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- Research Notes -

Selecting a Drip Irrigation System for Vineyards

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The purpose of this "Irrigation Note" is to provide a basis for thought when considering the purchase of a drip irrigation system for vineyards. It is not designed to provide a technical evaluation of drip systems, but rather a framework from which to ask informed questions.

The decision to install a drip irrigation system can cause concern, especially for the first time purchaser. There are many questions that should be asked before making the purchase decision. Among the more critical field questions are those concerning water source or sources, topography, filtration and level of control. Additionally, the type of services required from the dealer and product selection need to be considered.

Since water is the limiting factor for the majority of California's crops, this is probably the place to start. Will the source of irrigation water be from a well or a canal? Or a combination of both? The source of water will determine the level of filtration and type of water treatment required. It is recommended that a water sample be taken and analyzed by a qualified laboratory. If surface water is to be used, water samples should be taken several times during the year because water quality can and does change.

Sand media filtration has been the standard for many years. It is relatively simple to operate and easy to automate. A secondary screen filter is sometimes added for insurance against catastrophic failure of the sand media. A new challenger to sand media filtration is the disc type filter. Disc filters have shown satisfactory performance in the field. While they can require higher pressure for backwashing, they are more compact in high flow rate applications.

The introduction of fertilizers through the irrigation water transforms the drip systems into a growing system. You will want to consider multiple head injectors to apply basic fertilizers

to the vines. Substantial cost savings can be achieved through the bulk purchase of fertilizers vs. custom blends. Additionally, the ability to apply acids and nematicides through the irrigation water are important elements to your growing system.

Drip emitters come in two basic configurations: compensating and non-compensating. Compensating emitters provide nearly the same discharge rate over a wide range of operating pressures. Non-compensating emitters will have a change of discharge rate corresponding with a change of operating pressures. On the San Joaquin Valley floor, fields are relatively flat and a properly designed irrigation system will provide high water application uniformity using non-compensating emitters. While pressure compensating emitters will also provide good uniformity on flat ground, their application is most advantageous with changing topography or extended tubing length.

Drip emitters are also available in two distinct styles: online and inline. Online emitters are typically attached to the outside of the supply tubing in the field using a barbed fitting. Thus the emitter spacing can be random or repeating, depending on the desired outcome. Inline emitters are placed inside the tubing during the manufacturing process and are spaced at a predetermined interval. A typical irrigation design will use two 1/2 gph (2 liter) emitters per vine. A vine spacing of eight feet would require an emitter spacing of 4 feet (48 inches). A single grapevine in the San Joaquin Valley may require up- wards of 12 gallons of water per day at peak demand. The irrigation system would have to run for 12 hours daily to meet this demand (e.g., 1/2 gph emitter x 2 per vine x 12 hours = 12 gallons).

Most drip irrigation systems incorporate a wire hung approximately 16 to 24 inches above the ground to support the irrigation tubing along the entire length of the grape row. During system operation, water is applied between the vines from the drip emitters. While this system has proven effective, several caveats also must be considered.

First, above ground drip irrigation promotes weed growth and moisture directly under the vines. Weeds are more difficult to control here as opposed to the row centers. Preemergent herbicides are washed out during the growing season due to the large amount of water applied under the drip emitters. Most vines are grown on berms, and in tighter soils water runs off to form tire ruts in the rows. Finally, moisture is always problematic under the vine canopy, especially where the drip emitters are

placed.

Mechanized harvest equipment can also cause dam-age to drip emitters hung from the wire. These harvesters employ beaters and shakers which are apt to strike the emitters and tubing during harvest. Some growers are experimenting with placing the emitters higher in the canopy to avoid direct contact with the harvest equipment. The complete benefit of this approach has not been fully evaluated.

Setting these concerns aside, the use of above ground drip irrigation on grapevines has proven to be an effective method for producing grapes. Placing the emitters above ground allows for observation during operation and easy replacement of defective emitters.

A great deal of interest has been expressed in placing drip lines underground rather than the more conventional above ground placement. While this approach increases the management level of operation, it does promise additional benefits to the users.

To begin with, placing the emitters underground removes them from harvesting, pruning or coyote damage. When the emitters are placed 18 to 24 inches beneath the surface and directly in the row middle, weed growth is suppressed. Placing the emitters closer to the surface will allow moisture to reach the surface and support cover crop growth (see Photo 1).

Underground placement of the emitters is usually achieved by using a shank to pull the tubing in the ground. Inline emitters are the most common type placed underground. Assuming proper filtration, the major concern with underground installations is plugged emitters, either from root intrusion or soil ingestion (Photo 2).

Root intrusion must be controlled through some type of chemical barrier. The use of Trifluralin is the most common method for control. The chemical can be incorporated into the drip emitter during the manufacturing process, similar to plastic flea collars for dogs. This method is reported to provide protection for a minimum of 10 years.

A second method of application is through injection into the irrigation water. This should be done according to label instructions and is more effective in drier soils. Typically only a few ounces per acre are required, applied several times per year.

Soil ingestion occurs at system shutdown. As water drains in the system it can create a vacuum which can suck back soil particles from outside the emitter. Saturated soil particles can become lodged in the emitter discharge opening, thereby stopping or reducing flow during system operation. It is imperative that subsurface drip systems have proper air and vacuum relief installed to prevent catastrophic failure.

