Irrigation Scheduling for Small Fruit Crops

Research Proposal - 2005
Small Fruit Consortium

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Objective: Develop crop coefficients and an internet-based irrigation scheduling tool for small fruits grown in the southeast.

Justification: The water usage and crop coefficients of small fruit crops are poorly described in the literature, but essential for proper irrigation scheduling. Weather networks throughout Georgia and adjacent states provide much of the climatic data necessary for irrigation scheduling, but research is needed to quantify water use as a function of weather.

Methodology: Lysimetry is the simplest, most common means of quantifying plant water use in the field. Lysimeters are typically large, buried containers in which a crop is planted and grown for 1 to several years. The container sits with its top flush with the ground on a high-capacity scale that records weight automatically. The weight change in a given day is almost entirely attributable to water gain/loss, as dry matter gain is 500-1000 times lower in magnitude in crop plants. While such lysimeters are valuable research tools, they must be committed to a single crop for several years before useful data are obtained.

An alternative approach to traditional lysimetry was taken during 2004. An above ground lysimeter facility was developed at the Horticulture Research Farm in Watkinsville, GA, consisting of a specially constructed berm running east-west along the south side of a row of plants in large, square containers. The berm shields the south face of the containers from the sun, thereby avoiding abnormally high root zone temperatures. Plants are arranged side by side so the east and west faces are shielded from the sun, thus, only the north face of the container is exposed. Soil temperature at a 4" depth in the containers was within a few degrees of the 4" soil temperature at the farm. Containers were built on pallets to allow forklift access, and individual plants were moved to a digital scale for weighing at 24 hour intervals. This permitted collection of daily water use data from several different crops using only one expensive high-capacity scale. A “blank” container (no plant) was included to determine the amount of evaporation occurring from the container walls and base, which is subtracted out of the plant water use measurements. The digital scale is accurate to ½ lb, and has a capacity of 2000 lbs. The containers have a capacity of 124 gallons, large enough to accommodate full-grown blackberries, blueberries, and grapes.

Results: The main results obtained during 2004 are listed below. Blackberries exhibited the most vigorous growth, and used up to 1 gallon of water per day, averaging about 0.6 gal/day at mid season. At field spacings of 3 x 12', this level of water use corresponds to a crop coefficient (Kc) of 0.03 to 0.21. For other species, water use was less, averaging only about 1/3 of a gallon per day when PET was as high as 0.2 to 0.25 inches/day. Kc values for other species were therefore extremely low as well.

The irrigation scheduling web site for peaches has been modified and will serve as the template for a site for small fruits (see www.griffin.uga.edu/aemn/peaches)

Crop coefficients and water use of one-year-old small fruit plants obtained during 2004

Crop	Early		Mid		Late	
	Kc	gal/day	Kc	gal/day	Kc	gal/day
Blackberry	.01 - .08	0.0 - 0.2	.03 - .21	0.2-1.1	.07-.12	0.3-0.6
Blueberry	.01-.04	0.0 - 0.4	.01-.04	0.1-0.4	.01-.04	0.1-0.4
Muscadine grape	.01-.02	0.0 - 0.1	.01 - .02	0.1-0.6	.01	0.1-0.4
Wine grape	0.01	0.0 - 0.1	.01	0.1-0.2	---	---

Conclusions: First year data suggest extremely low water use and crop coefficients for young grapes, blueberries, and blackberries, such that drip irrigation applied weekly for just a few hours would likely satisfy crop water requirements. In subsequent years, data for 2-year-old and older plants will be collected, and Kc values will be determined using the same procedure.

Impact statement: The research proposed will generate the data and implementation methodology for accurate irrigation scheduling for small fruits in the southeastern USA. Similar systems based on PET and crop coefficient have been successful in California (CIMIS) and Washington state (PAWS). Precise water management is an integral component of sustainable crop production. Reductions in over-watering crops may be expected based on preliminary data. This has the potential to reduce chemical leaching and runoff, and reduce costs of irrigation.

Citations: No publications during 2004