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DEFICIT IRRIGATION STRATEGIES FOR PROCESSING TOMATOES

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A variety of research projects on tomato irrigation conducted over the past 20 years can provide guidance to processing tomato growers looking for ways to stretch water resources. Here is a brief discussion of some important points:

1) What constitutes full irrigation? The consumptive use of processing tomatoes (the total amount of water transpired by the crop or evaporated from the soil) typically runs between 24-28 inches. Daily water use is driven by environmental factors [accurately represented by reference evapotranspiration (ET_o) values available for many Central Valley locations], and the degree of ground cover by crop foliage (heating by sunlight interception is a primary driving force for plant transpiration). Fig. 1 shows the typical pattern of crop evapotranspiration (ET_c) for a drip-irrigated processing tomato crop on which no water stress is imposed. The major difference with non-drip irrigated fields is that in the early season (before there is substantial foliage cover) sprinkler or furrow irrigation will increase evaporation from the wetted soil surface. By midseason crop water use can be slightly higher than ET_o, but as the crop matures water use tends to decline.

2) Imposing deficit irrigation: A tomato crop is most sensitive to water stress during fruit set, and attempting to save water by reducing irrigation during fruit set is strongly discouraged. Even moderate levels of soil moisture deficit during fruit set can substantially reduce that set, and induce blossom end rot. However, once fruit set is complete (roughly the time that the earliest fruits are reaching the mature green stage, typically 5-6 weeks preharvest), a substantial level of moisture stress can be imposed with minimal loss of productivity. Fresh fruit yield may decline a few tons per acre, but an increase in soluble solids concentration usually results in little or no decline in brix yield.

The degree of deficit irrigation possible without loss of brix yield depends on a number of factors, primarily soil water holding capacity and the presence or absence of a shallow water table. As is clear from Fig. 1, the average crop water use during the fruit ripening period in a fully watered field is approximately 80-90% of ET_o. Most fields can tolerate irrigation of only 40-60% of ET_o during this period with minimal problems; fields with high water holding capacity and good rooting depth may be able to deal with as little as 25% of ET_o over the final 6 weeks.

The ability to precisely control irrigation during the fruit ripening depends on the irrigation system used. For drip fields, controlling deficit irrigation is easy; simply reduce the hours of run to deliver the desired % of ET_o. Within the last 10-14 days before scheduled harvest drip irrigation can be terminated in most fields without severe stress. During deficit irrigation root intrusion in buried drip systems can be a problem, so be vigilant. If harvest is delayed, small irrigations can be made to keep the vines up.

With furrow irrigation it is more difficult to precisely control irrigation volume, and consequently the primary tool for late season water management has been manipulating the irrigation cutoff date, thereby saving one or more irrigations. Extensive trials in clay loam soils in Fresno County have shown that cutting off furrow irrigation as much as 40 days preharvest will have minimal effect on brix yield (although, as previously stated, fruit yield may suffer a small decline). Even on these forgiving soils, however, earlier cutoff can lead to substantial yield loss. In fields with soil of lower water holding capacity even 40 days preharvest can be too severe a treatment. Using an early cutoff strategy can be risky, particularly if harvest is substantially delayed.

3) Using a groundwater table: In fields with a water table within 2-3 feet of the surface, deficit irrigation can result in the crop drawing as much as several inches of water from the water table, allowing for a more severe irrigation cutback or earlier cutoff than would otherwise be appropriate for the field. If the water table is non-saline, late-season deficit irrigation poses little risk of serious yield decline. However, if the water table is saline, a much larger yield loss is possible with an aggressive irrigation cutback; also, deficit irrigation at the end of the season will leave the root zone with high EC, thereby increasing next year's water requirement.

4) Use of poor quality irrigation water: San Joaquin groundwater can be poor quality, making its use problematic for some crops. However, after the crop has been established, tomatoes are quite tolerant of high salinity irrigation water. Research at the UC Westside Center showed that, once flowering had begun, irrigating with drainage water of 8.0 EC did not affect fruit yield. The limited supply of high quality water can be used on other, less tolerant crops. Similarly, tomatoes are more tolerant of boron than most other common Central Valley horticultural crops, with water B concentration up to several parts per million causing little loss of productivity.

The bottom line is that irrigation reduction strategies for processing tomatoes should focus on water management during the fruit ripening period; any attempt to reduce irrigation earlier in crop development is likely to result in significant reduction in yield and/or fruit quality. Growers can take advantage of the relative salinity and boron tolerance of tomato by substituting lower quality groundwater, saving higher quality water for more sensitive crops.

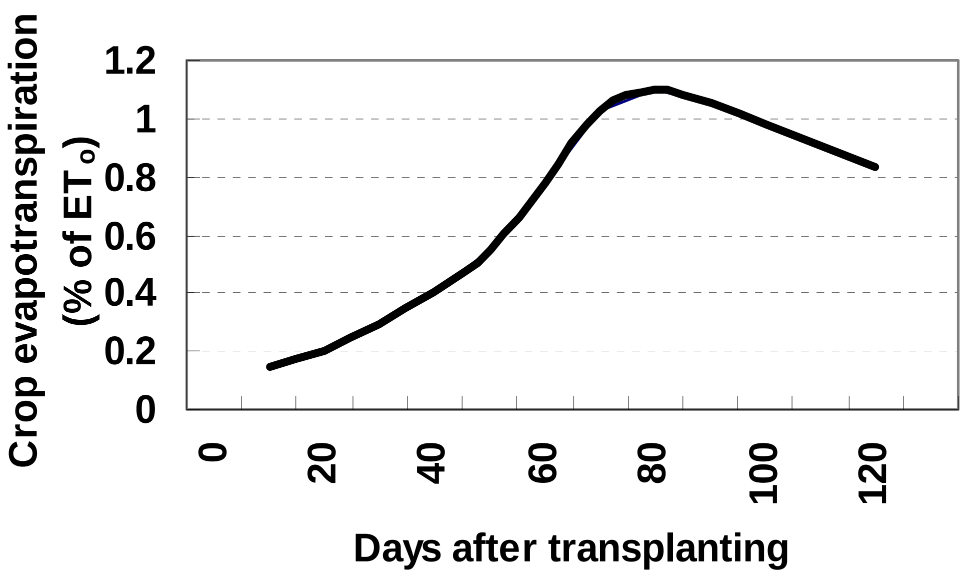

Fig. 1. Crop evapotranspiration of a drip-irrigated tomato field as a percentage of reference evapotranspiration (ET_o).

[**Click here to link to UCCE Vegetable Crop website.**]