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Popular Article

Advantages Components and Maintenance of Drip Irrigation System under Field condition

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Introduction

Drip irrigation may be defined according to a number of performance parameters including flow rates, wetting pattern, pressure rating and construction material. Regardless of the specific type, make or model of a drip irrigation system or component, its performance is typically characterized as follows:

Water is Applied at a Low Flow Rate

Emission device flow rates are typically measured in gallons per hour (GPH), resulting in low application rates.

Water is Applied for Long Periods of Time

Irrigation duration may be hours rather than minutes when the application rate is low.

Water is Applied Frequently

Irrigation events may occur daily, or even multiple times per day, when the application rate is low.

Water is Applied at Low Pressure

Operating pressures typically range between 10-30 psi, rarely exceeding 60 psi, for most emission devices.

Water is Applied Directly to the Soil and the Plant's Root Zone

Water drips, or sprays, directly onto the soil and into the targeted plant's root zone without wetting the plant or non-targeted areas, and without regard to the presence of wind. Depending on soil type and emission device, wetting paterns typically range from 0.5-6.0 feet for emitters and up to 40 feet for micro jets or sprays.

Water is Applied Through Numerous Emission Devices

In point source drip irrigation, each plant is fitted with at least one emission device to service the plant's water needs. In broadcast drip irrigation, a gridwork of emission devices wets the entire area, servicing all plants within the wetted area.

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Water is Filtered

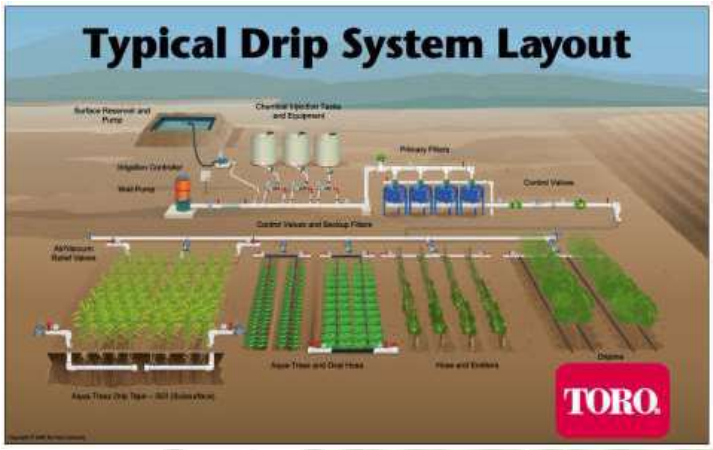
To avoid plugging the relatively small passages inside drip emitters, 150-200 mesh filters are used to remove mineral or organic materials from the irrigation water.

Fertigation is Enabled

Since water is applied directly to the root zone, there is an opportunity to apply nutrients along with the water.

Operation can be Automated

Drip irrigation systems are often controlled with solenoid enabled valves that can be automatically actuated according to a user defined program entered into an irrigation controller.



Drip Irrigation Layout

The "Typical Drip System Layout" illustration has been developed to help those who are unfamiliar with drip irrigation understand basic drip irrigation system components and concepts. The illustration is organized into two halves. First, the "headworks" portion of a drip irrigation system shows the typical water sources, pumps, filters, chemical injection equipment and controls used in a drip irrigation system. Second, the "field" portion of the drip irrigation system shows typical layouts for five different types of drip irrigation: field crop subsurface drip irrigation (SDI), short term vegetable crop, longer term vegetable crop, vine farm and orchard. Although every application and design will be different than this illustration, it provides a starting point for discussion with viewers unfamiliar with drip irrigation.

Advantages of Drip Irrigation

Today it is more important than ever to use water resources wisely and to irrigate intelligently. Consequently, many farmers have turned to drip irrigation and have enjoyed improved profitability by increasing crop yield and quality while at the same time reducing costs from water, energy, labor, chemical inputs and water runoff. Many landscapers have also enjoyed significant water and capital investment savings using drip irrigation, while simultaneously improving plant vigor by delivering water and nutrients directly to the plant roots and avoiding unnecessary wetting of plant leaves.

Drip irrigation is the targeted, intelligent application of water, fertilizer, and chemicals that when used properly can provide great benefits such as:

- Increased Revenue from Increased Yields
- Increased Revenue from Increased Quality

- Decreased Water Costs
- Decreased Labor Costs
- Decreased Energy Costs
- Decreased Fertilizer Costs
- Decreased Pesticide Costs
- Improved Environmental Quality

