SOME OBSERVATIONS ON DRIP IRRIGATION FOR CUT FLOWERS IN GREENHOUSES

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Some California growers have used drip irrigation for several years in cut-flower production. Some have been satisfied with the results; others have not. The purpose of this article is to make some observations on drip irrigation and to offer suggestions for correcting problems.

The term "drip irrigation" has come to include water application in distinct drops and in a small stream, such as out of a small opening or microtube (spaghetti tubing). A drip irrigation system places precise volumes of water on the soil close to the plant root zone. Water enters the soil immediately so that surface flooding does not occur.

Benefits

Benefits include savings in water and fertilizer applied, and increased yield.

Definite savings in the amount of water applied to crops under drip irrigation have been observed. In one study with carnations grown in raised benches, the amount of water applied to each bench from May to September was 7,424 gallons by surface spray and 5,010 gallons by the drip method. Savings in fertilizer also occur where it is injected into the irrigation water.

Improved yield of crops is difficult to quantify. Data obtained depended on the system and how it was operated. In one study on the use of drip irrigation on carnations growing in raised benches, the following index of flower production was recorded:

- Surface spray, tensiometer control — 100
- Drip, daily application — 109
- Drip, tensiometer control — 90 to 100, depending on system

When drip irrigation systems have been properly designed, maintained, and operated, yield has not been reduced. There are enough instances of increased yield to suggest this is quite likely to occur when a grower converts to drip irrigation.

Difficulties

Difficulties observed fall under four categories: uneven wetting of soil, with dry spots; clogging of the emitters; uneven distribution of water in the system; and salinity.

Uneven wetting of the soil and dry spots may be partially due to clogging of the emitter and uneven distribution of water throughout the system. These difficulties are discussed later.

Uneven wetting also is a function of the soil mixture. Soil mixtures vary in their ability to conduct water laterally; that is, they vary in how rapidly water flows by capillary movement. Most soils used for cut flowers have been highly amended with redwood sawdust and generally have poor capillary conductivity. Experiments with soil mixtures that have good to excellent capillary conductivity have shown that uneven wetting is not a problem with such soils.

Soil position also influences its moisture content. The sides of the bench dry out before the center. If capillary conductivity is poor, the sides never become wet. Between emitters the soil surface is dry; this is natural and does not harm crop production.

Uneven wetting with dry spots may be corrected by compounding a soil mixture that has excellent capillary conductivity of water.

Clogging of the emitters generally is attributable to (a) particles in the water, (b) deposition of salt and fertilizer crystals as water evaporates, and (c) algae and bacterial slime.

(a) Particles in the water must be removed by filtering, or the emitters will clog. Drip irrigation systems must be designed with suitable filters.

(b) Deposition of calcium carbonate and other salts from fertilizer can clog emitters. This occurs as water evaporates from the emitter between irrigations, leaving a residue of salt. Frequent, even daily, irrigations, the addition of acid to neutralize the calcium carbonate content of the water, and use of emitters designed to keep the water emission holes moist overcome this problem.

(c) Algae grow in the pipes, in the presence of nitrogen and light. Algae control is best accomplished by the addition of an algaecide to the irrigation water. Copper at the rate of about 1 ppm will keep algae from growing. Copper is essential for plant growth and at this rate of application will not injure plants.

Uneven distribution of water is caused by improper design and engineering of the system, as well as by clogging of the emitters. Plants under water stress have often been observed at the ends of benches. This has occurred because the emitter line was too long for its size (diameter). Looping (joining the ends of two long lines to form one continuous loop from the header) does not help. The solution is to use shorter lines. Uneven distribution also may occur on slopes when no steps are taken to compensate for differences in pressure. Each 1 foot difference in elevation means a 0.43 pound difference in water pressure. Therefore, pressure regulation valves or devices are needed.

Salinity can increase in the soil if water is not added in sufficient amounts to flush out the excess salts. Periodic leaching with water that does not contain fertilizers is suggested.

These observations suggest that drip irrigation can be used for cut flowers and that the difficulties can be solved. Drip irrigation does require that the grower pay close attention to details such as proper system design, filter maintenance, and operating pressures. Drip irrigation also requires special attention to the amount of water needed each day (evapotranspiration) and the fertilizer needed each day.