Job Role – Micro Irrigation Technician

Trade – Agriculture

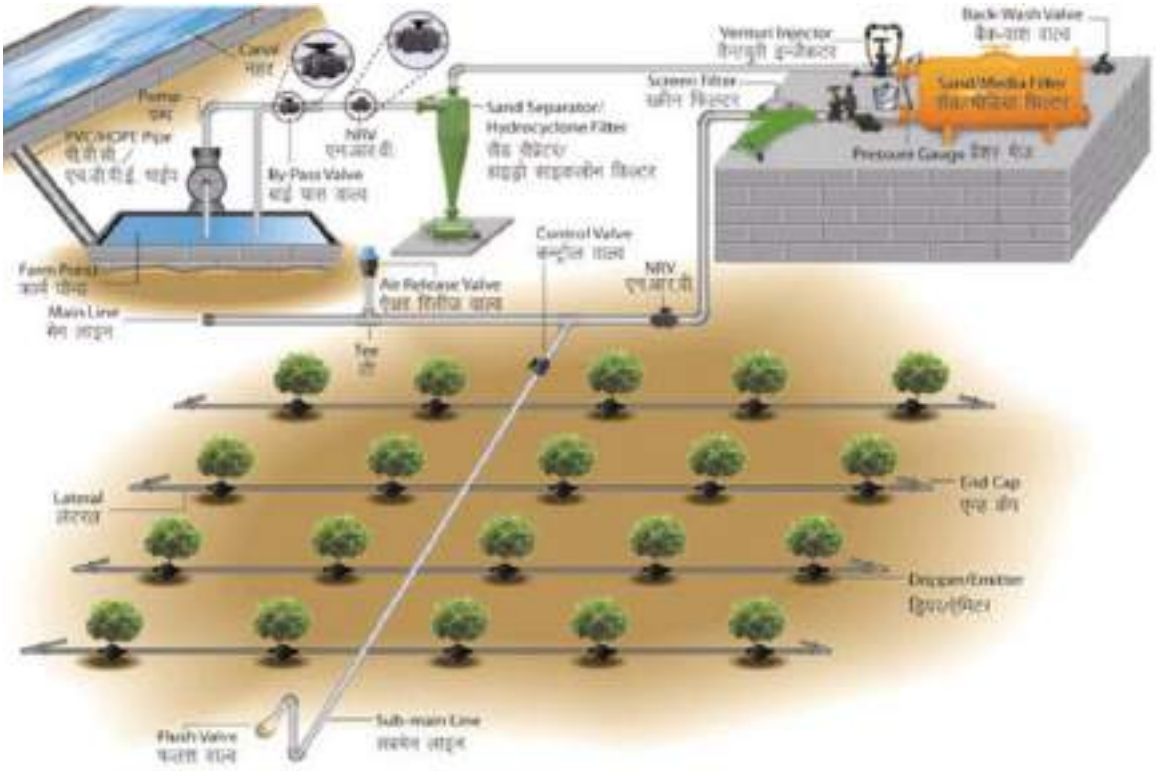
Class – 12

Contents

Unit 1: Introduction to Micro-irrigation System

- **Components of Micro Irrigation System (MIS)**

Irrigation pipeline systems are generally described as branching systems. Various branches are given names such as main, submain, and lateral. Fig 5.1 shows a typical layout of micro-irrigation system. Choosing the right size main, submain, and lateral pipe to match the flow rates from the water source is important. Basic components include a pump and power unit, a backflow prevention device if chemicals are used with water, a filter, a water distribution system, and some devices for controlling the volume of water and pressure in the system. If the water source is from a city/municipal/rural water supply, a direct connection is possible.



(Image source: http://74.52.53.155/sites/all/themes/ncpah/images/Drip_irrigation.jpg)

- **Pumps and power unit**

Micro-irrigation systems are typically designed to make the best use of the amount of water available. The type and size of pump selected will depend on the amount of water required, the desired pressure and the location of the pump relative to the distribution network. Electric

power units or internal combustion engine driven pumps are equally adaptable. However, the electric power unit is preferred because it is easier to automate.

- **Filters**

Filters remove sand and larger suspended particles before they enter the distribution network. However, the filters cannot remove dissolved minerals, bacteria and some algae. The three types generally used are screen, disk and sand filters.

- **Distribution lines**

The water distribution system is a network of pipes and tubes that can range in size from 1/2 inch to 6 inches (12 mm to 150 mm) in diameter. Water from the pump may be carried to the edge of the field by a single large main. Smaller submains may then carry the water to laterals and ultimately to the emitters.

- **Control Head**

The head control unit of micro-irrigation system includes the following components.

1. 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.
2. Fertilizer applicator: Application of fertilizer into pressurized irrigation system is done by either a by-pass pressure tank, or by venturi injector or direct injection system.
3. Filters: The hazard of blocking or clogging necessitates the use of filters for efficient and trouble free operation of the micro-irrigation system.

The different types of filters used in micro-irrigation system are described below.

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. Different types of media filters are shown through Fig. 5.2

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. The screens are usually cylindrical and made of non-corrosive metal or plastic material. Steel wire mesh filter is shown in Fig. 5.3 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.5.2 Different types of Media filters

(Image source: Report of the task report on Micro-irrigation, Ministry of Agriculture, Dept. of Agriculture & cooperation, Govt. of India, New Delhi, Jan, 2004)

Fig.5.3 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. 5.4).

Fig.5.4 Hydro cyclone filter

Fig.5.5 Disk filter showing stacks of discs

(Image source: Report of the task report on Micro-irrigation, Ministry of agriculture, Dept. of Agriculture & cooperation, Govt. of India, New Delhi, Jan, 2004)

d) Disk filters: Disk filter contains stacks of grooved, ring shaped disks that capture debris and are very effective in the filtration of organic material and algae. Fig. 5.5 shows disk filters. 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/cm2.

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.

- **Chemical injection equipment**

Micro-irrigation's high distribution uniformity gives it great potential for uniformly and efficiently applying agricultural chemicals, a process called chemigation. The main components of a chemigation unit are a chemical solution tank, an injection system and chemigation safety devices.

- **Chemical Solution Tanks**

Chemical solution tanks generally are constructed of poly or fibreglass. A conical form at the tank bottom facilitates flushing it completely so that no material is wasted. Tanks should have an easy-clean screen downstream of the valve to make them easier to clean.

- **Injection system**

The main types of chemical injectors are the venturi injector, injection pump, and the differential tank. The different types of fertilizer / chemical injection system are shown through Fig. 5.6. Criteria for selecting the proper injection system include cost, ease of use/repair, durability and susceptibility to corrosion.

With venturi injectors, water is extracted from the main line, then (1) pressure is added with a centrifugal pump or (2) a pressure differential is created by a valve in the mainline forcing water

through the injector at high velocity. The high-velocity water passing through the throat of the venturi creates a vacuum or negative pressure, generating suction to draw chemicals into the injector from the chemical tank. Although the venturi is cheaper than a positive displacement pump, its injection rate is more difficult to control.

With injection pumps, water is pumped into the system using pistons, diaphragms or gears. An injection pump has a small motor powered either by electricity or by energy from the water itself. The motor moves small pumps (diaphragms) or pistons to inject fertilizer into the system. The advantage of injection pumps is that chemicals can be injected with high uniformity at rates easily be adjusted regardless of discharge pressure.

With differential tanks, water is forced through a tank containing the chemical to be injected. As water passes into the tank, fertilizer is injected into the irrigation system. One disadvantage of such a system is that the concentration of the chemical in the tank decreases over time.

- **Water Distribution Network**

The water distribution network constitutes main line, submains line and laterals with drippers and other accessories (Fig. 5.7).

- **Mainline**

he mainline transports water within the field and distribute to submains. Mainline is made of rigid PVC or High Density Polyethylene (HDPE). Pipelines of 65 mm diameter and above with a pressure rating 4 to 6 kg/cm2 are used for main line pipes.

- **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/cm2 are used.

- **Laterals**

Laterals distribute the water uniformly along their length by means of drippers or emitters. These are normally manufactured from LDPE and LLDPE (Fig.5.8). Generally pipes having 10, 12 and 16 mm internal diameter with wall thickness varying from 1 to 3 mm are used as laterals.

