



Frost effects in fruit production at Murcia (Spain) as result of climate change

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Fruit establishment and development can be studied like an investment of time, work and resources that always involve a risk. Climate is often the most critical element determining the sustainability of agricultural systems and it constitutes by multiple factors. One of them are freezing temperatures, which restrict the length of the growing season and are responsible for reductions in yield and quality of many fruit crops. Temperatures of the Spanish region of Murcia, mainly minimum temperatures, were studied in relation to the number of frost days in March of 2004 and their impact on fruit production. From the analysis of series of temperatures since 1935, it has been observed that the lowest absolute minimum temperatures (T_{min}) reached at frost days this year, from $-0,5\text{ }^{\circ}\text{C}$ to $-4,0\text{ }^{\circ}\text{C}$, were statistically similar to the temperatures obtained in 1993. However, analysing the historical series, it can be observed that the average minimum temperatures have increased (t_{min}). The t_{min} reached until 1985 oscillated between $4,0$ and $-2,0\text{ }^{\circ}\text{C}$, depending on the different areas of the region, and during the last years these limits of t_{min} changed between $7,0$ and $0,5\text{ }^{\circ}\text{C}$. A first conclusion arrives at this point, these increasing temperatures increase the thermal time and the fruit trees develop faster. On the other hand, the frequencies of the minimum temperatures of March reached in each of the eighteen studied thermometric stations were of the order of 10% of the years, obtaining lower values. Once that these temperature changes has been observed, a major question about potential climate changes is how extreme events might vary. These increasing temperatures, that drive the fruit tree to a more sensitive phenological stage, could explain the exceptional perception of fruit producers on frost damage by the lowest reached temperature, as well as, the

increasing risk of it in fruit production.