Drip Irrigation Basics

Draft

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Figure 1 Simple drip line system with inline-emitters evenly spaced

Introduction: What is drip irrigation

Drip irrigation is a type of micro-irrigation; frequent irrigation at low flow rates into small or concentrated areas. Water flows out of small nozzles called 'emitters.' Emitters for drip-irrigation are typically designed to release water at specific slow rates. Drip emitters can be installed within the hose line (Figure 1) or on drip tubes, or in spans of drip tape, where individual ready-installed emitters are spaced evenly within the drip tape. Individual emitters can alternatively be installed strategically on poly hose throughout an area (Figure 2). Emitters can be placed above or below the ground depending on their use and specifications. Throughout the irrigation industry, there are many types and prices of drip systems and parts available. Systems are typically designed for irrigating row crops, orchards, landscapes, and plant nurseries including potted plants.

Figure 2 Inline-Emitter Tubing

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Figure 3 Stand-alone emitter attached to 1/4" poly hose

Drip irrigation is a very efficient method for irrigating plants it enables plant growers to provide a controlled amount of water in a timely manner, to target locations. A drip irrigation system that is operating appropriately enhances desired plant growth and development. It provides a uniform, slow flow of water to small areas keeping soil/media moist as needed thus reducing plant stress.

With specialized components (stock tank, injector and backflow preventor, figure 3) and appropriate chemical formulations, drip irrigation can be used for of fertilizer and pesticide application to plants. Moreover, drip-irrigation systems by minimizing plant water stress enhances plant yield and quality (Shock, 2013).

Table 1 Pros and Cons of Well-Designed Drip Irrigation Systems

Pros	Cons
Efficient: Even regular timing, accurate quantity watered, targeted plants,	System needs to be maintained and cleaned frequently: Lines get clogged,
Reduces labor cost involved in irrigation tasks,	Can be costly up front,
Water Conservation: Reduced water runoff, erosion, water waste on undesired plants or land areas, and increases water infiltration to maintain soil moisture levels,	If backflow prevention not installed correctly contaminants can enter main waterline when using a pump or chemical injector,
Improves plant growth and development.	Parts are not always available.

Planning/Designing a Drip Irrigation System

In order to design a drip irrigation system, one must understand the area/zone characteristics and plants that are to be irrigated (Fig 3).

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Figure 4 Field Layout of Drip Irrigation System

Important factors to consider when designing a drip irrigation system include:

Main water source

The most important step in developing and installing a drip irrigation system is to make sure there is a dependable main water source that has adequate pressure. A main water source can originate from a main water pipeline, a water tank/reservoir, or natural water body (river, stream, lake). Achieving at least 20 pounds per square inch (PSI) must be addressed if the source does not have this PSI.

Soil type/characteristics

Knowing soil types and their characteristics will help in determining optimum irrigation regiments. Characteristics important for irrigation efficiency include soil drainage ability and the soils water holding capacity (Cox and Mills, University of Nevada). Drainage ability refers to how fast excess water can percolate through the soil and water holding capacity refers to the ability the ability of the soil to capture and store water for use by plants due to the presence of soil materials (clay and organic matter) which can absorb and hold water.

Slope of the area

Land slope is important as it can impact/cause changes in water pressure. Water moving down a slope will increase pressure, and water moving up a slope will decrease pressure. This may affect the irrigation consistency of a drip irrigation system, depending on the type of emitters. Some emitters are designed to maintain even irrigation despite changes in slopes. These types of emitters or drip-lines are called 'pressure-compensating' emitters/drip-lines.

Plant production requirements

Knowing your plants' water and fertility needs including how much and how often they need to be irrigated will assist in developing proper irrigation system design and schedules.

Identify existing infrastructure

Identify any existing infrastructure and local regulations regarding infrastructure in or around the area (underground pipes, existing water and electrical lines, etc.). This will prevent potential hazards to people, expensive damage to existing infrastructure and potential penalties and fines during system installation and use.

Understand water pressure and flow rate

Water is measured by pounds of pressure per square inch (psi) and flow rate. Common drip irrigation systems usually operate best in the 20-40 psi. Water pressure that is too high or too low will hinder the drip system's

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ability to operate appropriately. A pressure regulator (Figure 4) may be necessary to decrease and/or stabilize the water pressure in the case of high or varying psi levels. In cases where the source psi is low a tank and pump may be needed to provide adequate water pressure.