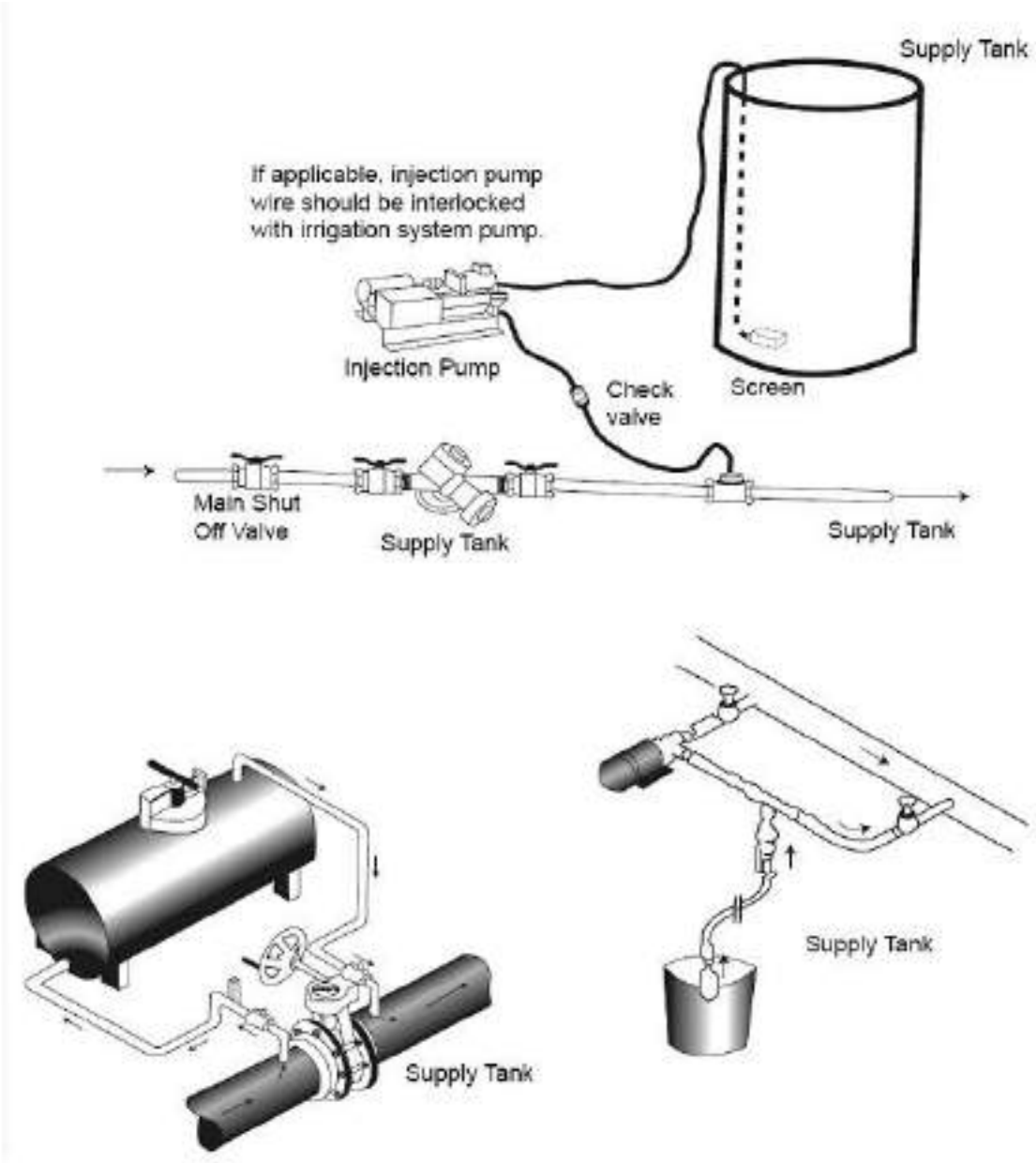
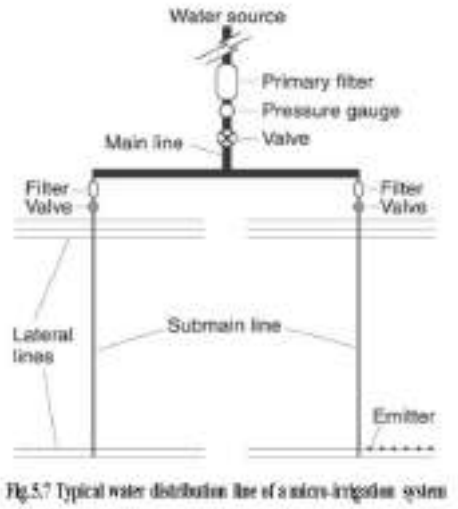


Fig.5.6 Fertilizer injectors

(Source: Enciso, J. and Porter, D. Basics of Micro-irrigation. Texas Cooperative Extension, The Texas A & M University System)



(Source: www.ag.ndsu.edu/pubs/ageng/irrigate/ae1243w.htm 16th Aug, 2012.)

- **Emission Devices**

The actual application of water in a micro- irrigation system is through an emitter. The emitter is a metering device made from plastic that delivers a small but precise discharge. The quantity of water delivered from these emitters is usually expressed in liters per hour (Lh-1). These emitters dissipate water pressure through the use of long-paths, small orifices or diaphragms. Some emitters are pressure compensating meaning they discharge water at a constant rate over a range of pressures. Emission devices deliver water in three different modes: drip, bubbler and micro-sprinkler. In drip mode, water is applied as droplets or trickles. In bubbler mode, water `bubbles out' from the emitters. Water is sprinkled, sprayed, or misted in the micro-sprinkler mode. Emitters for each of these modes are available in several discharge increments. Some emitters are adapted to apply water to closely spaced crops planted in rows. Other emitters are used to irrigate several plants at once. There are emitters that apply water to a single plant.

Fig.5.8 Laterals pipe

Fig.5.9 Online pressure compensating drippers

Fig.5.10 Online non-pressure compensating drippers

(Image source: Report of the Task Force on Micro-irrigation, Ministry of Agriculture, Dept. of Agriculture & cooperation, Govt. of India, New Delhi, Jan, 2004)

- **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 (Fig. 5.9). 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. Different types on line non-pressure compensating types of drippers are shown through Fig. 5.10.

- **Point source emitters**

Point source emitters are typically installed on the outside of the distribution line. Point source emitters dissipate water pressure through a long narrow path and a vortex chamber or a small orifice before discharging into the air (Fig. 5.11). The emitters can take a predetermined water pressure at its inlet and reduce it to almost zero as the water exits. Some can be taken apart and manually cleaned. The typical flow rates range from 2 to 8 Lh-1.

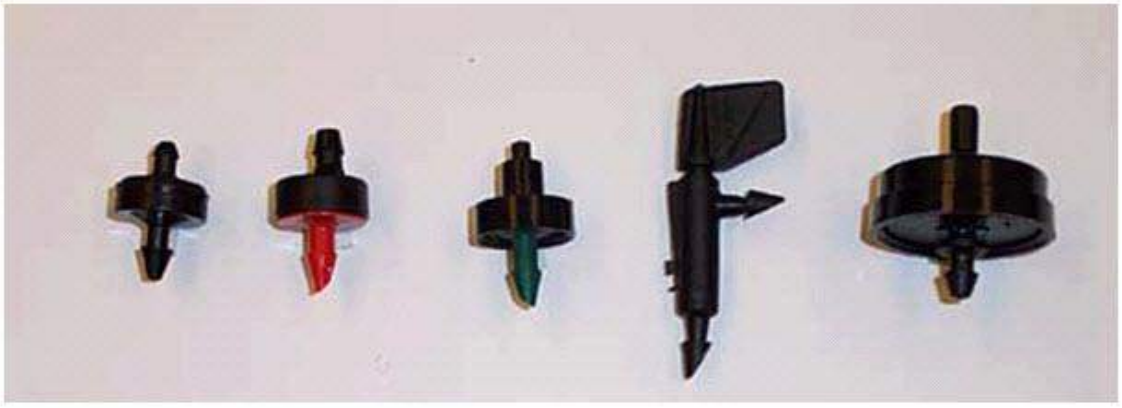


Fig.5.11 Point source emitters

(Image source: http://fvtchort.wikispaces.com/Soils+Group+1)

- **Line source emitter**

Line source emitters are suitable for closely spaced row crops in fields and gardens. Line source emitters are available in two variations:

- Thin wall drip line
- Thick wall drip hose.

