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Design and Installation of Microirrigation Systems



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Design and Installation of Microirrigation Systems

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1 Purpose and Scope

1.1 The purpose of this Engineering Practice is to establish minimum recommendations for the design, installation and performance of microirrigation systems: including trickle, drip, subsurface, bubbler and spray irrigation systems. This Engineering Practice should encourage sound system design and operation and enhance communication among involved personnel.

1.2 Provisions of this Engineering Practice are primarily those that affect the adequacy and uniformity of water application, filtration requirements, water treatment, and water amendments.

2 Definitions

2.1 chemical water treatment: Chemical treatment of the water to make it acceptable for use in microirrigation systems. This may include acids, fungicides and bactericides used to prevent emitter clogging or used for pH adjustment.

2.2 control station: The control station may include facilities for water measurement, filtration, treatment, addition of amendments, flow and pressure control, timing of application and backflow prevention.

2.3 crop area: The field surface area allocated to each plant. In tree crops the tree crop area is the spacing multiplied by the row spacing.

2.4 design area: The specific land area which is to be irrigated by the microirrigation system.

2.5 design emission uniformity: An estimate of the uniformity of emitter discharge rates throughout the system, as described by the equation in paragraph 3.5.2.

2.6 emitters: The devices used to control the discharge from the lateral lines at discrete or continuous points.

2.6.1 emission point: Point where the water is discharged from an emitter.

2.6.2 line-source emitters: Water is discharged from closely spaced perforations, emitters or a porous wall along the lateral line.

2.6.3 point-source emitters: Water is discharged from emission points that are individually and relatively widely spaced, usually over 1 m (3.3 ft). Multiple-outlet emitters discharge water at two or more emission points.

2.7 emitter discharge rate: The discharge rate at a given operating pressure from an individual point-source emitter expressed as a volume per unit time or from a unit length of line-source emitter expressed as a volume per unit length per unit time.

2.8 emitter operating pressure: The average operating pressure of the emitters within any simultaneously operated portion of the system.

2.9 evapotranspiration: The combined effects of evaporation from the soil and plant surfaces and transpiration from plants. Peak evapotranspiration is the maximum rate of daily evapotranspiration.

2.10 filtration system: The assembly of independently controlled physical components used to remove suspended solids from irrigation water. This may include both pressure and gravity-type devices and such specific units as settling basins or reservoirs, screens, media beds and centrifugal force units.

2.11 lateral: The water delivery pipeline that supplies water to the emitters from the manifold pipelines.

2.12 main and submain: The water delivery pipelines that supply water from the control station to the manifolds.

2.13 manifold: The water delivery pipeline that supplies water from the submain or main to the laterals.

2.14 manufacturer's coefficient of variation (C_v): This is a measure of the variability of discharge of a random sample of a given make, model and size of emitter, as produced by the manufacturer and before any field operation or aging has taken place.

$$C_v = \frac{s}{\bar{x}}$$

where:

$\bar{x}$ = the mean discharge of emitters in the sample

s = the standard deviation of the discharge of the emitters in the sample

$$s = \left[\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1} \right]^{1/2}$$

where:

x_i = the discharge of an emitter

n = the number of emitters in the sample

If a line-source emitter is used, the individual discharges from holes on a one-meter or other specified length of emitter tape are used. This term can also be used to describe the variability in the downstream pressure from pressure control valves or the variability in discharge from flow control valves or orifices.

2.15 microirrigation: The frequent application of small quantities of water on or below the soil surface as drops, tiny streams or miniature spray through emitters or applicators placed along a water delivery line. Microirrigation encompasses a number of methods or concepts; such as bubbler, drip, trickle, mist or spray and subsurface irrigation.

2.15.1 bubbler irrigation: The application of water to the soil surface as a small stream or fountain, where the discharge rates for point-source bubbler emitters are greater than for drip or subsurface emitters but generally less than 225 L/h (60 gal/h). Because the emitter discharge rate normally exceeds the infiltration rate of the soil, a small basin is usually required to contain or control the water.

2.15.2 drip and trickle irrigation: The application of water to the soil surface as drops or tiny streams through emitters. Often the terms drip and trickle irrigation are considered synonymous. For trickle and drip