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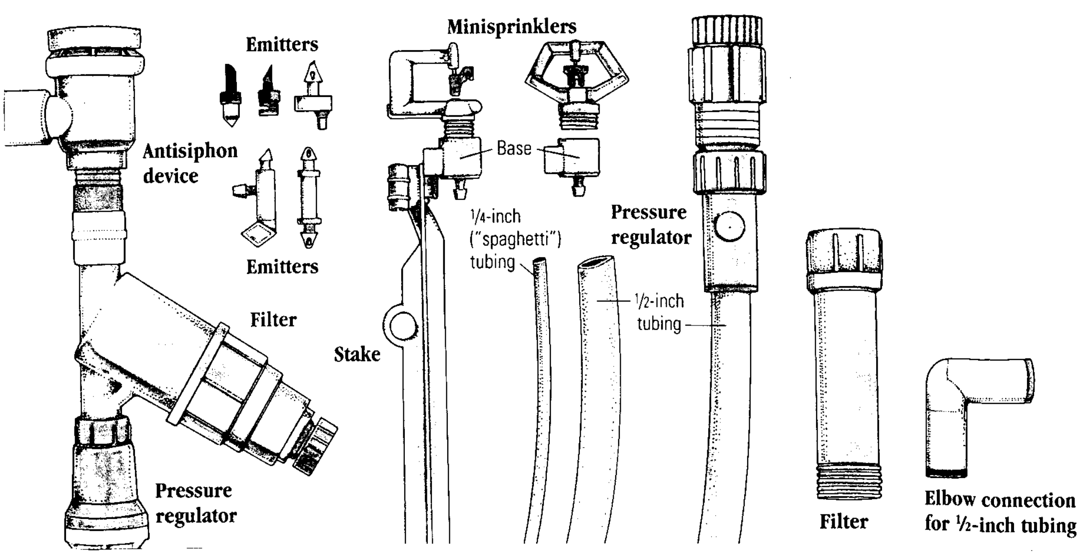
DRIP IRRIGATION

Drip irrigation is the slow, deep and regular application of water directly to the root zone of your plants. This method of irrigation requires 30-70 percent less water than conventional sprinklers by providing water directly to the plants, and reducing waste from runoff and evaporation. The water flows at a low pressure through polyethylene ("poly") pipes or soaker hoses laid in rows or serving groupings of plants. The water slowly enters the soil from emitters (also known as drippers), pre-punched holes or porous pipe. Drip irrigation is used to water everything from annuals in pots to full-scale fruit orchards.

There are many advantages to using drip irrigation including water conservation, reduced soil erosion, reduced plant disease and weed growth, increased plant vigor and protection of our groundwater. It maintains a constant level of soil moisture, while not saturating the root zone. This reduces the stress on plants caused by the traditional flood-to-drought cycles of overhead sprinklers. By reducing the amount of water splashed on plant foliage, drip irrigation discourages fungus and bacterial plant diseases. For example, powdery mildew can be significantly reduced on roses with the installation of soaker hoses or drip irrigation. This reduces the costly and time-consuming application of fungicides.

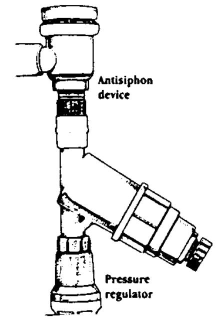
Applying water directly to the root zone of plants reduces the amount of water lost to surrounding soil. Every gardener has experienced the frustration of a freshly weeded garden that sprouts a new crop of weeds after the first irrigation. Drip irrigation controls the flow of water to areas where individual plants, shrubs and trees are growing, while leaving open spaces dry. This combined with generous amounts of mulch will deter weeds and conserve water.

Components of a Drip Irrigation System



Installing Drip Irrigation Systems

You do not need to be a plumber or irrigation contractor to install a system. For the first year you can install a simple system for a flower or shrub bed. This system can include a connection to a garden hose with an anti-siphon valve, filter and pressure regulator, all attached to the pipes for the system.



