an angle in the alignment of two adjacent disks, resulting in cavities of varying size and partly turbulent flow. The sizes of the groove determine the filtration grade. Disk filters are available in a wide size range (25-400 microns). Back flushing can clean disk filters. However they require back flushing pressure as high as 2 to 3 kg/cm^2.

Fig.1.5 Disk filter showing stacks of discs

4. **Pressure relief valves, regulators or bye pass arrangement**: These valves may be installed at any point where possibility exists for excessively high pressures, either static or surge pressures to occur. A bye pass arrangement is simplest and cost effective means to avoid problems of high pressures instead of using costly pressure relief valves.

5. **Check valves or non-return valves**: These valves are used to prevent unwanted flow reversal. They are used to prevent damaging back flow from the system to avoid return flow of chemicals and fertilizers from the system into the water source itself to avoid contamination of water source.

Distribution Network:

It mainly constitutes main line, submains line and laterals with drippers and other accessories.

1. Mainline

The mainline transports water within the field and distribute to submains. Mainline is made of rigid PVC and High Density Polyethylene (HDPE). Pipelines of 65 mm diameter and above with a pressure rating 4 to 6 kg/cm^2 are used for main pipes.

2. Submains

Submains distribute water evenly to a number of lateral lines. For sub main pipes, rigid PVC, HDPE or LDPE (Low Density Polyethylene) of diameter ranging from 32 mm to 75 mm having pressure rating of 2.5 kg/cm^2 are used.

3. Laterals

Laterals distribute the water uniformly along their length by means of drippers or emitters. These are normally manufactured from LDPE and LLDPE. Generally pipes having 10, 12 and 16 mm internal diameter with wall thickness varying from 1 to 3 mm are used as laterals.

4. Emitters / Drippers

They function as energy dissipaters, reducing the inlet pressure head (0.5 to 1.5 atmospheres) to zero atmospheres at the outlet. The commonly used drippers are online pressure compensating or online non-pressure compensating, in-line dripper, adjustable discharge type drippers, vortex type drippers and micro tubing of 1 to 4 mm diameter. These are manufactured from Poly- propylene or LLDPE.

A) Online Pressure Compensating drippers:

A pressure compensating type dripper supplies water uniformly on long rows and on uneven slopes. These are manufactured with high quality flexible rubber diaphragm or disc inside the emitter that it changes shape according to operating pressure and delivers uniform discharge. These are most suitable on slopes and difficult topographic terrains.

B) Online Non-Pressure Compensating drippers:

In such type of drippers discharge tends to vary with operating pressure. They have simple thread type, labyrinth type, zigzag path, vortex type flow path or have float type arrangement to dissipate energy. However they are cheap and available in affordable price.

C) In-Line Drippers or Inline tubes:

These are fixed along with the line, i.e., the pipe is cut and dripper is fixed in between the cut ends, such that it makes a continuous row after fixing the dripper. They have generally a simple thread type or labyrinth type flow path. Such types of drippers are suitable for row crops.

Inline tubes are available which include inline tube with cylindrical dripper, inline tubes with patch drippers, or porous tapes or biwall tubes. They are provided with independent pressure compensating water discharge mechanism and extremely wide water passage to prevent clogging.

Other accessories are take-out/starter, rubber grommet, end plug, joints, tees, manifolds etc.

INSTALLATION, OPERATION OF DRIP IRRIGATION SYSTEM

The installation of the drip system be divided into 3 stages.

1. Fitting of head equipments
2. Connecting mains and sub mains
3. Laying of lateral with drippers.

3.1. INSTALLATION OF HEAD EQUIPMENTS

The following points should be considered for fixing the position of filter station.

1. Minimum use of fitting such as elbows and bends to be made
2. Whether the pump delivery can be connected to the sand / screen filter
3. Sand / screen filter can easily be connected to mainline
4. Arrangement of back-wash to be made as per the farmer's suitability
5. Arrangement of by-pass water to be made

6. Sufficient space to be provided for the easy operation of filter valves
7. Hard surface or cement concrete foundation to be made for sand filter so that it will not collapse due to vibration and load. For screen filter, provide strong support by using GI fittings to avoid its vibrations due to load
8. Use hold-tight over the threads of GI fittings and apply proper mixture of M-seal over the joints uniformly to avoid leakage
9. Fix the pressure gauges in inlet and outlet of the filter
10. Avoid direct linking of oil pump delivery and filter. Instead connect the filter to the pump delivery using flanges or even the hose pipe can be used for this