There are three general options growers follow when working with dealers. The first option is to have the irrigation design done outside the dealership by a consultant or engineer. A material list is developed and either put out to bid or supplied by the dealership. At this level the dealership only provides parts. The installation is contracted out or done by the grower.

The second option is the dealer providing the design and parts but not being responsible for the installation or operational training. There are several problems with the first two options. When a problem arises, who is responsible? For instance, if a main line fails, who is responsible for coming in and making the repairs? These types of failures occurring during

peak irrigation times require immediate repair to put the system back in operation. Critical time can be lost arguing over whether the failure was caused by poor design, improper installation or product failure. The best course of action from the grower's standpoint may be to immediately repair the problem and then determine who was at fault.

Additional concerns with the above options are the lack of any formalized training for system operation and maintenance. Since the grower has taken the lead position on the project, the dealership may not feel obligated to provide operational training for free.

The third option is what can be described as a "turn-key" full service contract. This a where the dealership takes responsibility for the design, installation and training of the system for the grower. This option is highly recommended for the first-time buyer of a drip irrigation system. The lines of responsibility are clear: when and if a system component fails, it is the dealer's responsibility to correct the problem. The grower doesn't have to be drawn into the discussion of who is at fault.

There are several methods growers generally use when selecting an irrigation system. The tried and true method is to have a system put in like my neighbor's. While the neighbor's system may be serving him or her well, it may or may not be the system for you. The drip system you select needs to reflect the management style and level of technology you wish to employ.

For instance, do I want to have a fully automated system? Will it shut down at system failure? Do I want the ability to interrogate the system remotely? How about an on-site weather station? How will I measure soil moisture? Who will do the irrigation scheduling – the grower, employee or consultant?

It is always better to put your time in up front, asking the right questions before committing to a specific irrigation system design. Visit your neighbors and ask if they are happy with their irrigation system. Were they happy with the dealer and have the products performed satisfactorily? Were problems taken care of in a professional manner? Was training provided on the operation of the system once it was installed?

If you currently don't have an irrigation dealer, you may want to meet with several dealers and discuss their approach to designing a drip irrigation system. Does the dealer have a technical staff that can troubleshoot problems in the field? Ask for references in your area of growers who have purchased similar systems. Contact those references.

If you end up getting bids from several dealers, be sure not to focus too hard on price. A few hundred or a thousand dollars can be the difference between getting what you really need and getting a system that marginally applies water to the field.

Aside from making sure that the filtration system, controls, and emitters are all comparable, there are two other key indicators of whether the systems you are considering are similar or not. These are the design tolerance of the system and the TDH required.

The design tolerance of the system is usually expressed as plus or minus 10, 7 or 5 percent. This refers to the pressure variation as measured at the base of the emitters in the field. This

is more critical with non-compensating emitters, where pressure variation directly affects emitter discharge rate. Typically, the smaller the design tolerance number (e.g., 5 vs. 7) the more expensive the system. You are probably paying for larger or more pipe in the field to save pressure.

The TDH value gives total dynamic head required. This is expressed as a horsepower requirement. If two systems were generally equal in cost, but one required a 40 horsepower motor and the other required a 50 horsepower motor, this could have significant cost implications on operational costs. Be sure to fully investigate why this is and calculate the difference in annual operating costs.

Should I use an electric motor or a diesel or natural gas engine to power my system? The electric industry has gone through a major deregulation in 1998. The promise of lower power rates is offered, but we will have to wait and see if it materializes. Electric motors may be the only reasonable choice for smaller horsepower pumping plants. However, for larger horsepower installation, a significant number of growers have chosen diesel or natural gas (where available) as a power source over electric. Your local irrigation dealer should be able to help you with the cost calculations. Obviously, electric motors will require less maintenance, but this can be offset by a higher operational cost.

We have discussed some of the dealer's and manufacturer's obligations concerning the successful operation of a drip irrigation system. The grower also has responsibilities. While operating the system the grower must be sure proper filtration is maintained through periodic inspection and backflushing. Chemical treatment of the system must be maintained, such as chlorinating when required so the system does not fail due to organic growth.

Technical answers to questions on specific product performance can be obtained from the manufacturer, dealers and organizations like the Center for Irrigation Technology (CIT), part of California State University, Fresno. CIT maintains an ongoing product testing and evaluation program. There are a multitude of manufacturers for each product used in an irrigation system. Determining which manufacturer's product is most appropriate to use in each case can require years of experience. Laboratory and field testing of products can provide baseline data to help make critical purchasing decisions.

Whether it's a filtration system or drip emitter, specifying the desired performance and selecting products that meet the performance criteria is essential in obtaining an efficient operating system. CIT's technical staff can help explain and clarify specific concerns. The Irrigation Association also has many resources available to the grower. The IA web site, located at www.irrigation.org, provides information about products and services. It also contains a listing of all certified irrigation designers and contractors. These individuals have demonstrated a level of competence based on years of field experience and/or education and by successfully completing examinations. They have also made a commitment to keep up with the industry by subscribing to the IA requirement of continuing educational units.

The IA also maintains a search engine that is one of the most powerful information tools available in the industry today (irrigate.com).

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