

Spatiotemporal modelling of the quality and ripening of two cultivars of “Algarve Citrus” orchards at different edaphoclimatic conditions

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Abstract

“Algarve Citrus” are non-climacteric Protected Geographical Indication (PGI) commodities. They are harvested with minimal levels of juice content ($\geq 35\%$), soluble solids content (SSC) ($\geq 10\%$) and maturation index (MI) (≥ 8), as required by the respective PGI normative reference. These internal quality attributes (IQA) are usually determined in small samples of fruit collected from the orchards close to harvest. This study aimed to use geostatistics to help predict the optimal harvest date (OHD) of two sweet orange (*Citrus sinensis* (L.) Osbeck) cultivars, namely, ‘Newhall’, and ‘Valencia Late’, at two different edaphoclimatic conditions observed in the locations of Quarteira, at the coast, and Paderne, near a mountainous area. Two orchards of 0.5-0.7 ha per cultivar were chosen and a total of 25 trees were georeferenced within each orchard, comprising 100 sampling points/trees. Firmness, juice content, SSC and MI of fruit were determined through time. In general, the fruit grown in Quarteira showed higher SSC and MI and lower firmness values, ripening two months earlier than those grown in Paderne, although the full effect of the various edaphoclimatic factors on these results are not fully understood. However, geospatial modelling of ripening has shown a large variability within the orchards, with some IQA evolution patterns observed in some orchards and/or cultivars but not in the others. Specifically, 1) a negative correlation between the firmness and MI spatial patterns; 2) a variable decay rate of firmness, much faster in Paderne for ‘Valencia Late’; 3) local minima in juice content, below 35 %, observed in restricted spatial areas and in specific time periods, and which were clearer in ‘Newhall’. These local variations highlight the need for an optimized management based on geospatial modelling.

For example, the variable decay rate of firmness must be taken into account during fruit harvest and postharvest handling. On the other side, the observation of localized plots with juice content below 35 % must be contextualized in the broader picture of the entire orchard which, in the present study, always had consistent temporal average level above 35 %. This study has provided evidence that fruit ripening variability should be considered in the site-specific orchard management of citrus to optimize their harvest date.