3.2. CONNECTING MAINS AND SUB MAINS

1. It should be laid at a depth of more than 30 - 45 cm so as to avoid damages during intercultivation
2. Remove mud, if any, in the pipes before fitting. These pipes can be fitted using solvent cement with the help of brush
3. A gunmetal gate valve / PP Ball valve is provided at the start of sub main with PVC MTA fittings for connecting the valve in the PVC sub main
4. Provide flush valve at the end of main and sub main such that it faces towards slope
5. Apply uniform pressure vertically over the drill while drilling in the sub main so that the hole will be smooth and round.
6. Fix the rubber grommets in the holes made in the sub main in such a way that the groove in it goes inside the pipe
7. Fix the take-off position such that its arrow or the chamber faces towards the gate valve of the sub main for the easy flow of water. See that the take-off is fixed tightly in the grommet. The loose fitting of take-off indicates the breakage of grommet
8. Get the sub main flushed so that the PVC piece / mud fallen in the sub main while making drill will get flushed. Otherwise this scrap will block the drippers through polytube

3.3. LAYING OF LATERALS AND DRIPPERS

1. Pass water through the poly tube and get it flushed so that it gets bulged and makes easy for punching
2. Punch the lateral sideway from the yellow strip

3. The dripper position should be fixed according to design, soil and water report and water level in peak summer
4. If two drippers are to be provided such that all the drippers come in a straight line
5. Do not fix drippers unless a complete lateral line is punched. Otherwise the placement of drippers will be changed if moved
6. Punching should be done from the sub main
7. While fixing the dripper, push it inside the lateral and pull it slightly
8. Close the end of lateral by fitting end cap

4. STANDARD PROCEDURE FOR ASSESSING DIS PERFORMANCE

1. Check installation according to approved design layout
2. Start the pump
3. Flush the filters
4. Allow the drip system to be loaded with water for 10 min.
5. Note the pressure from the pressure gauge at the inlet and outlet of sand and screen filters
6. Record the dripper discharge as per the format
7. The discharge and pressure readings have to be taken in the below mentioned locations
    a. First, Middle and Last Dripper of a lateral
    b. For laterals at beginning, ¼, ½, ¾ and end of sub main
8. Laterals on anyone side of the sub main can be selected in case of plain land or alternative laterals on either side in case of slight slope in the direction along the lateral
9. Measure the volume of water collected for 36 seconds
10. Measure the pressure at start and end of laterals
11. If the Emission Uniformity is less than 85 % then the issue has to be taken up with the Drip Irrigation System Designer
12. Modifications have to be taken accordingly

FERTIGATION

FERTILISER APPLICATOR

This is the process of applying fertilisers through the irrigation system. The soil is negatively charged at high pH and PO_4^- will be precipitated with Ca^+ and absorbed with clay. Availability of P is very low as time proceeds due to this precipitation. Fertigation is problematic at high pH because the availability of micronutrients (Fe, Mn, etc.) is less due to the precipitation. Hence iron chelates (Sequestrene -138) are applied which prevents Fe from precipitation. Also zinc chelates are good to prevent Zn precipitation.

ADVANTAGES

1. Eliminates manual application
2. Quick and convenient
3. Uniformity in application
4. High efficiency and saving of fertiliser upto 30 - 40%
5. Less fel1ilizer leaching
6. Better penetration of P and K in the layers
7. Co-ordination of nutrition requirement with crop stage or development
8. Possibility of dosage control.
9. Others like herbicides, pesticides, acid, etc can also he applied

LIMITATIONS

1. Toxicity to field workers
2. Chance of backflow into water source, for that NRV and vacuum valve has to be installed
3. Insoluble fel1ilisers are not suitable (super phosphate)
4. Corrosive effect of fertiliser
5. Phosphate may get precipitated in the pipe line and dripper due to pH reaction
6. High cost

FERTILISATION

NITROGEN FERTILISATION

Fertiliser sources

Nitrogen (N) being one of the major plant nutrients, is often supplied in order to obtain optimum crop production. Nitrogen availability is usually limited in the soil compared with other plant nutrients because its various forms can be leached, volatilised, denitrified or fixed in the organic fraction of the soil.

WATER QUALITY INTERACTIONS WITH 'N'

Although water quality must be considered when N is applied through a trickle irrigation system, it is less of a problem than other nutrients such as phosphorus. The injections of anhydrous ammonia or aqua ammonia into irrigation water will bring about an increase of pH that may be conducive to the precipitation of calcium, magnesium and phosphorus, or the formation of complex magnesium ammonium phosphates, which are insoluble. This can be especially serious if bicarbonate is also present in the irrigation water.

