

**Micro-irrigation**, also called as localised irrigation, low volume irrigation, low-flow irrigation, or trickle irrigation is an irrigation method with lower pressure and flow than a traditional system. Low volume irrigation is used in agriculture for row crops, orchards, and vineyards. It is also used in horticulture in wholesale nurseries, in landscaping for civic, commercial, and private landscapes and gardens, and in the science and practice of restoration ecology and environmental remediation.

## **Description**

There are several types of micro-irrigation systems. Many of the components are the same for all of these types of systems. Most systems typically include filters, pipes, valves, and tubing. The main difference is in the type of emission device that is used to deliver the water to the plants. Drip irrigation utilizes drip emitters that deliver water at very low rates. The typical range is 0.2 to 4.0 gallons per hour. In some systems, the emitters are installed manually on the outside of the tubing and placed where needed. Other systems might use integral dripperline or drip tape with the emitters already installed at a predetermined spacing. Micro-sprinklers, which can include fixed stream sprays and rotating spinners typically deliver water at a higher rate, such as 10 to 25 gallons per hour and will cover a larger area than drip emitters. These are more typically used in tree orchards where the plants are larger. The goal is to distribute water slowly in small volumes and target it to plants' root zones with less runoff or overspray than landscape and garden conventional spray and rotary sprinklers. The low volume allows the water to penetrate and be absorbed into slow-percolation soils, such as clay, minimizing water runoff

## **System components**

There are a wide variety of system components included in a micro-irrigation systems. Most systems include a filter. These may include pre-filters, sand separators, media filters, screen filters, and disc filters. The level of filtration required depends on the size of the emission device and the quality of the water source. A pressure regulator or regulating valve may be required to reduce the system pressure to the desired level. Automatic or manually operated valves will be required to switch from one irrigated section to another. An irrigation controller will be used with automatic systems and may also be needed for back-flushing the filter or sand

separator. Since water conservation is a frequent reason for choosing micro-irrigation systems, soil moisture sensors, rain shutoff sensors, and sometimes even weather stations may be installed.

## **The Important Components of Micro Irrigation Systems**

Micro irrigation has become an essential part of efficient farming, helping growers get the most yield from their crops for the dollar invested. Although there are a few varieties of micro irrigation systems with several different options, they all involve basically the same setup. Installing most micro irrigation systems is fairly simple and can be accomplished by a farmer using the parts referenced below. A micro irrigation systems professional can also be hired to do the installation work.

From the source of water, to the plants being irrigated, micro drip irrigation systems are comprised of three main parts: control system; delivery system; and emissions system. There are multiple parts to each of these systems that are built together to create an entire setup.

### **Control System**

The control system handles the entire micro irrigation system that delivers a specified amount of water to plants based on the size of the system, its components, and other variables that affect water delivery. It consists of the following:

- **Flow Meters** – Control the amount of water passing through the micro irrigation system from the source of water.
- **Pressure Gauges** – Used in various places throughout the system to measure water pressure in different areas.
- **Control Valves** – Control water flow to different zones when systems are designed to irrigate multiple areas.
- **Irrigation Controllers** – These are electronic control valves designed to stop and start the system , based on how they are programmed.

### **Delivery System**

The delivery system distributes water from the source to the emitters that irrigate the plants. This system includes the following:

- **Pipe, Fittings and Tubing** - Used throughout the irrigation system to move water from the pumps to the irrigation heads. PVC is generally used as a mainline delivery to fields, while tubing is used from mainlines to emitters. Fittings connect various sections together.
- **Flush and Vacuum Relief Valves** – Utilized to clean out the irrigation system and release any air trapped in lines that might prevent water delivery.
- **Pressure Regulators** – Employed to control water pressure to downstream lines to prevent damage due to high pressure.
- **Chemical Injectors** – Installed into irrigation lines for cleaning out the system or providing plant food in the irrigation water.
- **Filters** – Set up at the beginning of the delivery line when water is sourced from ponds or other reservoirs to filter out dirt or particles in the water that might plug the system.