Components of a Drip Irrigation System

Drip irrigation systems consist of emission devices serviced by a water distribution network that includes control zone equipment. At the water source, water is controlled with automatic valves, sometimes amended with nutrients or chemicals, filtered and regulated at levels suitable for the emission devices chosen and plants being grown. From there, water is delivered to each of the emission devices through a network of PVC and PE pipes. The emission device, whether it is drip tape, a drip emitter, jet or micro-sprinkler, then delivers water and nutrients to the soil where plant roots may nourish the plant. All components have attributes that affect performance, and that are traded off with initial, installation, operation and maintenance costs. A thorough understanding will assist in selecting the proper equipment to achieve desired expectations for the given application. Drip irrigation systems are durable and are built to withstand outdoor conditions for reasonable lengths of time, but care should be taken to avoid damage by wildlife, foot traffic or field equipment. In many cases, the environmental conditions will dictate the choice of emission device for any given application. A brief description of the three equipment classes follows:

Emission Devices

Once the emission device is chosen, a system of filters, chemical injectors, pipes , valves and fittings must be constructed to deliver water reliably, safely and efficiently to each outlet, and to facilitate system maintenance. The major categories are as follows:

Drip Tape

Drip Tape is a "line-source" product that incorporates a series of relatively inexpensive, engineered emission devices into a thin walled tube. Water is distributed evenly along the length of the tube through emission devices which may be spaced anywhere from 4" to 24" apart. To accommodate various crops and terrain, tube wall thicknesses are available from .004" to .015" (4 mil to 15 mil), emitter flow rates from .07 - .34 gph, and pipe diameters from 5/8" to 1 3/8". Drip tape is available in standard and pressure compensating models, and is used extensively for vegetable and field row crop cultivation. It may be installed above or below the ground, and may be retrieved for multi-season reuse or disposed at the end of each season. Drip tape is relatively inexpensive and is ready to install without any additional emission device installation labor.

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On-line Emitters

On-line Emitters are small plastic devices which convey small streams of flow from polyethylene (PE) tubing to the soil. Water then moves through the soil via capillary flow and creates a wetted circle, the size of which is dependent upon the soil type, flow rate and irrigation schedule. On-line emitters are attached to the PE tubing wall by inserting the emitter's barb shaped base through a precisely punched hole. On line emitters offer the user the advantage of installing an emission device exactly where wanted, and if the emitter is "take-a-part", it may also be serviced. The disadvantage is that the end user must manually insert each emitter. Although the ability to self-clean an emitter is an attractive feature, it should be viewed as an occasional event that is no substitute for proper filtration and maintenance. Drip irrigation systems may employ hundreds or even thousands of emitters, a quantity impractical to flush by hand.

In-line Emitters / Dripline

In-line Emitters, or Dripline, consists of small plastic emission devices similar in function to on-line emitters, but in this configuration they are pre-inserted into the PE tubing at specified intervals during the tubing extrusion process. The emitters may be cylindrical or flat "boat shaped", and are attached to the inner tube wall via a controlled heating/adhesion process. Labor savings for the end user may be substantial since emitters are factory pre-installed. Flexibility is not affected since additional emission devices are easily added to the tubing in the field if desired. The drawback is that emission devices may exist where unneeded, and they are not serviceable. Unlike all other classifications of emission devices, dripline may be installed below the surface such that the soil surface may be kept dry and surface damage may be avoided.

Foggers

Foggers are small plastic devices that emit water as a fairly confined mist, or fog, via a small plastic online device. In addition to irrigation water being applied to the soil, temperature may be manipulated and/or a humid environment may be created. Foggers were originally developed for the citrus industry, but work well for potted plants or hanging baskets as well where confined roots require frequent wetting.

Jets

Jets are small plastic devices mounted on risers and/or stakes that jettison water through the air as separate streams which create finger shaped patterns of water in the soil. A variety of finger patterns are available including full circle, half circle, hi/low trajectory, butterfly, etc. The versatility of patterns provides a great deal of flexibility for the end user to accurately apply water

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only where wanted, such as enveloping each tree in an orchard without wetting the trunk, or in landscape beds with odd shapes, or in potted plants.

Micro-sprinklers

Micro-sprinklers are small plastic devices that emit water in a full circle spray/sprinkler pattern through the air via a rotating spinner. The device is attached to the PE lateral tubing via a separate plastic stake or via a combination of a plastic stake fitted with a length of PE micro-tubing. The advantage is that water is applied over a larger area using only one emission device, and the operating pressures and application rates are low. A possible drawback is that, similar to conventional sprinklers, water is delivered through the air and may be applied to non-target areas such as roads, tree trunks, foliage or other non-target areas. In addition, water applied through the air is affected by wind. It should be noted that a performance overlap exists where the higher flow rate ranges of micro-sprinkler approach the lower flow rate ranges of conventional sprinklers.

Distribution System

Once the emission device is chosen, a system of filters, chemical injectors, pipes , valves and fittings must be constructed to deliver water reliably, safely and efficiently to each outlet, and to facilitate system maintenance. The major categories are as follows:

Filters

Filters are used to remove organic and inorganic debris from the water that could potentially clog the emission devices. In agriculture, sand media filters, screen filters or disk type filters are commonly used, and may be cleansed manually, semi-automatically or automatically. Even where potable water is used, which is typical of land scaping applications, disc or screen filters should be installed since scale and chemical precipitants may occur which present a potential clogging hazard. Depending on the emission device chosen, the degree of filtration should be 80-200 mesh.