Nitrogen injected in the form of ammonium phosphate can cause serious clogging of the irrigation system. If calcium and magnesium are present in the irrigation water, the phosphate can form complex precipitates.

One of the favoured forms of N for use in this system is urea, because it is a highly soluble nitrogen fertiliser that does not react with water to form ions unless the enzyme urease is present. The enzyme, however, is often found in water containing large amounts of algae or other microorganisms. Since urease is not removed by filtration, its presence could cause hydrolysis of nitrogen in urea to the ammonium ion.

PHOSPHORUS FERTILISATION

Generally, injection of phosphorus (P) fertiliser through a trickle irrigation system has not been recommended. Most P fertilisers have created chemical or physical precipitation problems and subsequent clogging of the trickle irrigation system. Further, the fixation rate of P by soils is high and subsequent movement from its point of placement is limited.

WATER QUALITY INTERACTION WITH P

The possibility of precipitation of insoluble phosphate is extremely high in calcium and magnesium. The result is the .clogging of emitters or trickle lines with calcium and/or magnesium phosphates. However, if precautions are taken phosphoric or sulphuric acid can be added to a trickle irrigation system to prevent such problems.

POTASSIUM FERTILIZATION

No adverse chemical reactions are expected with the COl1unon potassium (K) fertilisers when they are added alone to water. However reduced solubility and/or fertiliser incompatibility is possible when different fertiliser types are mixed. An example is a mixture of calcium nitrate and potassium sulphate, which will yield insoluble calcium sulphate.

PLAN AND FERTLIZER SCHEDULE

The actual plan and fertilization schedule of drip irrigated crops depends on site specific conditions such as cultural practices, soil type, crop, nutrients required, amount of water to be applied, fertiliser injector and system design. Finally, a correct rate and concentration of application is desired and the same should be selected to avoid over fertigation. For perennial crops with wide spacing where the fertiliser is applied manually, it may result in a very high application rate and thus, higher concentration which may damage the plant. It will also upset the nutrient balance, change the pH' and may create toxicity.

Fertiliser application through drip irrigation may be applied through the desired or half the strength concentration. Most crop needs may be met at a concentration of 100 mg /l in the irrigated water.

Other accessories are take-out/starter, rubber grommet, end plug, joints, tees, manifolds etc.

Fertilizers Suitable for Fertigation

Name	Chemical form	$N-P_2O_5-K_2O$ Content (%)	Solubility (g/l at 20^0C)	Remarks
Ammonium Nitrate	NH_4NO_3	34-0-0	1830	Incompatible with acids
Ammonium Sulfate	$(NH4)_2SO_4$	21-0-0	760	Clogging with hard water
Urea	$CO(NH_2)_2$	46-0-0	1100	
Diammonium Phosphate	$(NH4)_2HP_2O_5$	18-46-0	575	Contains phosphorous at high solubility
Potassium Chloride	KCl	0-0-60	347	Chloride toxic for some crops, Cheapest K source
Potassium Nitrate	KNO_3	13-0-44	316	Expensive, high

				Nitrate
Potassium Sulfate	K_2SO_4	0-0-50	110	Excellent source of sulfur, clogging with hard water.
Phosphoric acid	H_3PO_4	0-52-0	457	Incompatible with Calcium

Equipment and Methods for Fertilizer Injection: Injection of fertilizer and other agrochemicals such as herbicides and pesticides into the drip irrigation system is done by i) By-pass pressure tank ii) Venturi system and iii) Direct injection system.

(i) **By-pass pressure tank**:

This method employs a tank into which the dry or liquid fertilizers kept. The tank is connected to the main irrigation line by means of a by-pass so that some of the irrigation water flows through the tank and dilutes the fertilizer solution. This by-pass flow is brought about by a pressure gradient between the entrance and exit of the tank, created by a permanent constriction in the line or by a control valve.

(ii) **Venturi Injector**:

A constriction in the main water flow pipe increases the water flow velocity thereby causing a pressure differential (vacuum) which is sufficient to suck fertilizer solution from an open reservoir into the water stream. The rate of injection can be regulated by means of valves. This is a simple and relatively inexpensive method of fertilizer application.