The anti-siphon valve prevents contaminated water from flowing from the drip system back into your domestic water supply. The filter is critical in preventing foreign particles such as sand and silt from clogging drip emitters. The pressure regulator can protect the low-pressure drip system from the high pressures sometimes available from municipal water supplies. Piping typically consists of poly pipes for supply lines connected with compression fittings or barbed fittings.

Drip irrigation equipment is generally sold at the large hardware and garden stores and at many local irrigation dealers. These stores and the manufacturers of drip irrigation equipment generally have detailed information available concerning the types of parts and their use.

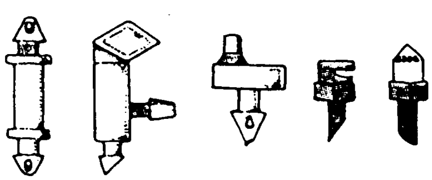
Some manufacturers offer parts to modify existing sprinkler systems into drip systems. These modifications involve removing a sprinkler head in the shrub bed and adding a drip distribution cap that allows either a 1/2" pipe connection or multiple 1/4" spaghetti tubing connections.

Poly pipe and compression fittings can be used with water pressure up to 60 psi (pounds per square inch), while barbed fittings should not be used with water pressure exceeding 30 psi. Ensuring water pressure does not exceed these standards is the function of the pressure regulator.

A very simple system involves a hose end connection to the drip system from a standard faucet. This can be made more efficient by adding a simple irrigation timer at the faucet to control the length of time your system is operating.

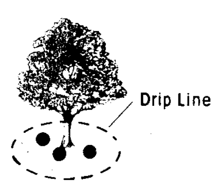
Drip irrigation systems can be installed on top of the ground or buried. It is usually easier to install the system on top of the soil and apply mulch over the pipe. The emitter can be installed directly in the poly supply line or attached to the supply line via a 1/4" flexible vinyl feeder tubing.

Ideally, install the emitters so that they can be checked periodically for proper operation. There are some in-line emitter products with drippers in the pipe for watering rows of plants in flower beds or gardens. These include products like Netafim, Bi-wall tubing and 1/4" laser cut slit pipe.



The most critical component of any drip irrigation system is the emitter, sometimes called a dripper. In general, a dripper is the device that delivers a regulated amount of water during a specified amount of time (flow rate). The most common flow rates are .5 gph (gallons per hour), 1 gph, and 2 gph. The flow rate is usually listed for a given pressure. This tells you that at 20 psi a particular dripper will emit .5 gph. Some drippers are pressure compensating. They maintain a relatively constant flow regardless of the pressure.

Another important feature to look for when selecting drippers is clog free design. Many are now available with turbulent flow design that allows an outlet opening that is much larger than other drippers. Larger particles are able to flow through the dripper without clogging, while maintaining a constant flow.



The number of emitters required by plants depends on the size and kind of plant as well as the type of soil. Trees require more water than shrubs, and shrubs more than groundcovers. Newly planted trees should receive 4 drippers initially while ensuring that the system will be adequate to add drippers as the tree grows. Drippers should be gradually moved away from the trunk of the tree and added at a rate of one dripper for each 2.5' of canopy diameter. This process will ensure an expanding and healthy root zone.

Different types of soils allow water to soak in at different rates. This makes it necessary to use .5-gph drippers on clay soils, 1-gph drippers on loam soils and 2-gph drippers on sandy soils. The lower flow drippers on clay soils will have to run longer than the 2-gph drippers on sandy soils to apply the same amount of water. Choosing the right dripper for the soil conditions reduces runoff and wasted water.