A thin walled drip line has internal emitters molded or glued together at set distances within a thin plastic distribution line (Fig. 5.12). The drip line is available in a wide range of diameters, wall thickness, and emitter spacing and flow rates. The emitter spacing is selected to closely fit plant spacing for most row crops. The flow rate is typically expressed in gallons per minute

(gpm) along a 100-foot section. Drip lines are either buried below the ground or laid on the surface. Burial of the drip line is preferred to avoid degradation from heat and ultraviolet rays and displacement from strong winds. However, some specialized equipment to install and extract the thin drip distribution line is required.

Fig.5.12 Thin wall drip line & Thick wall drip line

(Image source: http://fvtchort.wikispaces.com/Soils+Group+1)

Bubblers

Bubblers typically apply water on a "per plant" basis. Bubblers are very similar to the point source external emitters in shape but differ in performance (Fig. 5.13). Water from the bubbler head either runs down from the emission device or spreads a few inches in an umbrella pattern. The bubbler emitters dissipate water pressure through a variety of diaphragm materials and deflect water through small orifices. Most bubbler emitters are marketed as pressure compensating. The bubblers are equipped with single or multiple port outlets. Most bubbler heads are used in planter boxes, tree wells, or specialized landscape applications where deep localized watering is preferred. The typical flow rate from bubbler emitters varies between 8 and 75 Lh-1.

- **Micro sprinklers**

Micro-sprinklers are emitters commonly known as sprinkler or spray heads (Fig. 5.14). These are of several types. The emitters operate by throwing water through in air, usually in

predetermined patterns. Depending on the water throw patterns, the micro-sprinklers are referred to as mini-sprays, micro-sprays, jets, or spinners. The sprinkler heads are external emitters individually connected to the lateral pipe typically using "spaghetti tubing," which is very small (1/8 inch to 1/4 inch) diameter tubing. The sprinkler heads can be mounted on a support stake or connected to the supply pipe. Micro-sprinklers are desirable because fewer sprinkler heads are necessary to cover larger areas. The flow rates of micro-sprinkler emitters vary from 16 lph to 180 lph depending on the orifice size and line pressure

Fig.5.13 Bubblers

(Image source: http://fvtchort.wikispaces.com/Soils+Group+1)

Emission devices selection

The selection of emission devices involves choosing the type of device to be used and then determining the capacity of the device. The type of emission device depends on such factors as the crop to be irrigated, filtration requirements, the need for a cover crop and/or frost protection, cost and grower preference. Micro sprinklers should be strongly considered when a cover crop is needed for erosion, pest or disease control or when frost protection is desired. Line-source emitters are especially well suited for row crops, although closely spaced point-source emitters, bubblers and micro sprinklers can also be used. In situations where filtration requirements are high, bubblers and micro sprinklers may be the most viable alternatives.

Ref: http://ecoursesonline.iasri.res.in/mod/page/view.php?id=124907

Unit 2: Layout and Installation of Sprinkler Irrigation system

Materials for a drip irrigation system

List of the basic parts/components for a Drip Irrigation Systems:

Starting from the hose bib:

- **Y Hose Connector with shutoff values** – The Y connector allows you to keep the drip system connected at all the times and you can still use your regular garden hose with removing the drip system.
- **Timers –** Turns the water on and off. This offers a more foolproof means of controlling the system rather than simply turning the faucet manually.
- **Backflow preventer** – This is required to prevent water from re-entering your water supply when the system is turned off.
- **Filter** – Screens out particles that could clog the holes in the drip system.
- **Pressure regulator** – The typical home water supply using to much pressure, this reduces the pressure to a lower pressure required by drip systems.
- **Hose fitting** – Connects the pressure regulator to the tubing.

Tubing:

- **1/2-Inch Blank Tubing Roll** – *TIP: Limit the length of 1/2-in. tubing on one zone to a maximum of about 200 ft.*
- **1/4-Inch Tubing –** Used to connect to emitters

** There are 2 different types of tubing: blank (no holes) or emitter tubing with spacing (*pre-made holes to connect emitters*). Make sure you are buying the right type for your project.**

Fittings for 1/2" Tubing: There are four different types.

- **Tee** – Splits the direction of the tubing.

- **Straight** – Connects one section of tubing to another.
- **Elbow** – Allows right-angle turns.
- **End Fitting / Figure Eight** – Closes the system at the end of the line.

Barbed Adapters: Connects tubing and emitters. Comes in three different types.

- **Tee** – Splits the direction of the tubing.
- **Straight** – Connects one section of tubing to another.
- **Elbow** – Allows right-angle turns.

Emitters: These are the drippers, sprayers, sprinklers or drip line. They are available with different flow rates to accommodate the need of the plant (GPH- gallons per hour). TIP: Use 1/2-GPH drippers in clay soil,1-GPH drippers in loam and 2-GPH drippers in sandy soil but it also depends on the size of plant.

- **Dripper –** Use these to water individual plants.
- **Bubblers –** Often used for larger plants – like roses, tomatoes, trees and shrubs — deliver more water in less time.
- **Sprayers –** Like regular sprinklers without moving parts, use sprayers to water ground cover or densely planted flowerbeds.
- **Mister –** Provides humidity to plants.
- **Soaker Drip Line** – Tubing with built-in drippers, great for vegetable gardens and rows of plants.

Loop Stake – Anchors the tubing to the soil.

Tubing Stake – Prevents emitters from clogging.

Riser Stake – Allows emitters to be placed above the plants.

Pipe Cutter or Pruning Shears – Cuts tubing to desired length.

Hole Punch – Punch holes in the tubing wherever you want to install emitters.

Goof Plugs – Plugs up a hole you may have punched by mistake (or allow you to move an emitter without replacing the tubing).
Ref: https://www.twofeetfirst.net/supplies-needed-drip-system/

Prerequisite checks to be performed during installation of Drip irrigation system

- Test the water quality of source water regularly, during the seasonal changes and/or whenever the water source changes. Water quality parameters shall be as per 'Normal Level' mentioned in Table 1, Clause 4.3 of IS 14791.
- Keep the bypass valve "OPEN" before switching on the pump and adjust / close the same gradually to adjust the required pressure on the mainline.
- Always install suitable pump as per design/system requirements.
- Always maintain the required operating pressure within the system.
- Do not under or over irrigate. Always maintain optimum moisture level in the field.
- Always position J-Turbo Aqura with emitter facing upwards.
- Keep the lid of filter and fertilizer tank optimally tightened while in operation.
- Backwash the media filters regularly. Drain the screen filter and hydrocyclone filter daily.
- While back-washing the manual media filter, always first open backwash valve, then close outlet valve, after this, open the middle valve and then close inlet valve. Follow vice versa procedure while switching over to normal mode.
- Flush the main line, submains, laterals and online emitters at regular interval (generally once in a week) depending upon the water quality.
- Carry out the chemical treatment (Acid and/or chlorine treatment) as per requirement to prevent dripper clogging. Follow procedure given in Indian Standard IS 14791.

- Drinking water from the system should be strictly avoided & particularly during chemigation and fertigation.
- Root intrusion can occur if plants are under-irrigated or if chemicals and fertilizers are not flushed out of the line properly.
- Periodically inspect all the components installed above the ground for physical abuse, damage by field machinery, rodents etc.
- Do not pull the laterals while shifting, laying / relaying.
- The end cap / stop of laterals and flush valve at the end of submain should always be in closed position. If left open, these points may allow pressure loss / drop and also water wastage.
- Operation of valve should be proper as per the direction given on valve. Do not tamper with or disturb the factory setting.
- Before making any alteration or change in the system design, always consult the technical division of the Company or Authorised dealer. The system designed for one crop may not be adequate or suitable for another crop and / or spacing.
- Always use pump as per design requirements. Consult Company or Authorised dealer in case of any change in pump HP.
- Do not change the water source without ascertaining the quality of water.
- Run system daily to keep continuous wetted strip. It also helps to avoid salt precipitation inside the tubing/ emitter.
- To avoid damage, protect the system properly while operating farm machineries in the field or carrying out any manual operation.
- Roll the laterals properly in coil form while removing the laterals from the field and ensure that no damage is done to GTO while folding lateral-tubes.
- Store the polytube/ piping properly stacked and away from rodents at levels higher than ground.
- It is advisable to conduct a ‘rat campaigning’ when rats/mice is a nuisance.
- Use only 100% Water Soluble Fertilizer during fertigation through MIS. Don’t use any other type of fertilizer.

- Do not mix cow dung in suction piping to prevent / stop leakage in the foot valve, instead change rubber flap and / or clean the foot valve strainer properly.
- Power supplied (including current, voltage and frequency) to any electrical/electronics components (including controllers, control panel, pumps etc.) shall be regulated and/or as per the specifications / requirements.