(iii) **Direct injection system**:

With this method a pump is used to inject fertilizer solution into the irrigation line. The type of pump used is dependent on the power source. The pump may be driven by an internal combustion engine, an electric motor or hydraulic pressure. The electric pump can be automatically controlled and is thus the most convenient to use. However its use is limited by the availability of electrical power. The use of a hydraulic pump, driven by the water pressure of the irrigation system, avoids this limitation. The injection rate of fertilizer solution is proportional to the flow of water in the system. A high degree of control over the injection rate is possible, no serious head loss occurs and operating cost is low. Another advantage of using hydraulic pump for fertigation is that if the flow of water stops in the irrigation system, fertilizer injection also automatically stops. This is the most perfect equipment for accurate fertigation.

Two injection points should be provided, one before and one after the filter for fertigation. This arrangement helps in by-passing the filter if filtering is not required and thus avoids corrosion damage to the valves, filters and filter-screens or to the sand media of sand filters.

The capacity of the injection system depends on the concentration, rate and frequency of application of fertilizer solution.

MAINTENANCE OF DRIP IRRIGATION SYSTEM

The maintenance of drip irrigation system is very essential for its successful functioning.

SAND FILTER

Backwash the sand filter to remove the silt and other dirt accumulated. Figure 1 shows the sand filter in normal filtration mode and in Figure 2 shows the Backwash mode.

Backwash allows the water to come out through the lid instead of backwash valve. Stir the sand in the filter bed upto filter candle without damaging them. Whatever dirt is accumulated deep inside the sand bed, will get free and goes out with the water through the lid.

a) Backflush sand filter every day before starting the system and possibly before stopping irrigation
b) Do not allow pressure difference across the sand filter more than 0.30 ksc
c) Backflush at a pressure of 0.5 ksc to avoid loss of sand till clean water comes

SCREEN FILTER

Refer Figure 3. Open the flushing valve on the filter lid so that the dirt and silt will be flushed out. Open the filter and take out the filter element. Clean it in flowing water. Take out the rubber seals and clean them from both sides. Care should be taken while replacing the rubber seals, otherwise they might get out.

a. Clean screen tilter everyday
b. Do not allow pressure difference across filter more than 0.2 ksc
c. Open the drain valve to remove impurities before cleaning
d. Use thin water jet / nylon brush to clean the filter element
e. Do not use stones to rub the screen surface
f. Check for any mechanical damage
g. Never use the system without filter element inside filter

DAILY MAINTENANCE

a. Clean the sand and screen filters for 5 minutes before starting the system
b. Ensure all drippers are working properly without any leakage
c. Before stopping irrigation, backwash the sand filter for about 5 minutes

WEEKLY MAINTENANCE

a. Clean the sand filter by hand
b. Flush the sub main by opening the flush valve for 5 minutes
c. Flush laterals 5 numbers at a time for 5 minutes

MONTHLY MAINTENANCE

a. Treat the system with chlorine / acid.

Note: The frequency of chemical treatment depends on the degree of problem at the site.

CHEMICAL TREATMENT

Clogging or plugging of drippers may be due to precipitation and accumulation of certain dissolved salts like carbonates, bicarbonates, Iron, Calcium and Manganese salts. The clogging is also due to the presence of microorganisms and the related Iron and Sulphur slimes due to algae and bacteria.

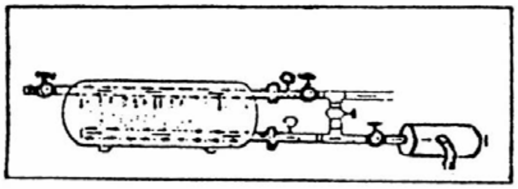
The clogging is usually avoided / cleared by chemical treatment of water. Chemical treatments commonly used in drip irrigation systems include addition of chloride and/or acid to the water supply.

ACID TREATMENT

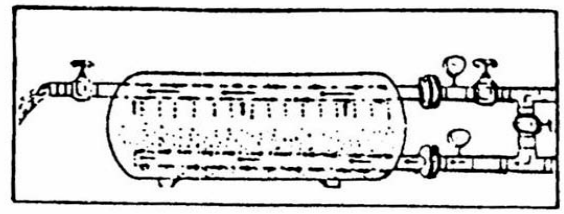
Hydrochloric Acid (HCl) is injected into drip systems at the rate suggested. The acid treatment is performed till a pH of 4 is observed and the system is shut down for 24 hours. Next day the system is flushed by opening the flush valve and lateral ends.