Selecting the right drippers for your soil, shrubs and the weather conditions

PLANT TYPE	SOIL	# OF EMITTERS	EMITTER SIZE (gph)	WEATHER					
				COOL		WARM		HOT	
				hrs/ day	days/ wk	hrs/ day	days/ wk	hrs/ day	days/ wk
LARGE SHRUBS	SAND	4	2 gph	3.5	2	4	2	5	2
10'+ diameter	LOAM	4	1 gph	4	3	5	3	6	3
70 gal per week	CLAY	4	1/2 gph	7	4	8	4	9	4
SHRUBS AND	SAND	3	2 gph	3	2	3	2	4	2
VINES 8.00' dia	LOAM	3	1 gph	4	3	4	3	5	3
45 gal per week	CLAY	3	1/2 gph	6	4	6	4	7.5	4
SMALL SHRUBS	SAND	2	2 gph	2	1-2	1.5	2	2	2
4.00' diameter	LOAM	2	1 gph	2	1-2	3	2	4	2
16 gal per week	CLAY	2	1/2 gph	3	3	4	3	5	3
GROUNDCOVERS	SAND	1	2 gph	2	1-2	1.5	2	2	2
AND PERENNIALS	CLAY	1	1 gph	2	1-2	3	2	4	2

Calculating Water Requirements for Plants

The exact amount of water a plant requires can be calculated accounting for size, soil type, and local weather conditions. These steps will help you to understand the preceding table and find specific requirements for your plants.

Important Factors:

1. The climate type for the Inland Northwest (for drip system design) is warm and dry, an important factor when establishing the potential evapotranspiration (P.E.T.) rate. Evapotranspiration is defined as the loss of water from the soil both by evaporation and by transpiration from the plants growing there. Our P.E.T. is .25 inches daily.
2. You will need the location and plant type for each plant that will be irrigated. This can be broken down into "tree", "vine" and "shrub".
3. Knowing the mature size of each plant is necessary to properly design the system to meet the needs of the plants through maturity.
4. Knowing the soil texture of your yard is important when determining the spacing of emitters.

Determine how much water to apply to the plants:

The formula to calculate this is:

$$\text{Gallons per plant per day} = \frac{.623 \times \text{root zone area} \times \text{plant type factor} \times .25\ (\text{P.E.T.})}{.85\ (\text{drip efficiency for Spokane})}$$

.623 is a constant that represents the conversion factor that reconciles the root zone area in square feet, the P.E.T. in inches per day, with gallons of water. .25 (P.E.T.) is the potential maximum evapotranspiration in Spokane.

Calculate the root zone area:

1. Measure the diameter of the canopy of the plant <u>at maturity</u>. The canopy refers to how far the branches of any plant, shrub or tree spread. Remember to use the estimated mature sizes for new plantings.
2. Multiply the diameter measurement times itself (diameter squared).
3. Multiply your previous answer by .7854 and you have the plant area in square feet.

For example, a 15' diameter tree calculation would be:
15' x 15' x .7854 = 176.71 square feet of root zone

The factor for plant type can be drawn from this general list:

Plant Type	***Factor***
Mature trees	.80
Vines and shrubs over 4' diameter	.70
Small shrubs under 4' diameter	1.00
Newly planted native plants	.70
Established native plants	.40

The Drip Efficiency for Spokane (.85) results from the calculation of the percentage of irrigation water available for consumptive use by the plant material.

Example

A lilac (Syringa vulgaris) has a spread (diameter) of approximately 10' at maturity. The calculation for the gallons per plant per day required would be:

$$\frac{.623 \times (10 \times 10 \times .7854) \times .70 \times .25\ (\text{P.E.T.})}{.85\ (\text{Drip efficiency for Spokane})} = \textbf{14.76 gallons per day}$$

Conclusion

Drip systems are relatively easy to install and maintain. They can provide irrigation to larger areas of plants with less water consumption and at lower pressures. This is particularly attractive to gardeners irrigating with a well producing 5-10 gallons per minute or less. The opportunity for expansion and automation is always available with little concern for the impact of changes. The greater flexibility of a drip system allows plants to be moved or the size of beds to be changed without abandoning portions of the system.

Compiled by Mike Terrell. For more information, contact Master Gardeners at (509) 477-2181.
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