

## **New definition of Regulated Deficit Irrigation phases in pistachio: more sustainable, more efficient**

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Regulated Deficit Irrigation (RDI) is an irrigation methodology in which a water stress is imposed by irrigation withholding in function of fruit growth phases. The objective of this method is to find phases where water stress has no effect on yield or only a slight effect. RDI in pistachio has been demonstrated as an efficient tool to save water without negative effect on yield, or even the contrary, a slight water stress has produced pistachios more appreciated by consumers opposite to well irrigated. Phases of fruit growth are widely defined as: Phase I, from leaf out to full shell expansion; Phase II, from full shell expansion to the onset of rapid kernel growth; Phase III, from rapid growth to harvest. Water stress applied in Phase II does not affect yield. Traditionally Phase II had been considered interchangeable with shell hardening; however, recent studies have showed that shell hardening extends for two weeks from the beginning of the kernel growth. In this assay, conducted in Ciudad Real (Spain) in 2015 and 2016, different irrigation treatments were applied on a pistachio crop in order to check if shell hardening can be considered as phase II instead the previous definition. The T1 treatment consisted of water stress during the shell hardening, always trying to maintain a stem water potential (SWP) of -1.5 MPa during this phase. The T2 treatment was severely water stressed, in this case trying to maintain -2 MPa during the phase II, as previous definition. In the rest of the season, both treatments were irrigated in order to have no water stress. Additionally, a control treatment (T0), irrigated following FAO methodology, was established to evaluate the loss of yield. Water irrigation applied in T0 was 596 and 505 mm in 2015 and 2016, respectively. In T1, 317 and 245 mm were applied, respectively, which means an average water save about 270 mm year<sup>-1</sup>. In T2, water irrigation was 396 and 272 mm, respectively, higher amounts than in T1, which an average water save of 217 mm year<sup>-1</sup>. In relation to the minimum SWP measured in the different treatments in 2015 and 2016, T0 reached -1.53 and -1.39 MPa, T1 -1.89 and -1.82 MPa, and T2 -2.26 and -2.21 MPa, respectively. There were not significant differences among yield treatments, neither when considering each year independently or over the entire period of study. In this sense, cumulative yields from the two years were 61, 57 and 68 kg tree<sup>-1</sup> in T0, T1 and T2 respectively. Therefore, a new definition of Phase II allows the same yield with a higher water save than when applying an intense water stress during the previous definition.