Ref: http://jainpipe.com/Designtechnical/help%20us%20to%20serve%20u%20better.htm

Installation of inline (dripline) drip irrigation:

Important Instructions to Students: Before Installation

Our Company Engineer or Dealer's representative will visit the field in which Drip Irrigation System is to be installed and mark the outline for excavating the trenches for laying the sub-main and main pipelines and the location for filters, as per the design. It is farmer's responsibility to get the trenches dug within the specified time to avoid the delay in installation of your drip irrigation system. The width of trench should be 45 cm to 70 cm and the depth of trench should be 75 cm (2.5 feet) or as instructed by our representative. The trenches should be dug in a straight line. The trench in which both main and submains will be laid, should be at least 75 cm wide.

Please ensure that there are no stones or sharp objects in the trenches. If the bottom of the trenches have hard surface or murum, then put a layer of sand or soft soil at the bottom. Construct a platform or pedestal of brick masonry or cement concrete for filter station as per the dimensions and at the location finalized by our Engineer / Dealer's representative.

For filter station a leveled, hard surface is required. A platform of brick masonry or cement concrete should be constructed. The size of the platform depends on the size of the sand filter. For 1.5" sand filter, minimum platform size should be 5 x 3 feet, where as for 2" and 3" sand filters, it should be 6 x 4 feet and 6 x 5 feet respectively for single units. If fertilizer tank is also provided, the platform size will have to be increased accordingly. While deciding the height of the platform, the height of the hydrocyclone filter (if provided) and its fittings (e.g. pipe bend etc) should be considered. Inform Company representative (or Dealer) as soon as the trenches and the platform for filter station are ready.

Installation of Inline Drip irrigation system can be divided into three stages.

A) Installation of filter station

B) Connecting mainline and submains

C) Laying of laterals with drippers / Inline drip system

A) Installation of Filter Station

1. Install the sand / screen filters in the correct position on the leveled platform such that adequate space is available for cleaning of filters and for keeping fertigation equipment.

2. Ensure that all the fittings such as pressure gauge, back wash, bypass and air release valves are done properly.

3. Check that the filter candles and mushrooms are fixed in proper position, then fill the sand up

to the level marked on the filter.

B) Submain and Mainline Connections

1. Mains and submains are PVC / HDPE pipe lines. PVC pipelines should be laid at a depth of minimum 2 feet below the ground surface to avoid possible damage to pipelines due to the farm implements used for various cultivation operations in the field.

2. After installation of filter, main pipeline is laid starting from the filter outlet. Air relies valve and Sectional valves (gate valves) are provided on mainline at appropriate locations as shown in the installation sketch. Air release valves are normally installed at points of higher elevation on the mainline and submains.

3. Submains are connected to the mainline using various fittings like Tee, Elbow, etc. as per the installation sketch. Adequate amount of solvent cement should be used to ensure perfect bonding at joints.

4. A flow control valve (ball valve) is provided at the beginning of each submain. A flush valve is provided at the end of each submain to facilitate flushing of submain. The flush valve should be located at about 6 inches above the ground so that the impurities can be flushed out easily. Flush valve should not be fixed in a vertical position. It should be fixed horizontally after providing an elbow so that water will not be spread on the person while flushing.

5. The parts of the submain control valve (ball valve) and flush valves exposed to direct sunlight should be protected by wrapping a jute bag or cloth. In the sunlight the PVC material becomes hard and brittle and can be broken into pieces.

C) Installation of Lateral Pipes

i) Installation of Lateral (Polytube)

1. To connect the laterals (polytube) to the submain, holes are drilled on the PVC submain pipes using appropriate drill guide and drill. Holes are drilled at a distance equal to the row spacing of the crop as given in the design. The size of hole depends on the size of the lateral and the grommet take off (GTO). For 8mm ID GTO a drill of 11.9 mm diameter is used and for 13 mm ID GTO, 17 mm drill is used.

2. Grommets are fixed in the holes and takeoffs are fixed on the grommets. Laterals are then connected to the take-offs.

3. Keep the length of plain polytube till start of bed or first tree. Inline will be connected to this polytube using polyxinline joiner.

ii) Installation of Driplines

Proper installation of dripline is important for efficient and trouble free operation. The following recommendations apply to the installation of Jain Turboline.

1. All these driplines may be laid on the surface or buried.
2. Driplines should be laid straight with emitter outlet placed near the root zone. To prevent the snaking of the lateral, use of 'C' clip tube holding stake is recommended. This will ensure application of water exactly in the root zone.
3. Care should be taken during the installation to prevent entry of soil, insects and other contaminants into the tubing.

4. Proper air release valve shall be installed at the submain to prevent suction in the driplines, when the system is shut down. The suction in the driplines will tend to draw contaminants back into the tubing through the orifices, causing emitter clogging.

5. When applying fertilizers or chemicals through driplines, operate the system till all residual material is flushed out.

Commissioning of Drip Irrigation System

After installation, the testing / commissioning should be done in the following way.

1. Ensure that all the control valves and flush valves of submains and lateral ends are open before testing.

2. Start the pump and allow the water to flow through the system. For a drip system having number of sections, the water is allowed to flow in different sections one after the other.

3. Check that there is no leakage in the main and submain lines at pipe joints, at connections to control valves, at various junction points having Tee and Elbow connections and at the lateral take-off points. If any leakage is found, rectify the same. Verify again that there is no leakage ofany type in the entire pipeline network and then only the trenches are to be re-filled with the soil.

5. When laterals are completely flushed, close their ends with the help of end caps.Close the flush valves.

6. Ensure that pressure gauges on the sand and screen filters are functioning properly. Check the pressure on the gauges installed at the inlet and outlet of the filter. It should be as per the designed pressure at the inlet of filter. During rains water may enter into the gauge and may lead to its rusting. To avoid damage from rains, cover the pressure gauge with Polyethylene sheet or tin can during the rainy season.

7. Allow the water to flow into the system.

8. After the system is completely filled with water read the pressure on the pressure gauge. For measuring the pressure at the submain, use pressure gauge adopter.

9. Maintain the desired pressure at the filter as mentioned above. If excess pressure is observed, open the bypass valve slowly till the desired pressure is obtained.

10. At this pressure, measure the discharge of drippers at minimum 25 different places. For this volumetric method can be used.

11. Check the working of air release valve provided at the inlet of submain. Check the pressure at the inlet of the submains. It should be about 1.50 kg/cm².

12. After the entire fitting of the system is checked, install ventury (or Fertilizer Tank) on the filter manifold properly and demonstrate how to apply the chemical treatments and fertilizers through it.

IMPORTANT

During the installation and at the time of commissioning of the drip irrigation system our Company's

/ Dealer's representative team will explain you the lay-out, different components of the system, their principles, functions and working, and guide you how to operate and carefully maintain the system as well as apply fertilizers and chemical treatment using the Ventury / Fertigation tank.

You should understand and learn these things very carefully with full personal involvement as you have to operate the system independently in future to derive the benefits of this hi-tech method.

So get all your doubts clarified from our representative team during the installation.

MAINTENANCE OF INLINE DRIP IRRIGATION SYSTEM

There are basically two reasons why maintenance of drip irrigation system is so important.

1) Water is never found in its purest form in nature. Always it contains some physical, chemical and biological impurities which may block the pipeline, laterals and drippers in the system.

2) The function of dripper / emitter is to allow a gradual transition of water flow from high pressure (nearly 1.0 kg/cm²) to atmospheric pressure when it comes out through emitter, so as to get discharge in the form of a droplet. In doing so the flow of water has to pass through labyrinth, turbulent and minute flow path. There is always a chance of blockage of this flow path due to dirt particles or due to chemical precipitation.

In order that your drip irrigation system works smoothly and efficiently for years together, it is very essential to maintain the system with great care.

For this you can prepare your own system maintenance schedule. The schedule can be divided into daily, fortnightly, monthly and half-yearly maintenance activities as given below.

A) DAILY MAINTENANCE

In order to get maximum efficiency and optimum results it is necessary to prevent clogging of emitters, sprinklers and laterals. Properly maintained filters will ensure maximum efficiency of irrigation systems, by avoiding clogging. Hence, filtration unit is the heart of irrigation system.

Following activities should be carried out daily.

1) Start the pump and allow the pressure to become stable. Open the drain valves of hydrocyclone and screen filters to remove the debris.