## **Emissions System**

Emissions devices differ based on how water must be delivered. Emitters are connected by flexible tubing and are last in the delivery system. They differ in type, pressure, and drip rate - all of which must be considered before deciding on a specific type of irrigator. Following are the various types of emitters:

- **Drip Tape or Drip Line** – Tube laid on or in the ground; includes regularly spaced emitters that seep water along its length.
- **On-line or In-Line Emitters** – Tubing with emitters that deliver water in specific spots. The only difference in these two types is on-line emitters must be hand-installed into tubing at required intervals, while in-line emitters are factory installed inside tubing at various intervals to save installation time.
- **Micro-sprinklers** – Small sprinkler heads that emit water in a circle around the root area of plants.
- **Misters** – Emitters that deliver a fine, continuous mist of water to plants.

- **Jets** – Emitters that jettison water to land in specific areas to send larger amounts of water at one time.

Although all micro irrigation systems will likely use similar parts, variables such as water pressure, line types, and other necessary parts will depend on the type of emitter used and the type of plant being irrigated.

## **Drip Irrigation System - Components and their Function**

A drip irrigation system consists essentially of mainline, sub mains, lateral, drippers, filters and other small fittings and accessories like valves, pressure regulators, pressure gauge, fertilizer application components etc.

### **1. Filter:**

It is the heart of drip irrigation. A filter unit cleans the suspended impurities in the irrigation water so as to prevent blockage of holes and passage of drip nozzles. The type of filtration needed depends on water quality and emitter type. A two-stage filter unit is usually needed.

#### **a) Gravel Filter (Sand Filter):**

These filters are effective against inorganic suspended solids, biological substances and other organic materials. This type of filter is essential for open reservoir, when algae growth take place. The dirt is stopped and accumulated inside the media in the filter. Gravel filter consist of small basalt gravel or sand (usually 1-2 mm dia) placed in cylindrical tank, made of metal. Water enters form the top and flows through the gravel while leaving the dirt in the filter. The clean water is discharge at the bottom. The filter is cleaned by reversing the direction of flow. Pressure gauges are fitted at the inlet and outlet of the filter. When the dire accumulates, the pressure difference between the inlet and outlet increase and when the pressure difference is more than 0.5 to 1.0 kg/ cm<sup>2</sup> ( 5-10 m) , then filters must be cleaned by opening the clover or back washing, Automatic self cleaning filter are also available.

The flow rate of the filters may be 10,15,20,25,30,40,50 cu/m/hr and the tank diameter may range from 10-50 cm depending on the capacity of the system.

#### **b) Screen Filter:**

These are installed with or without gravel filter, depending upon quality of water. The screens are usually cylindrical shape and are made of non-corrosive metal or plastic material. Screen filters are specified as below:

1. By the diameter of inlet and outlet (range from  $\frac{3}{4}$  "to 4" inches)
2. By the recommended range of flow rate (ranges from 3, 5,7,10,15,20,30, 40, cu. m/hr).
3. By the size of holes in the screen (in mm, micron or in mesh i.e. the number of holes per square inch). As a approximation, 20, 40,80, 100,120,150 and 200 mesh ( 0.15, 0.1 and 0.08 mm) respectively. The most common mesh selected for drip irrigation is 100 to 200 meshes (0.15 to 0.08mm-dia).
4. By the total surface area of the filter ( in sq. m) or the active or net filter area, which is usually about  $\frac{1}{3}$  of the total filter surface area.
5. By the cleaning methods: manual or automatic. The head loss across the filter should not be more than 3 m and otherwise needs cleaning. The filters are cleaned by flushing the screen with a stream of water. After cleaning the screen is checked for tears and the gasket should be checked and replaced when necessary.
6. With relatively clean water, screen filters can be used alone.

#### **c) Disc Filter / hydro cyclone Filter:**

The filtration elements are grooved plastic disc, which are piled together around a telescopic core, according to the desired degree of filtration. Both sides of the discs are grooved and the grooves cross each other when piled up and tightened together. The housing is made of plastic or metal and comes in many different sizes mainly  $3\frac{3}{4}$  to 3. The water passes through the filter from the outside to the inside. There is no danger of filter tearing. The filtration is affected in two stages: the larger outer surface operates as a screen filters and collects the larger particles. The grooves inside the disc allow the adhesion of fine particles, mainly organic matter. The filter element can be cleaned easily. When opening the core, the discs are released and can easily be

rinsed under running water. The pressure drop is slightly higher than screen filter but disc filters have better cleaning capacity than screen filter. The water flow should be on a tangent to the disc to allow them to spin freely.

