WHAT IT TAKES TO SET UP A "*SUCCESSFUL*" DRIP IRRIGATION SYSTEM

A well designed drip or trickle irrigation system is as important to the successful production of vegetable crops as the selection of variety, management of inputs, pest and disease control; it needs to be a part of your overall management plan for each crop. It should be designed in advance of the growing season with a well-planned implementation strategy.

There are many types of drip irrigation systems; row crop, orchard and vineyard, short-term and long-term subsurface, potted plant and greenhouse systems; but we are going to focus on row crop systems. The good news is that much of the information will apply to all types of systems.

The first questions that you need to address are:

- **What am I irrigating?**
- **What is my cropping practice going to be?**
- **What is my water source?**
- **What are the soil characteristics?**

These questions are necessary to determine what type of equipment you will need to install your system, what type of equipment your need to operate the system, and what type of materials and supplies will be best suited for your system.

What am I irrigating? Since we are going to focus our discussion on row crops, then the type of crop is going to determine row spacing and selection of the type of drip tubing or "tape" that is best. Row spacing is necessary to determine how many lineal feet of drip tape you need per acre which then translates into how much volume of water you need per acre. Product selection can also vary depending on your crop duration…a thinner tape can used for a quick crop and a heavier mil may be used if the crop is a longer duration.

What is my cropping practice going to be? Are you using plasticulture and laying the tape under the plastic, or burying the drip on bare ground? Other possibilities are double cropping on the same plastic and drip. In all cases, it is good idea to bury the tape a few inches under the surface so that it is separated from the plastic. How many acres are you trying to irrigate, and specifically how many acres of each crop and are the crops harvested in blocks or all at once?

What is my water supply? This question, to an irrigation designer, is one of the most important, since water availability and quality can make or break a system. More on this when we get into the details.

What are my soil characteristics? This is of extreme importance as it will determine emitter spacing and flow rates on your tape.

Example: You have a total of 15 acres of row crops on 6' spacing under plastic; 5 acres of tomatoes, 2 ½ acres of squash, 2 ½ acres of cucumbers, and 5 acres of pumpkins. An ideal design would be to have 6 – 2 ½ acre zones and using a 24 gallon per hour tape, the volume of water needed would be:

7260 lineal ft per acre (43,560 sq ft per acre divided by 6 ft row spacing) x 24 gallon per hour per 100 ft tape / 100 = 1742.4 gallons per hour per acre

1742.4 gallons per hour per acre / 60 minutes per hour = 29 gallons per minute per acre

29 gallons per minute per acre x 2 ½ acres = 72.5 gallons per minute

A system can be designed to deliver 72.5 gallons per minute with six zones. You need to make sure that you can deliver enough water to your crops in a 24-hour period during the peak of the season. If you want to get the irrigation done in 12 hours of the day, then you have 2 hours per zone per day to deliver all the water needs to that crop.

The Drip system can be divided into three distinct areas:

1. **The Mechanical System: Pump systems, Filtration, Chemical Treatment, Fertigation, Chemigation, and Controls**
2. **The Distribution System: Mainline Pipe, Sub main Pipe, Valves, Laterals, Air Vents and Backflow Protection,**
3. **The Application System: The tubing or emitters that apply the irrigation to the crop.**

The Mechanical System:

Pumping systems are determined by the water source and available utilities. If you are pumping from a well, an electric submersible is the best option. If the systems are high volume then a line shaft turbine pump is most efficient with either an electric motor or a right angle gear box driven by a diesel power unit. If your water source is a pond or stream, the pump would be centrifugal with either an electric motor or diesel engine drive. In either case, the pump needs to be sized to the system.

