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Development of deficit irrigation scheduling strategies for ‘Prime Giant’ sweet cherry

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Precision regulated deficit irrigation scheduling is useful for improving water productivity and ensuring crop production sustainability. This form of water management requires continuous monitoring in order to know soil and/or plant water status at all times. Water status sensors are key tools for modulating irrigation water amounts. The objective of this work was to study the physiological and agronomic response of cherry trees to different irrigation treatments based on crop evapotranspiration (ETc). However, the final purpose was to establish threshold values of water stress indicators, which can be considered of practical applicability in automatic irrigation scheduling.

The experiment was carried out in 2015 in a 0.5 ha commercial plot of ‘Prime Giant’ cherry [Prunus avium (L.)] in SE Spain. Three treatments were studied i) T110, irrigated above the maximum crop water requirements (110% of ETc), ii) T85, sustained deficit irrigation, irrigated to satisfy 85% of ETc, throughout the growing season, and iii) T100-55, regulated deficit irrigation with different water deficit levels: 100% and 55% of ETc during pre- and postharvest, respectively. Each treatment was randomly distributed in blocks and run in triplicate. Soil and plant water status were assessed from the soil matric potential and volumetric water content (Ym and Ov), midday stem and fruit water potential (Ys and Yf), maximum daily trunk shrinkage (MDS), daily trunk growth rate (TGR), stomatal conductance (gs), photosynthesis (Pn) and transpiration rates (E). Vegetative growth, yield and the quality of the fruit were also evaluated. Ys and MDS signal intensity were used as the main indicators of water stress.

The water applied during the 2015 growing season was 7190, 5425 and 4225 m3 ha-1 for T110, T85 and T100-55, respectively. The mean values of Ys during pre- and postharvest were -0.51, -0.57, -0.54 and -0.65, -0.77 and -0.97 MPa in T110, T85 and T100-55, respectively, while Yf was -1.20, -1.36, -1.27 MPa, during the preharvest period, respectively. The deficit irrigation strategies tested, T85 and T100-55, corresponded to equivalent signal intensities of Ys, 1.1 and 1.05, and of MDS 1.40 and 1.25, respectively, which would denote that the treatment irrigated to satisfy 100% of ETc during preharvest (T100-55) was slightly stressed. Our results show that the water regime applied generated statistically significance differences between treatments both in plant (Ys, Yf, MDS, TGR, gs, Pn, E) and soil (Ym, Ov) water relations. There were no differences in vegetative growth, trunk cross-sectional area or summer pruning values. The irrigation strategies followed did not cause any difference in total production (16.1 t ha-1). Moreover, fruit quality at harvest did not differ between treatments, except for the solid soluble content and unitary cherry weight, when significant differences were obtained. The results confirm the usefulness of support deficit irrigation scheduling in sweet cherry trees. However, these good results need to be followed up in subsequent growing seasons.

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