CHLORINE TREATMENT

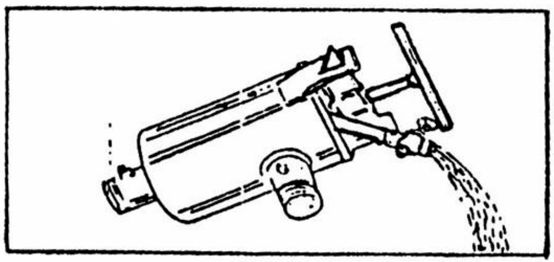
Chlorine treatment in the form of bleaching powder is performed to inhibit the growth of organisms like algae, bacteria. The bleaching powder is dissolved in water and this solution is injected into the system for about 30 minutes. Then the system is shut off for 24 hours. After 24 hours the lateral ends and flush valves are opened to flush out the water with impurities. Bleaching powder can directly added into the water source at a rate of 2 mg / litre or through ventury assembly.



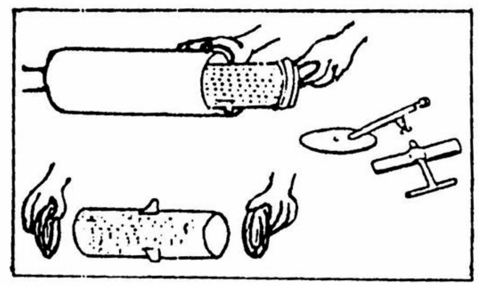
Sand Filter: Filtration Mode



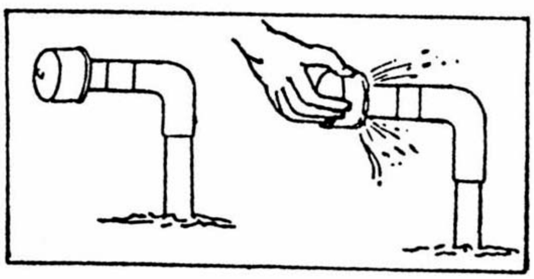
Sand Filter: Backwash Mode



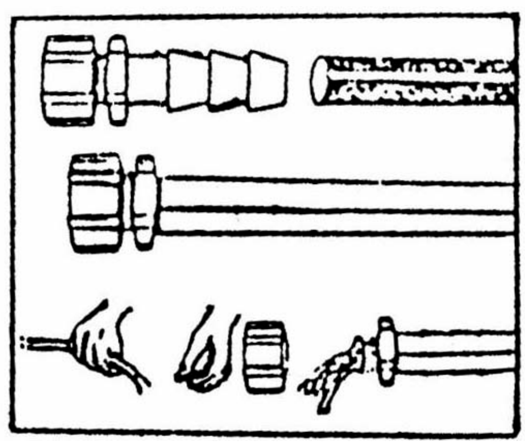
Flushing of the Screen Filter



Cleaning of Screen Filter Rubber Caps



Flushing of Sub-mains



Flushing of Lateral

Fig. 1.8 Maintenance of Microirrigation Components

APPLICATION OF FERTILISER AND OTHER AGRO CHEMICALS

The drip irrigation method offers an opportunity for precise application of water soluble fertilisers and other nutrients to the soils at appropriate time with the desired concentration. The development of root system is extensive in a restricted volume of soil when cultivation is done with drip irrigation and application of fertiliser or any other chemical through drip can efficiently place plant nutrients in the zone of highest root concentration. At the same time, fertiliser application presents nutrient deficiencies that can develop because of the limited soil volumes, explored by roots.

CRITERIA FOR APPLYING FERTILISERS THROUGH DRIP IRRIGATION SYSTEM

All chemicals applied through irrigation systems must meet the following criteria. They must (i) avoid corrosion, softening of plastic pipe tubing, or clogging of any component of the system (ii) be safe for field use (iii) increase or at least not decrease crop yield (iv) be soluble or emulsifiable in water and (v) not react adversely to salts or other chemicals in the irrigation water. In addition, the chemicals or fertiliser must be distributed uniformly throughout the field. Achieving such uniformity of distribution requires efficient mixing, uniform water application, knowledge of the flow, characteristics of water and fertilisers in the distribution lines.

To avoid clogging, chemicals applied through drip irrigation system must meet certain requirements. The chemicals must be completely soluble. If more than one material is used in preparing a concentrated stock solution for subsequent injection into the drip lines the chemicals must not react with each other to form a precipitate. The chemicals must also be compatible with the salts contained in the irrigation water.

EQUIPMENT AND METHOD FOR FERTILISER INJECTION

Fertilisers can be injected into drip irrigation systems selecting appropriate equipment from a wide assortment of available pumps, valve, tanks, venturies, meters and aspirators.