2) Backwash the sand filter.

Backwashing is the process in which flow direction is reversed so that water flows upwards through the sand bed. The sand gets lifted up and expands allowing it to release the dirt arrested in it.

The dirt id then driven out of the filter through the backwash valve. If backwashing is not done regularly, then the impurities accumulate in the sand bed which reduces the efficiency of the filter and the system does not get water at desired pressure. Backwashing of sand filter should be strictly done in the following sequence.

1. Open the Backwash valve.
2. Close the Outlet valve.
3. Open the Bypass valve.
4. Close the Inlet valve.

Backwash operation is complete when clear water starts flowing out through the backwash valve. To resume the filtration process again, 1) Open the Inlet valve, 2) Close the Bypass valve,

3) Open the Outlet valve, and 4) Close the Backwash valve. Clean the filters after every 5-6 hours or at recommended timings based on the water quality analysis report.

2) After cleaning the filters, operate the by-pass valve of the header assembly to obtain the desired pressure in the system. Operating the system at design pressure results in uniform discharge through the drippers as well as reduction in clogging or choking of laterals and drippers.

3) Take a round of the entire field and check if there is leakage at joints or damage to any component of the system. Rectify the defects, if any, by replacing the spares. Remove the folds or kinks on the laterals, if found, and make them straight.

4) Check drippers for uniformity of discharge. Open and clean the drippers which are not emitting water. Do not pull the emitter while cleaning, it will enlarge the hole on the lateral causing leakage.

5) After irrigation is over, check whether the wetting patterns of the drippers are uniform or not. Also check the wet bulb depth taking auger holes randomly.

6) Check the position of the drippers, if drippers are misplaced; place them at correct location. In case of drip irrigated plants, the root development is enormous in the wet zone created by the drippers. The roots will not get sufficient water and plant growth will hamper if the dripper position is changed frequently. In case of saline soil the salts are leached out of the wetted bulb. Changing the position of the drippers may bring back the salts in the root zone (as shown in the adjoining figure). This will reduce the water uptake rate of the plant roots.

7) Remove the end s tops and flush the laterals / In lines thoroughly for about 1-2 minutes. Starting from submain inlet, flush the first 4-5 laterals / In lines and proceed to the end. This will help in gaining higher velocity in the laterals / In lines for thorough cleaning.

8) Flush the submain at the end of irrigation to remove the debris. Remember that the impurities accumulate at the submain pipe end and if these are not flushed out from there, these will find access to laterals and clog the drippers. So regular flushing of submains is a must.

B) FORTNIGHTLY MAINTENANCE

After completing the steps 1 to 8 of the Daily Maintenance Schedule given above, perform the following operations at every 15 days interval.

1) Sand Filter

The pressure difference between the inlet and outlet of a filter is an indicator that suggests whether filters need cleaning. If pressure difference is more than 0.5 Kg/cm² (5 m of water), it means filter needs cleaning. The pressure difference between the inlet and outlet of a filter can be checked using a pressure gauge provided with a 3-way control valve. Due to deposition of salts present in water the top surface of sand bed becomes hard like a stone and backwashing is not effective to clean the sand bed. Therefore, clean the sand filter every 15 days as follows)

Open the lid of sand filter as illustrated in the figure.

ii) Allow the water to come out through the lid opening. Adjust the flow using bypass valve such that sand does not come out of the opening.

iii) Stir the sand thoroughly by moving the hand through entire sand media from top to bottom. Be careful and do not disturb the position of the black filter candles provided at the bottom, else sand may enter the screen filter.

iv) Break the lumps of sand by squeezing in hand.

v) Ensure that half the filter is filled with sand up to the level marked on the filter. Add new sand if it is below the mark.

vi) Allow water to flow till clean water starts flowing out of the opening.

vii) Put the lid back in position tightly.The sand used in filter is a special type of crushed silica sand having angular particles. Due to interlocking of particles the dirt is arrested in this sand,

which is not possible in ordinary sand having rounded particles. Therefore, never use ordinary river / nallah sand in the filter.

2) Screen Filter

The fine particles and dirt which escape through the sand filter are arrested on the filtering element of screen filter. This affects the filtering process. Therefore, it is essential to clean the filtering element every 15 days. For this, open the lid of screen filter and take out the filtering element. Remove the rubber seals from both ends of the filtering element; reverse them, clean with water and fix them tightly on the element again. Rinse the element in flowing water gently with hand, as shown in figure, and clean it. Do not use wired brush, as it may damage the screen.

C) MONTHLY MAINTENANCE

If the salts, algae and other impurities present in water enter into the drip irrigation system, then the laterals and drippers get clogged and may stop emitting water. Therefore, it is necessary to apply acid and chlorine treatments once in a month or as recommended in the water quality analysis report. The procedure and calculation of doses for acid and chlorine treatment are explained in detail in Chapter 6.

1) Perform acid treatment to remove precipitated salt from drippers and pipeline network.

2) Perform chlorine treatment to remove bacterial slime, algae or other biological contamination.

3) Inspect all the component above ground for physical abuse, damage by field machinery, rats, squirrels etc.

Do not perform both acid and chlorine treatment simultaneously.

D) HALF YEARLY MAINTENANCE

1) Change the sand of the media filter with new one as sand particles get rounded off due to continuous abrasion during operation.

2) Check out the system for wear and tear, replace the spares whenever necessary.

3) If the pump works efficiently, it generates the adequate pressure head and discharge required to operate the system satisfactorily. Provide adequate lubrication to the pump and motor. Make necessary maintenance of the pump as per instructions given by pump manufacturer.

Importance of Operating Drip System at Correct Pressure

Always maintain a pressure of 1.5 kg/cm² at the submain. Please note that maintaining proper pressure is very important as it directly affects the plant performance i.e. its growth and yield.

Do not keep the system pressure very high or very low. The higher pressure will result in discharging more water than required by the plants. This will cause runoff and the soil in the root zone will be fully saturated. Such over-irrigation not only results in wastage of water and nutrients, but also disturbs the air-water balance in the plant root zone. As the plant roots are deprived of oxygen, the root and plant growth will be poor and thus the crop yield will reduce.

If the system pressure is lower than 1 kg/cm², the drippers will supply much less water than the plant's requirement. The plant will be subjected to water stress. If such condition prevails for a longer period the growth of plant will stop or even the plant may die. Therefore, always run the drip system at proper pressure as mentioned above.

GENERAL MAINTENANCE TIPS

Have you paid attention to the following important things?

1) Check whether all components of the drip irrigation system are installed properly and are working efficiently.

2) At least one outlet of the dripline shall be facing upwards.

In case of dripline with strip emitters, there is only one outlet. In case of driplines with cyllindrical emitters, there can be multiple emitters. Outlet facing upright takes in the air and break the partial vaccumm created during shutoff of the system. 3) If the pressure difference

between inlet and outlet of the sand filter is more than 0.5 kg/cm², it is the indication that the filter needs backwashing.

4) Open the sectional valves of the section/s to be irrigated as per requirement. Refer to the Technical Information Report supplied with the design.

5) Sometimes students use mud or cow dung for priming of pump. The mud or cow dung so used should be thrown out of the system using the bypass valve after the. Otherwise, these will be deposited on the sand bed of the filter forming a hard layer and proper filtration will not take place.

6) Bypass valve arrangement is essential in the system. Provide it, if it is not existing.

7) If the sand and screen filters are cleaned regularly, there will be no reduction in their filtering capacity and they will continue to work efficiently.

8) Half of the filter is always filled with sand up to the level marked on the filter. Add new sand if it is below the mark. Never use ordinary river / nallah sand in the filter. Use the special crushed silica sand available for the purpose.

9) Observe the wetting patterns of the drippers of Inline. If the wetting pattern is not uniform, then apply suitable corrective measures like- clean the drippers, flush the laterals / Inlines / submains, provide acid / chlorine treatment.

10) If the drip system is put off for a few days, it is likely that some insects occupy the drippers and laterals. Some insects may even build cocoon inside. This may reduce the flow rate. It is, therefore, wise to operate the system daily for about 10-15 minutes.

11) If lateral is found to be broken for some reasons, cut it and put a poly-joiner and join the ends to stop the leakage.

12) To protect the laterals from squirrels, place bowls full of water in different locations in the field for squirrels. Wrap GI sheet/plastic / polyethylene cloth around the trunks of big trees so that squirrels can not climb the trees.