Flow rate is how much water is flowing through a site's water source and is measured in gallons per hour (gph) or gallons per minute (gpm). The flow rate of water from the water source determines how large of an area/zone can be irrigated at one time. This is based on the source flow rate and the flow rate of individual drip line emitters and the area covered by each emitter. The source flow rate divided by the flow rate of the individual emitters determines how many emitters can be used at one time (or on one zone of a multi-zone nonsynchronous system.) The area covered is determined by each emitter's coverage area times the number of emitters allowed by the system flow rate. Durations of irrigation times are dependent on types of plants, soil, and weather. If an area/zone is too large to be irrigated by a single system off the main water line, consider splitting the area into multiple zones (Figure 4) and plan for different irrigation schedules for each zone. Large areas/farms can be irrigated appropriately by well-designed drip systems that are divided into multiple zones (Simonne et al, 2018).

Investigate of government programs/organizations that support financial and technical support
The Cooperative Extension & Outreach of the College of Natural and Applied Sciences, University of Guam provides technical assistance in designing appropriate drip irrigation systems. The USDA Natural Resources Conservation Service (NRCS), Guam Field Office also provides technical assistance and possible financial assistance to farmers especially the Environment Quality Incentive Program (EQIP). The Guam Department of Agriculture provides services to obtain an agricultural main line water source and certifies for Guam agricultural water rate.

Know the components of the desired drip irrigation system and the capacity of the system
Drip systems vary. It is important to know the desired system, the necessary components, and the capacity of the system.

In order to help in the planning of the system the following list of possible components is included. On Guam it is difficult to find all the components in one location so it is good to use this check list when visiting local stores to identify what can be obtained locally. Some may need to be ordered from off-island.

Figure 5 Components of a Multi-zone Drip Systems control manifold note pressure regulator, filter pressure gauge, backflow preventer and shut off valves/hose link for individual zones, among others.

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Table 2 Planner: Components of a Drip Irrigation System

Quan.	Item: Description	Cost
_______	Main water line source (hose bib or pipe outlet)	_______
_______	Water pump (if a water tank is the main water source)	_______
_______	Hose bib thread to pipe thread adapter (if main water source is from hose bib)	_______
_______	Shut-off valve (if main water source is straight from pipe)	_______
_______	Water filter (reduces potential clogging of drip systems emitters)	_______
_______	Backflow preventer or check valve (prevents water from drip irrigation system from potential back flow into main water source)	_______
_______	Necessary pipe fittings for adjustments and connections (tees, couplings, elbows, nipples, etc.)	_______
_______	Pipe thread to poly hose (submain) insert/adapter	_______
_______	Poly hose (submain water line for drip lines or stand-alone emitters)	_______
_______	Hole puncher (install connectors from submain to drip line or stand-alone emitters)	_______
_______	Connectors for poly-hose to drip lines or stand-alone emitters (for extension tubes) appropriate for desired type of drip irrigation system	_______
_______	Hose clamps (to secure submain poly-hose to pipe thread-to-poly hose insert/adapter)	_______
_______	Emitters (stand alone with appropriate connectors if necessary, drip lines with ready-installed emitters, other tubes (spaghetti tubes) if needed)	_______
_______	End plugs (used for closing end of poly hoses, hose may also be bent and tied)	_______

In Summary

Have an inquiring mind, and strive to:

1. Know your site (soils, slopes, area/zone size, utilities)
2. Ensure you have a main water source
3. Measure your psi and flow rate
4. Acquire appropriate parts of the irrigation system
5. Install and test your system's capacity to ensure your area to be irrigated is covered by the system
6. Monitor your system as you monitor your plants

For Support

Contact the College of Natural & Applied Sciences' Cooperative Extension and Outreach at (671) 735-2080 for help or more information. Additional publications can be found on our website at: www.cnas-re.uog.edu under the Publications tab.

For more information on EQIP program and technical and design assistance contact your local NRCS field office on Guam NRCS offices can be reached at (671) 300-8591 for EQIP on the web https://www.nrcs.usda.gov/wps/pertal/nrcs/main/national/programs/financial/eqip/

Disclaimer

Mention of a company or organization is to provide an example and is not an endorsement or recommendation in preference to others that may also be suitable.

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