

# Comparative Study of smart irrigation control in greenhouses

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With greenhouses it is possible to increase crop production and reduce significantly the water use. Additionally advancements in electronics and shortage of water have led to the development of "smart" or adaptive irrigation controllers that adjust the water application depth to plant needs, and thus increase water savings. The two most common types are soil moisture based and evapotranspiration based systems. In the first type, one or more sensors monitor the evolution of the soil water content, and trigger irrigation when a pre-defined soil moisture deficit is achieved, or a certain water tension is reached in the soil. The climate based systems usually measure one or more weather parameters and based on these establish the The objective of this work is to compare the performance of these two smart irrigation technologies for producing lettuce in greenhouses in southern Iberia. In the soil moisture methodology, Echo 5 sensors made by Decagon devices were used to monitor soil moisture content. The irrigation was set to start at three different soil moisture content, corresponding to a depletion of 10, 20 and 30% of soil moisture content at 10 cm depth.

For the evapotranspiration based method, the Hargreaves Samani reduced-set evapotranspiration estimates were used to control irrigation. A purpose built microcontroller was developed that calculates daily ETo values based on maximum and minimum temperature, and then makes daily water applications to compensate the exact amount of water lost to the Atmosphere. For this research specific The results indicate that the Eto based methodology is easier to use, and can provide excellent water use efficiency as long as it is previously calibrated. Smart irrigation based on soil moisture proved greater overall water use efficiency, although greater care needs to be taken in managing the system and ensuring a uniform water application near the sensor.

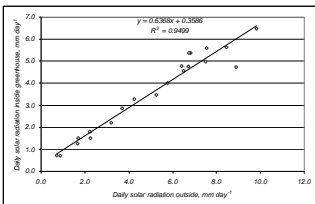


Figure 1. Daily solar radiation inside and outside the greenhouse

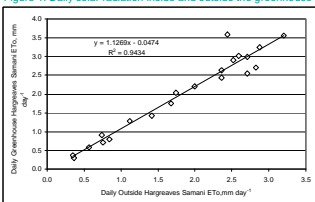


Figure 2. Daily ETo inside and outside the greenhouse

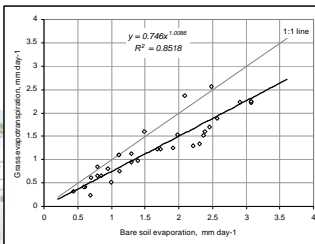


Figure 3. Correlation between Grass ETo and bare soil evaporation

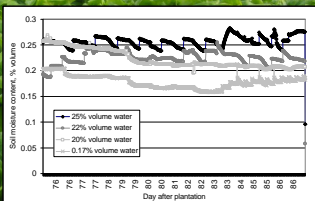


Figure 4. Evolution of soil moisture content when irrigation was managed based on four different soil moisture contents