Filtration is the heart (really the kidney) of the system. If the water supply is a surface supply, then a media filter is the best option. A media filter uses sand to filter the organics out of the water. With the proper sand, a media filter can filter to 200 mesh, which is more than 10 times smaller than the pathways that the water is traveling through in the drip tape. Secondary filters are also helpful after the sub mains as a precaution. If you are using well or municipal water, a screen or disc filter are usually adequate, but again filtering to 200 mesh is a good idea. Pressure gauges should be placed before and after the filter to monitor the pressure differential through the filter. Remember, you are making a large investment in your crop, and the last thing you want is drip tape that delivers spotty results because it is plugged up.

Chemical Treatment may be necessary depending on the quality of your water. There are a variety of situations that mandate treatment. In surface water applications, algae in the water can clog the drip lines, even if it is treated with a sand filter. The algae can grow over time in the drip tape, and a chlorine treatment may be necessary to prevent algae growth. If the surface water is exposed to animal manure, then chlorine can prevent any spread of bacteria throughout the system. There are other water situations that may require treatment such as iron concentrations, salinity, sulfides, among others.

Fertigation and Chemigation equipment is a part of the system that adds great flexibility to your ability to manage the crop. There are a several methods of delivering fertilizer and chemicals to your system. The most sophisticated and accurate is a positive displacement pump or injection pump, which usually requires an electric motor. Other devices are a venturi type injector or a pressure differential tank. A venturi type uses a pressure differential to force water through a venturi injector which creates a vacuum to draw the fertilizer or chemical into the mainline. A pressure differential tank diverts water through a tank and forces a fixed amount of fertilizer or chemical into the mainline with no regard to the concentration.

Controls include at the least the valves that divide your system into zones, but could include an automatic control device with solenoid operated valves, as well as moisture monitoring devices.

The Distribution System:

Mainline Pipe and Sub main Pipe needs to be sized properly to deliver the volume of water to your zones with an acceptable pressure loss. Changes in elevation must be taken into account to be sure that you have adequate pressure at the beginning of your zones. Ideally, you should have 12 to 15 psi in the sub mains that are feeding your drip tape. Mainlines are often buried PVC pipe and sub mains are PVC layflat or polyethylene flat tube. Pressure gauges are one of the least expensive yet most important tools in managing your system. They should be placed at the pump and also on the sub mains.

Valves serve several functions in a drip system. Zone valves are used to isolate each zone from the mainline and can be manual or automatic (solenoid operated). Flow/pressure regulation valves are used in some instances when zone sizes vary and the pump can handle back pressure, or if water levels in the supply cause a fluctuation in pump pressures.

Laterals are the tubes that carry water to the emitters. In the case of row crop drip, the tape is actually the lateral.

Air Vents are important to evacuate air in the system as it is filling with water and should be installed at every high spot in the system as well as at the ends of the sub mains. They will also prevent a vacuum from drawing dirt back in the emitters when the system is shut down.

Backflow Protection is required to keep fertilizer and chemicals from going into the water supply.

The Application System:

The tubing or emitters that apply the irrigation to the crop as mentioned above are the lateral lines which are the drip tape. Drip tape comes in various thicknesses: 5, 6, 8, 10 mil; spacing: 4, 6, 8, 12 inch; flow rates: .17 to 1.00 gpm per 100ft; and diameters: .5/8, 3/4 and 7/8 inch. All the drip tapes available today are turbulent flow, in which water velocity is used to lower the pressure from the time the water enters the flow path to the time it leaves through the emitter. The purpose of this is to maintain uniformity down the length of the lateral so that the same amount of water is coming out of the first emitter as the last emitter. The objective in a good design is to produce a very uniformly irrigated crop.

In closing, a well-designed system can produce uniformities above 90%, but it does not end with the design. Your drip system needs to be managed throughout the season. First, make sure you are ready to irrigate before you plant, and in some cases irrigating before planting may be helpful if soil moisture is deficient. Closely monitor the crop needs and weather to determine your schedule, and do not get behind! Check pressures throughout the season to make sure the system is performing as it should and that there is no clogging. Maintain filter systems for peak performance and flush your lateral lines periodically. Remember, the details do make a difference!

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