13) Rats are very destructive creatures. They not only damage the laterals of drip irrigation system, but also destroy the food grains and seeds etc. To protect the system from rats following measures can be adopted.

Always maintain continuous wetted strip in the field. This is very well possible in closely spaced crops. Rats are afraid of water and laterals can be saved by maintaining wetness.

• If the distance between the drippers is more as in case of orchards, bury the lateral line between two drippers about 3 to 4'' below the ground.

• Use rat repellent chemicals along the laterals.

• Start a 'Rat Campaign' to destroy the rats. This campaign should be taken up by all the students in the area simultaneously. They should search for bore holes in the farms and close all the holes with mud. Keep some marks for identifying the hole locations. Next day inspect the holes and close down the holes which are found open. Open holes indicate presence of rats. Place rat killing tablets / powder mixed eatables around the holes. If all students take up the campaign together, then it is possible to destroy the rats.

• Do not kill the snakes in the field. Snakes control the population of rats.

Special Precautions for Dripline System (Jain Turbo Excel/ Jain Turboline Super/ J-Turboline/ J-Turbo Aqura/ Jain Turboline PC/Jain Turbo Cascade/ Jain Turbo Top)

1) Dripline should be laid straight and exactly in the centre of the two crop rows so that each row gets uniform quantity of water. If the dripline has any folds or kinks, then the further length of tubing will not get sufficient pressure and the crop will get less water than its requirement.

2) For dripline system a sand filter is essentially required and proper maintenance of sand filter is the key for the best performance of the system.

3) In dripline system an air-cum-vacuum release valve should be installed either at the inlet of the submain or at the point of highest elevation on the submain. It releases the entrapped air when the pump is started and breaks the vacuum during shut off.

4) If the dripper discharge is observed to be low, then hammer the dripper gently with hands to remove salt or dirt deposited inside. Do not use needle, nail or sharp metal objects for cleaning the dripper.

5) Install the dripline tubes in the field in the morning hours or in the evening when it is cool, so that drippers will remain at proper position.

6) At least one outlet of the dripline shall be facing upwards. In case of dripline with strip emitters, there is only one outlet. In case of driplines with cyllindrical emitters, there can be multiple emitters. Outlet facing upright takes in the air and break the partial vaccumm created during shutoff of the system.

6) Before planting vegetable, sugarcane and similar crops, the dripline should be run continuously for 24 - 48 hours to ensure sufficient moisture for germination. This is known as planting/ germination irrigation. The duration of this irrigation depends upon the season, climate and soil/crop. Prior to irrigation for planting, the land should be prepared properly making the soil friable by breaking the clods.

7) If the dripline is run daily, the rat menace can be considerably reduced. Use of kerosene, neem cake, zinc phosphate tablets are some other measures to control the rat problem.

8) Dripline system should not be kept off for a long duration. It must be operated at least for 2-3 hours in a week, even in rainy season or when not in use, just to flush the tubing. Otherwise the holes may get clogged and also bacterial or algae growth may take place.

9) When the dripline is to be taken out of the field, it should be chemically treated before taking it out. It should be properly wound and stored in a safe place to protect from rats, ants, etc.

10) During harvesting, tractor or bullock cart should not be taken in the field. It may damage the dripline.

11) The labour should be made well aware of the Inline laid in the field and care should be taken to avoid damage to it during intercultivation operations as well as harvesting the crop, especially sugarcane.

12) As far as possible do not burn the sugarcane trash. It can be used for mulching or for composting.

13) It is always safer to burn the sugarcane trash out of the field. But if burnt in the field, first ensure that the Inline is completely covered with soil and on the previous day the systems should be run to wet the soil sufficiently.

14) After burning the trash, the Inline should be taken out carefully if ratoon crop is not to be taken.

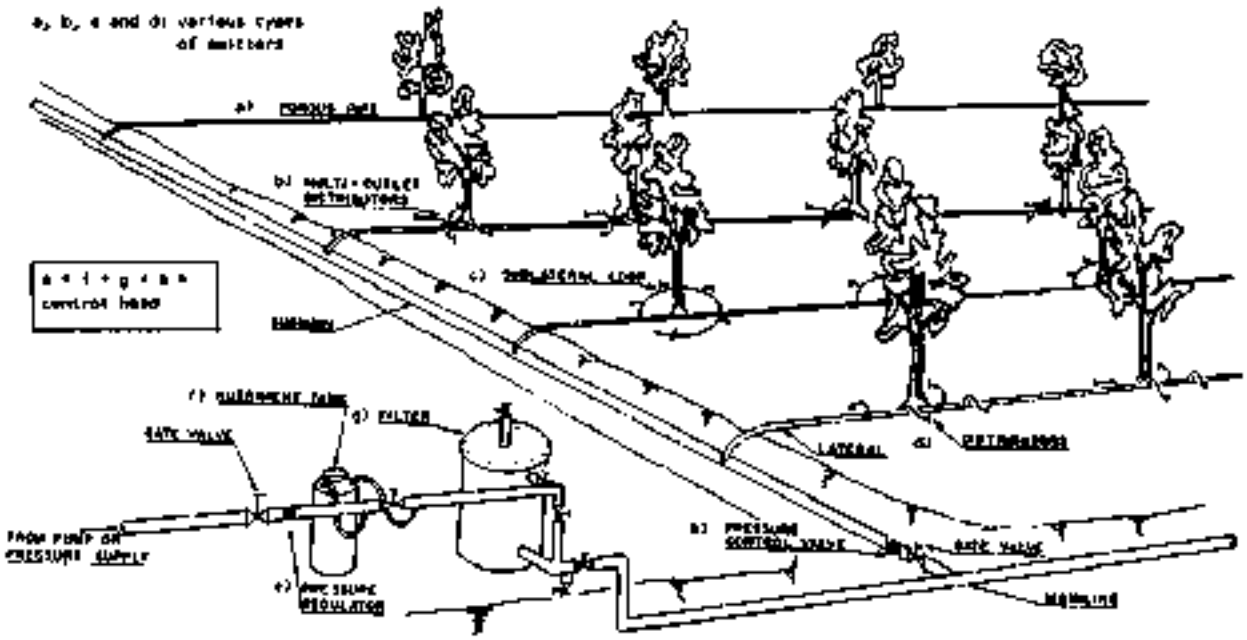
15) Regular acid treatment is necessary to avoid chemical precipitation and clogging of the system.

16) Ensure proper chlorination to control the algae and bacteria growth in the system.

4. Close the flush valve after the submain is completely flushed.

A typical drip irrigation system is shown in Figure 61 and consists of the following components:

- Pump unit
- Control head
- Main and submain lines
- Laterals
- Emitters or drippers.



The pump unit takes water from the source and provides the right pressure for delivery into the pipe system.

The control head consists of valves to control the discharge and pressure In the entire system. It may also have filters to clear the water. Common types of filter include screen filters and graded sand filters which remove fine material suspended in the water. Some control head units contain a fertilizer or nutrient tank. These slowly add a measured dose of fertilizer into the water during irrigation. This is one of the major advantages of drip irrigation over other methods.

Mainlines, submains and laterals supply water from the control head into the fields. They are usually made from PVC or polyethylene hose and should be buried below ground because they easily degrade when exposed to direct solar radiation. Lateral pipes are usually 13-32 mm diameter.

Emitters or drippers are devices used to control the discharge of water from the lateral to the plants. They are usually spaced more than 1 metre apart with one or more emitters used for a single plant such as a tree. For row crops more closely spaced emitters may be used to wet a strip of soil. Many different emitter designs have been produced in recent years. The basis of design is to produce an emitter which will provide a specified constant discharge which does not vary much with pressure changes, and does not block easily. Various types of emitters are shown in Figure 61 and Figure 62. Figure 63 gives an example of sub-lateral loops.

Maintenance of Drip Irrigation System:

1. Ensure that J-Turbo line/J-Turbo Aqura / Jain Turbo Slim/Jain Turbo Tape / Chapin Twin Wall is connected to submain through 1- 1.5 mtr. long lateral piece (approximately up to the first tree or start of the bed) & not directly to take off to avoid wastage of water, wetting sub-main trench & empty border space. If directly fitted to sub-main the emitter inside trench may suck-back soil while shutting down of the system which may result in to clogging the drippers.