Chemical Injectors

Chemical Injectors are typically installed in drip irrigation system in order to facilitate system maintenance with chlorine or acid, and also to supply nutrients or other liquid or gaseous substances to the plants being irrigated. Whatever type of injector chosen, extreme care should be taken to ensure that the system includes proper safety and backflow prevention devices.

Pipe

PVC pipe is widely used to transport water from the water source to irrigation equipment of all types. In drip/micro-irrigation systems, it is typically used in the control zone and in the delivery network as both mainline and sub-mainline. In some cases, it may also be used as the lateral serving the emission devices. White PVC pipe is not UV resistant.

Tubing

PE tubing is widely used as the lateral pipe servicing the emission devices. It is available in numerous diameters, wall thicknesses and reel lengths with varying pressure ratings and hydraulic characteristics. PE tubing, regardless of the color, is UV resistant.

Fittings

PVC pipe connections are typically made using solvent welded fittings, while PE tubing is usually connected via compression, insert, or ring-lock type fittings.

Flush Valves

Flush Valves are used to periodically cleanse the conveyance and emission device components of organic and inorganic debris that could clog the emission devices if left unchecked. They may be simple manual valves fitted at the ends of mainlines, sub-mainlines and/or laterals, semi-automatic valves that flush only at start-up or shut-down, or fully automated solenoid valves.

Air/Vacuum Relief Valves

To avoid general equipment failure, pipe rupture or pipe blockage, A/V relief valves are used to expel air that builds up in the pipeline network during startup and operation. A/V relief valves are also used to allow air to enter the pipeline network as water exits at shutdown. This avoids undesirable vacuum suction in both the pipelines and the emission devices. A/V relief valves are typically installed at high elevation points, at control points, and at periodic pipeline intervals.

Pressure Regulators

Pressure Regulators are installed to protect downstream components from excessive pressures. They are especially important in drip/micro systems because the plastic and PE construction materials typically have lower pressure ratings than conventional sprinkler systems.

Control Zone Equipment

Now the drip irrigation system must be monitored and operated. It cannot be stressed enough how important the first two categories (flow meters and pressure gauges) are to assess performance and guidance for operation, and how important the last two categories (valves and controllers) are to deriving the maximum benefit from a drip irrigation system.

System Flow Meters

System Flow Meters are available in a range of sizes and types, and commonly provide both instantaneous and cumulative water flow with an accuracy of approximately two percent. Flow meters may also be fitted with electrical analog conversion units that are capable of transmitting flow rate data to a centralized irrigation control computer. A micro-irrigation system offers the user an unprecedented degree of control over his water and power costs, and over the growing conditions of his crop. To take full advantage of this ability to control the irrigation system, it is necessary to have useful feedback information on flow rates and total water applied during a given time period. Accurate flow rate information is also indispensable for the analysis of crop response to water and nutrients, and for monitoring the continuing performance of the irrigation system. A good quality system flow meter is therefore an essential part of a well designed micro-irrigation system.

Pressure Guages

Pressure Gauges are an essential item for drip systems since visual monitoring is often impractical or impossible. Pressure gauges placed at the pump station, before and after the filter station, and upstream and downstream of each control valve will provide an immediate indication of system performance. If pressures are too low, a leak could be indicated, a filter plugged or a valve jammed. If pressure are too high, the system could be plugged or a valve may be set incorrectly. Similar to a flow meter, accurate pressure information is essential part of a well designed and operated drip system.

Zone Control Valves

Zone Control Valves are used to control the flow of water to the various blocks or network zones. They may be simple manually operated valves, or fully automated solenoid activated on/off or pressure reducing valves. They may be co-located at the pump station or other Point of Connection (POC), or may be dispersed throughout the farm or landscape.

Irrigation Controllers

Irrigation Controllers are used to automatically start and stop irrigation events by sending electronic current to solenoid activated valves. The electronic current is controlled by a user defined schedule that is entered for each zone control valve. More sophisticated controllers may allow automatic adjustment of the program based on sensor inputs such as weather (plant water use or rain), system flow or system pressure.

Maintenance

■ Inspect drippers, micro sprinklers and microtube periodically to ensure that the drippers have not clogged and the microtube has not moved.

■ Filter screens should be flushed and cleaned at least once a month, depending on water quality. A check of the filter one week after installation should give you an idea on how often to schedule cleaning.

■ Tubing lines should also be flushed periodically, again, water quality will determine the frequency of flushing.

■ *During freezing weather, we recommend draining your polytube or rolling it up and storing it.*

■ Remove end caps and open hose ends to flush the line once a year.

■ As your landscape matures, you may need to add, change or remove drippers or micro sprinklers.