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Design Tips For Drip Irrigation Of Vegetables[1]

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This publication provides a quick reference regarding important points which should be considered when planning a drip irrigation system for vegetable production. It lists factors which can improve water application uniformity which is necessary for high efficiency of water use. High water application efficiency is especially critical when chemicals are injected into the irrigation system since chemical application uniformity will also be low if water application uniformity is low.

- The following factors should be considered when designing a new drip irrigation system or converting from a sprinkler irrigation system to drip: • Length of lateral lines should not exceed the manufacturer's recommendations for the specific tape used. Excessive length of laterals will result in poor uniformity and uneven water application. The amount of water applied by the emitters in the last section of the lateral will be significantly reduced when compared with the amount of water applied by the emitters close to the lateral entrance. If the irrigation system uniformity is low, chemicals should not be applied though the system because the chemical application uniformity would also be low.

• • All delivery lines (mains and submains) should be sized to avoid excessive pressure losses and velocities. Excessive pressure losses result in a large difference in pressure at the beginning and at the end of the line. Since the flow rate of the emitters is usually a function of the pressure, the water application at the beginning of the line may be very different from the water application at the end of the line which results in poor application uniformity. Excessive water velocities in the lines, due to too small a diameter, can create a water hammer (pressure wave) which can damage the delivery lines.

• • Lateral lines should be laid following the contour lines of the land. This avoids pressure variations within the line due to elevation change. If significant changes in elevation along lateral lines cannot be avoided (rolling hills), tape with pressure compensating emitters may be needed.

• • The maximum size of the zones depends on the flow rate from the well. The water flow rate from an existing water pump limits the maximum size of the irrigation zone. This is especially important when converting from another type of irrigation system to drip

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irrigation. Flow rates should be measured when pumping against the pressure required to operate the irrigation system because the pumping rate will be reduced when pumping against pressure as compared to free discharge.

• • Zones should be approximately the same size. Variation in zone sizes will reduce the efficiency of pump operation. When all zones are of the same size, pipe sizes and system cost will normally be minimal.

• • Pressure regulators may be required if the pressure produced by the pump is too large or if zones vary greatly in size. If the pump was sized for a previously existing sprinkler system, it would likely operate at pressures which are excessive for components of a drip system. If the system consists of different size zones, the pump must deliver the amount of water required in the largest zone at the pressure required by the tape used for lateral lines. If some zones are significantly smaller, the pump will produce higher pressure at the smaller discharges required by these zones. This pressure must be reduced by pressure regulators to the pressure required by the drip tape used for the lateral lines.

• • Drip irrigation systems require filtration. Selection of filters depends on water source and water quality. Surface water normally requires sand media filters to trap organic materials such as algae, bacteria, and other organic debris. Screen or disk filters are usually sufficient for well water.

• • An irrigation system should include an injection port to allow for injection of chlorine or other chemicals which will normally be necessary. Many drip systems experience plugging problems which reduce water application uniformity. The degree of problems depends on water quality, type of emitters, and quality of water filtration. Under Florida conditions, injection of chemicals are almost always required to avoid emitter plugging.

• • The injector should be located as close as possible to the irrigation zone. When there are hundreds or thousands of feet of pipe between the injector and the zone, a large amount of water (necessary to pressurize the system at the beginning of the cycle) must be applied to the crop before the chemical can reach the zone. This can create problems with over-watering, especially for small zones. It is usually less of a problem in large, (greater than 25 acres) fields.

• • By state law, any irrigation system that will be injecting fertilizers or toxic chemicals is required to be equipped with proper backflow and anti-siphon equipment to prevent the chemicals from contaminating the water source.

• • Flowmeters and pressure gauges should be used to help manage the system. Sudden changes in water flow rates or pressures indicate system problems. These problems usually require immediate attention. For example, an increase in flow rate may be a sign of a broken pipeline, whereas, a gradual decrease may indicate plugging problems. Flowmeters are also a necessary tool for proper irrigation scheduling. It is important to know how much water is applied to each zone with every irrigation cycle. The duration of the cycle may not be sufficient, especially if the flow rate is gradually decreasing due to plugging of emitters.

• Pressure changes should also be monitored. An increase in pressure can be a signal of emitter plugging or some other blockage such as the failure of a valve or pressure regulator. A pressure drop may indicate a broken line, leaking valves, the failure of flush valves to close properly, or too many zone valves open at once.

• For more information on any point discussed in this publication select appropriate publications from the Reference section of this document.

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