2. While laying - J-Turbo Aqura / Jain Turbo Slim/Jain Turbo Tape/Chapin Twin-Wall always position to emitter facing upwards (yellow line facing upwards). It is recommended to use winders for unwinding and rewinding of tubing.
3. Run the system daily. With daily running all the dissolved salts do not precipitate and can be thrown out in dissolved form only. Also running the system daily would help to keep the salts out of the wetted bulb of the dripper.
4. Use water soluble & EDTA based chelated fertilizers as they helps to prolong frequency of special treatments.
5. To prevent rodent/squirrel damage, use rodent deterrent tubing or if the tubing is not with RD rat repellent apply along the line. Do not kill the snakes in the field, snake controls the population of rats. Rat campaigning on larger scale by a group of students is the effective solution for rat problem. To prevent squrill problem, cover the trunk of the tree on which squirrel stays, with polyethylene or GI sheet or use a bowls of water near their places of inhabitant, hole/ tree, etc.
6. Never try to clean the blocked dripper by forced hammering or by using sharp objects like nail, pin etc.
7. Always keep the field clean. Some insects staying in the field garbage can make the holes in the tubing or even in drippers.

Unit 3: Maintenance of Sprinkler Irrigation System

The Maintenance schedule of Drip Irrigation System is in 4 steps;

1. **Current or Daily maintenance,**
    1. After starting the pump let the pressure be stabilized in the system. Check for leaks & correct the pressure at sub-main. It should be as per the design. If pressure is less adjust it by throttle/ by-pass valve.
    2. Inspect the dripping and ensure that water is reaching all the corners of the plot/field if at some portion water is not dripping correctly find the cause & correct.

3. If a twist, fold, cut, puncher etc. is found causing discharge variation, correct it immediately.
4. At the end of shift inspect uniform wetting pattern. If dry patches are found increase duration of operation.
5. Inspect throughout the field to detect precipitation, scaling, if clogging is taking place, the end drippers are the first affected. Take corrective actions if scales/precipitates are found.
6. Monitor the mechanical damages by rodents, farm operations by labour, animal or machinery, causing leakage; correct it immediately by using proper joiners.
7. Flush all the laterals by opening end plug 1 to 5 in a series; then close them 1-5 in the same sequence allowing flushing for 3 minutes until clean water starts flowing.
8. Flush each sub-main at the end of every section (shift) till dirt free clear water starts flowing.
9. Check inlet & outlet filter pressures. Remove slurry from hydrocyclone, back flush sand filter at every 5 hours; flush screen/ disc filter at the end of days operation.

2. **Periodic or Fortnightly maintenance.**
    1. Repeat 1 to 9 operations and take corrective actions.

Take out the element of screen/disc filter and clean it thoroughly. Open the lid of sand (media) filter manhole, allow the water to come out through manhole, stir the sand thoroughly by moving the hand in between filter mushrooms (candles) without disturbing their position for thoroughly separating accumulated foreign material with media (sand) for recharging its filtering capacity.

Acid Treatment: Precautions – Always use goggles & surgical/rubber hand gloves & never pour water in acid but always add acid in to water as safety precaution before handling acid. Always use plastic containers for acids.

The commercial Grade of Acid recommended for Acid Treatment are:

In most of the cases the 0.6% application with irrigation of these commercial grades of acids brings down the pH between 2-4 capable of dissolving most of the precipitations. Most of the cases HCl can be used which is highly effective & the cheapest of all, except the crops which can not tolerate Chloride. In that case HNO_3 or H_2SO_4 could be used. H_2SO_4 is not recommended where ca, mg salts are above 500ppm. Acid treatment is always done before chlorination as chlorination is effective under ph range of 6.5-to-8.5. If iron is present, do not use ortho phosphoric acid (H_3PO_4) as iron would precipitate with phosphoric acid.

H2O2 Hydrogen Peroxide can also be used to bring down ph where use of other acids is not feasible.

Select the most suitable acid and proceed as under:

1. Flush & clean filters, Flush main, Submain & lateral ends.
2. Calculate quantity of Acid required for the valve (section/shift) based on 0.6% injection of Acid for 15 minutes. As a thumb rule 15 ltr Acid @ 1 ltr/min Acid is required for each of 10m3/hr flow. (10,000 lph x 0.006(6%) x 0.25hrs). If injection rate is say 1.5 ltr/min add 7.5 ltr of water in Acid to ensure 0.6% rate of injection.
3. Open inlet & outlet of Venturi without disturbing its calibration settings. In case of fertilizer tank create appropriate pressure differential between inlet & outlet by throttle valve. Do not spill the acid/chlorine on the fertilizer tank.
4. After the injection of Acid, allow acidified water to react with precipitated salts for about minimum 4 - 6 hours (It is desirable to prolong the period for 24 hours). Then open the ends of laterals and submain flush valve. Start on the pump and allow all the water to flow out. Measure the discharges of marked drippers. Flush Main, sub-main & laterals. If there is no significant improvement repeat the treatment, repeat the treatment as above for all the sections.

5. At the end of acid treatment wash the equipment & vessels with clean water, whip & dry removing residue of Acid. If clogging is observed due to algae or other causes; carry out chlorination treatment.
6. Run the system for half an hour more than normal irrigation schedule so that extra quantity of acid will be taken out of root zone.

Iron, Manganese Treatments: If water analysis report shows higher amount of iron and/or manganese following measures can be taken, oxidation by aerations allows iron to precipitate faster. Store the water in settlement tank after stepped aeration to allow iron to precipitate down and then pump the water for your system. Chlorination along with aeration can enhance rate of oxidation. Please note that manganese impurities react slow with chlorine hence they coagulate after the main filters. In such cases, either allow some additional reaction and precipitation time or use plot filters as secondary fine filter to avoid drip per clogging which cannot be cleaned by any chemical means.

Chlorinaton Treatment: Precautions for chlorination – Chlorine is toxic to human & animal. Do not have direct contact with Skin, eyes, nose, mouth with any Chlorine substance or Cl_2gas; as it is poisonous for human and animal. Wear goggles, hand gloves, safety shoes etc. during chlorination treatment. Vessels for the solution should be thoroughly washed to avoid accident by reaction. Never use Fertigation of Nitrogenous fertilizer during Chlorination to avoid formation of sublime compound like Ammonium Chloride etc. Never mix acid in Chlorine solution; use another device of injection for acid prior to Chlorine. For making/diluting solution of Chlorine add Chlorine product into water but do not pour water in chlorine substance/solution. It can be in three forms: Cl_2 gas (100 %Chlorine), Sodium Hypochlorite NaOCl, (10% Chlorine) or Calcium Hypoclorite $Ca(OCl)_2$ (50 to 65% Chlorine).
Ref: https://www.alberta.ca/maintenance-and-cleaning-of-drip-irrigation.aspx

Unit - 4: Occupation Health, Hygiene and First Aid Practices

Types of hazards: Some items are hazardous by nature, while others only become hazardous if used inappropriately or carelessly. Often, accidents don't just happen – they are a result of workers neglecting or ignoring hazardous situations.

There are two basic categories of hazard:

Acute hazard	Acute hazards are those that have an obvious and immediate impact.
Chronic hazard	Chronic hazards have a more hidden, cumulative, long-term impact.

An example of an acute hazard is a slippery floor where there is an immediate danger of someone slipping and being injured. A chronic hazard could be workplace bullying, where the long-term impact may result in stress or other psychological injury.

Hazards generally fall into one of six groups:

1. **Physical –** Slippery floors, objects in walkways, unsafe or misused machinery, excessive noise, poor lighting, fire.
2. **Chemical –** Gases, dusts, fumes, vapours and liquids.
3. **Ergonomic –** poor design of equipment, workstation design, (postural) or workflow, manual handling, repetitive movement.
4. **Radiation –** Microwaves, infra-red, ultraviolet, lasers, X-rays and gamma rays.
5. **Psychological –** Shiftwork, workload, dealing with the public, harassment, discrimination, threat of danger, constant low-level noise, stress.
6. **Biological –** Infection by bacteria, virus, fungi or parasites through a cut, insect bite, or contact with infected persons or contaminated object.

Ref: https://etraining.communitydoor.org.au/mod/page/view.php?id=216

Safety Measures and guidelines

Dos

1. Do check the Toxicity labels marked on the pesticide packing (Fig: 1), must be taken into account while using pesticides.