The injection points should be provided, one before and one after the filter. This arrangement can be used to bypass the filter if filtering is not required, and thus avoid corrosion damage to the valves, filters, and filter screens or to the sand media of sand filters. Furthermore, the discharge line from the fertiliser tank should have a filter, and similarly, the injection hoses line should be equipped with an in line hose filter or screen. The intake or suction side of tile injector should be equipped with a filter or strainer. Injection points must be installed so that injected fertilisers are properly mixed before the flow divides in several directions.

The size of capacity of the injection system depends on the concentration, rate and frequency of application. Naturally, less fertiliser solution and more frequent application require smaller, less costly units. Fertiliser application rates and application times vary considerably depending on crop and emitter spacing.

10. DRIP IRRIGATION SYSTEM TROUBLESHOOTING

SI.No.	Problems	Causes	Remedies
1.	Leakage of water at the joint between sub main and lateral	Damaged joints	Correct damages
2.	Leakage in the poly tube	Damage of poly tube by farming activities/rat	Block the holes by Goof plug. Use poly joiners at cuts.
3.	Water not flowing upto lateral end	Holes in laterals. Cuts in laterals. Bents in laterals.	Close the holes and cuts. . Remove the bends.
4.	Out coming of white mixture on removing the end plug	More salinity in water. Uncleaned lateral	Remove the end stop. Clean the laterals fortnightly
5.	Under flow or over flow from laterals	Clogging of drippers. Unclosed end plug	Clean the sand and screen filters. Close the end cap
6.	Oily gum material comes out on opening the lateral end	More algae or ferrous material in water	Clean the laterals with water or give chemical treatment

7.	Oily gum material comes out on opening the lateral end	More algae or ferrous material in water	Clean the laterals with water or give chemical treatment
8.	More pressure drop in filters	Accumulation of dirt in ers	Clean filters every week. Back wash the filters for every 5 minutes daily.
9.	Pressure gauge not working	Rain water entry inside. Corrosion in gauge pointer damage	Provide plastic cover and fix pointer properly.
10.	Drop in pressure	Leakage in main opened outlet. Low water level in well.	Arrest the leakage and close outlet. Lower the pump with reference to well water level
11	More pressure at the entry of sand filter	No bypass in the pipeline/bypass not opened. Displacement of filter element. Less quantity of sand in filters	Provide bypass before filter and regulate pressure. Place filter element properly. Fill required quantity of sand
12.	Accumulation of sand and debris in screen filter	Displacement of filter element. Less quantity of sand in filters	Place filter element properly. Fill required quantity of sand
13.	Ventury not working during chemical treatment and fertigation	Excess pressure on filters Improper fitting of ventury assembly	Bypass extra water to reduce pressure Repair the ventury assembly.
14.	Leakage of water from air release valve.	Damaged air release valve ring.	Replace the damaged ring.

COST OF DRIP IRRIGATION SYSTEM:

The cost of drip system depends on the type of crop, spacing, water requirements, proximity to water source etc. An attempt was made to prepare estimate of cost for installing drip irrigation system for all important crops by considering the cost of component supplied by the manufacturer for farmers having holdings of one acre. The cost estimation of drip system for Coconut, Amla, Banana, Tomato, Bhendi and Chilli crops are worked out and are as given below. The life of the system is about 6 to 10 years.

COST OF MATERIALS OF DRIP IRRIGATION SYSTEM

12 mm Lateral Pipe	-	Rs. 3.75/m
16 mm Lateral Pipe	-	Rs. 5.80/m
2" Pipe	-	Rs. 186.00/ 6 m
1 ¼" Pipe	-	Rs. 112.00/ 6 m
12 mm start, washer and end cap	-	Rs. 4.50/ 1 set
16 mm start, washer and end cap	-	Rs. 6.80/ 1 set
Emitter 4 lph, 8 lph, 16 lph (open type)	-	Rs. 2.80 each
12 mm connector	-	Rs. 1.00 each
16 mm connector	-	Rs. 1.50 each
Dummy	-	Rs. 0.30 each
2" Venturi with accessories	-	Rs. 2000 each
1 ¼" Ball valve	-	Rs. 120 each
2" Ball valve	-	Rs. 180 each
2 ½" Ball valve	-	Rs. 250 each
5 HP motor pump set	-	Rs. 10000 each
Screen Filter – 2" size	-	Rs. 2500 each
Erection charges:		
Coconut	-	Rs. 3 per tree
Banana	-	Rs. 0.5 per tree
Vegetables (lump sum)	-	Rs. 1000 per acre