## **2. Main Line:**

The main line conveys the water from filtration system to the sub main. They are normally made of rigid PVC pipes in order to minimize corrosion and clogging. Usually they are placed below the ground i.e. 60 to 90 cm ( 2 to 3 ft ) , so that they will not interfere with cultivation practices. Their diameter is based on the system flow capacity. The velocity of flow in mains should not be greater than 1.5 m/s and the frictional head loss should be less than 5ml /1000 m running length of pipeline.

## **3. Submain:**

The Submain conveys the water mainline to the laterals. They are also buried in ground below 2 to 2.5 ft and made of rigid PVC. The diameter of Submain is usually smaller than main line. There may be number of Submain from one mainline depending upon the plot size and crop type.

## **4. Laterals:**

Laterals are small diameter flexible pipes or tubing made of low density polyethylene (LDP) or liner low density polyethylene (LLDPE) and of 12 mm, 16mm, and 20 mm size. Their colour is black to avoid the algae growth and effect of ultra- violet radiation. They can withstand the maximum pressure of 2.5 to 4 kg/cm<sup>2</sup>. They are connected to Submain at predetermined distance. The pressure variation between two extreme points of lateral should not be more than 15-20 % and discharge variation should not be more than 10%. On slopping ground, the laterals are placed along the contour with 1% extra length for sagging purpose.

## **5. Emitters or Drippers:**

It is the main component of Drip irrigation system for discharging water from lateral to the soil. i.e. to the plants. There are various types and size of drippers, based on different operating principles. They are made of plastic, such as polythene or polypropylene. Their discharge range

is between 1-15 ph. Each dripper has its own characteristics, advantages and disadvantages which determine its use.

The drippers can be classified according to working principle, discharge, type, structure, working pressure, designation, durability, regulated and non regulated discharge.

The main principle when planning a dripper is to achieve the minimum discharge with maximum size of water passage. The large water passage is essential to minimize clogging and provide the minimum discharge for cheapest set-up. Therefore, an emitter is necessary, ( a hole in a pipe is not a dripper). Emitters may be on the lateral or inside to lateral, accordingly they are called on line or inline emitters.

#### **6. Controls Valves (Ball Valves):**

These are used to control the flow through particular pipes. Generally, they are installed on filtration system, mainline, and on all Submain. They are made up of gunmetal, PVC cast iron and their size ranges from 1/2" to more than 5".

#### **7. Flush Valve:**

It is provided at the end of each sub main to flush out the water and dirt's.

#### **8. Air Release Cum Vacuum Breaker Valve:**

It is provided at the highest point in the main line to release the entrapped air during the start of the system and to break the vacuum during shut off. It is also provided on Submain if Submain length is more.

#### **9. Non Return Valve:**

It is used to prevent the damage of pump from flow of water hammer in rising main line.

#### **10. Pressure-Gauge:**

It is used to indicate the operating pressure of the drip system.

### **11. Gromate and Take-off:**

These are used to connect the lateral to Submain. A hole is punched with hand drill of predetermined size in Submain. Gromate is fixed into the hole. Take off is pressed into the hole. Take off is pressed into the gromate with take of punch upto the step provided. Gromate acts as a seal. The sizes are different for 12 mm, 16mm, and 20 mm lateral.

### **12. End Caps (End Sets):**

They are used to close the lateral ends, Submain ends or mainline ends. Sub mains and mains are preferably provided with flush valve. They are convenient for flushing the line.

### **13. Fertilizing System:**

It is used to add the chemical irrigation water; however, fertigation is not free of hazards. Chemicals added to water may be toxic human beings and animals so, safeguard must be taken to prevent back flow of irrigation water into the water source, which might be used for drinks purpose. Only water-soluble fertilizers should be used to minimize the clogging hazard.