Fig: 1 Colours showing toxicity labels of pesticides

2. Be cautious about some of the reasons for injuries and accidents at agricultural farms are as follows: being hit by a moving vehicle, falling from height (Fig: 2), contact with large animals, contact with a heavy falling object or material, contact with a farm machinery, drowning, muscle-skeletal injury (aches, sprains or strains), effects of toxic chemicals through inhalation or exposed body parts etc.
3. While using machineries, ensure there is no faulty switches and machines, poor quality cords, overhead power lines, etc. Faulty electrical installations and use of cheap quality equipment can even cause fires. (Fig: 3)

Fig: 2 Height hazard sign

4. Always wear safety and protective devices, such as headgear, while working on rooftops.
5. Climbing ladders should be strong, unbreakable and non-slippery.
6. An attendant must always hold the ladder.
7. Always ensure the following measures that can help avert an accident in a farm.

Fig: 3 Electricity hazard sign

- identification of dangers in every aspect of a work
- identification of people who may be exposed to particular risks
- the reliability and adequacy of existing precautionary or preventive measures
- First aid box must be well maintained at school
- List of emergency contacts must be there

Don'ts

1. Chemicals should not be sprayed in foggy and windy weather.
2. A person spraying chemicals should not have an open injury on his/her body.
3. Don't go near to the chemical spraying area without face mask, gloves and glasses.
4. Inappropriate and cumbersome postures while working on field can lead to damage or pain in muscles and tendons. These are mainly caused while working on or with poorly designed tools.
5. Student are cautioned not to go near water bodies.
6. Do not work on field during extreme weather conditions in an agricultural farm may occur due to sunburn, heatstroke, dehydration and extreme exposure to cold.

First aid equipment, facilities and training

The information provided in this chapter may be used as a guide to determine the appropriate first aid equipment, facilities, first aiders and procedures needed in various workplaces. First aid equipment, facilities and first aiders must be accessible to workers whenever they work, including those working night shifts or overtime.

First aid kits

All workers must be able to access a first aid kit. This will require at least one first aid kit to be provided at their workplace. Contents The first aid kit should provide basic equipment for administering first aid for injuries including:

- cuts, scratches, punctures, grazes and splinters
- muscular sprains and strains
- minor burns
- amputations and/or major bleeding wounds
- broken bones
- eye injuries
- shock.

The contents of first aid kits should be based on a risk assessment. For example, there may be higher risk of eye injuries and a need for additional eye pads in a workplace where:

- chemical liquids or powders are handled in open containers
- spraying, hosing or abrasive blasting operations are carried out
- there is any possibility of flying particles causing eye injuries
- there is a risk of splashing or spraying of infectious materials
- welding, cutting or machining operations are carried out.

Additional equipment may be needed for serious burns and remote workplaces. The recommended content of a typical first aid kit and information on additional equipment is provided in Appendix C.

Design of kits

First aid kits can be any size, shape or type to suit your workplace, but each kit should:

- be large enough to contain all the necessary items
- be immediately identifiable with a white cross on green background that is prominently displayed on the outside
- contain a list of the contents for that kit
- be made of material that will protect the contents from dust, moisture and contamination.

Location

In the event of a serious injury or illness, quick access to the kit is vital. First aid kits should be kept in a prominent, accessible location and able to be retrieved promptly. Access should also be ensured in security-controlled workplaces. First aid kits should be located close to areas where there is a higher risk of injury or illness. For example, a school with a science laboratory or carpentry workshop should have first aid kits located in these areas. If the workplace occupies several floors in a multi-storey building, at least one kit should be located on every

second floor. Emergency floor plans displayed in the workplace should include the location of first aid kits. A portable first aid kit should be provided in the vehicles of mobile workers if that is their workplace (e.g. couriers, taxi drivers, sales representatives, bus drivers and inspectors). These kits should be safely located so as not to become a projectile in the event of an accident.

Restocking and maintaining kits

A person in the workplace should be nominated to maintain the first aid kit (usually a first aid officer) and should:

- monitor access to the first aid kit and ensure any items used are replaced as soon as practicable after use
- undertake regular checks (after each use or, if the kit is not used, at least once every 12 months) to ensure the kit contains a complete set of the required items (an inventory list in the kit should be signed and dated after each check)
- ensure that items are in good working order, have not deteriorated and are within their expiry dates and that sterile products are sealed and have not been tampered with.

First aid signs

Displaying well-recognised, standardised first aid signs will assist in easily locating first aid equipment and facilities. Further information on the design and use of signs is available in AS 1319 - Safety Signs for the Occupational Environment.

Other first aid equipment

In addition to first aid kits, you should consider whether any other first aid equipment is necessary to treat the injuries or illnesses that could occur as a result of a hazard at your workplace.

Automated external defibrillators

Providing an automated external defibrillator can reduce the risk of fatality from cardiac arrest and is a useful addition for workplaces where there is a risk of electrocution or where there are large numbers of members of the public. Automated external defibrillators are designed to be used by trained or untrained persons. They should be located in an area that is clearly visible, accessible and not exposed to extreme temperatures. They should be clearly signed and maintained according to the manufacturer's specifications.

Eye wash and shower equipment

Eye wash and shower equipment may be permanently fixed or portable, depending on the workplace. Eye wash equipment should be provided where there is a risk of hazardous chemicals or infectious substances causing eye injuries.

Immediate access should be provided to shower equipment in workplaces where there is a risk of:

- exposure to hazardous chemicals resulting in skin absorption or contamination from infectious substances
- serious burns to a large area of the face or body (including chemical or electrical burns or burns that are deep, in sensitive areas or greater than a 20 cent piece).
- Shower facilities can consist of:
- an appropriate deluge facility
- a permanently rigged hand-held shower hose
- a portable plastic or rubber shower hose that is designed to be easily attached to a tap spout—for small, relatively low risk workplaces where a fixed deluge facility would not be reasonably practicable but the risk of serious burns is still foreseeable (e.g. a fish and chip shop). Portable, self-contained eye wash or shower units have their own flushing fluid which needs to be refilled or replaced after use. Further guidance is available in AS 4775 – Emergency eyewash and shower equipment.

First aid facilities

A risk assessment will help determine the type of first aid facilities needed. For example, a clean, quiet area within the workplace that affords privacy to an injured or ill person may be suitable and practicable for some workplaces. Access to a telephone for contacting emergency services or an emergency call system should be provided as part of all first aid facilities.

First aid rooms A first aid room should be established at the workplace if a risk assessment indicates that it would be difficult to administer appropriate first aid unless a first aid room is provided. For example, workers who carry out work at workplaces where there is a higher risk of serious injury or illness occurring that would not only require immediate first aid, but also further treatment by an emergency service, may benefit from having access to a dedicated first aid room. A first aid room is recommended for:

- low risk workplaces with 200 workers or more
- high risk workplaces with 100 workers or more.

The contents of a first aid room should suit the hazards that are specific to the workplace. The location and size of the room should allow easy access and movement of injured people who may need to be supported or moved by stretcher or wheelchair. The following items should be provided in the room: • a first aid kit appropriate for the workplace

- hygienic hand cleanser and disposable paper towels
- an examination couch with waterproof surface and disposable sheets
- a cupboard for storage
- a container with disposable lining for soiled waste
- a container for the safe disposal of sharps
- a bowl or bucket (minimum two litres capacity)
- electric power points
- a chair and a table or desk
- a telephone and/or emergency call system
- the names and contact details of first aiders and emergency organisations.

A first aid room should:

- be located within easy access to a sink with hot and cold water (where this is not provided in the room) and toilet facilities
- offer privacy via screening or a door
- have entrances and corridors leading to and from the first aid room that are wide enough to permit transport of injured or ill persons supported by a stretcher, wheelchair and carrying chair, and other people
- be well lit and ventilated
- have an appropriate floor area
- have an entrance that is clearly marked with first aid signage. Maintaining a first aid room should be allocated to a trained occupational first aider, except where this room is part of a health centre or hospital.

Health centers

Health centers staffed by a registered health practitioner (a doctor or nurse) or paramedic can provide emergency medical treatment and cater to the types of hazards in high risk workplaces. A health centre may be established in the workplace or, if readily available, external emergency services may be used. If a health centre is located at the workplace, the facility should:

- be self-contained
- be located at ground level where possible in a quiet, clean area that is a safe distance from hazardous operations and clear of any general thoroughfare
- be convenient and accessible to workers at the times that they work and have an entrance clearly marked with health centre signage
- have walls, floors and ceilings that are made of impervious materials and are easy to clean
- have enough space to accommodate first aid equipment.

Ref: https://www.worksafe.qld.gov.au/__data/assets/pdf_file/0004/58162/First-aid-in-the-workplace-COP-2014.pdf