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Relationship between remote sensing, agronomic and quality traits of pistachio

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Pistachios are an important crop due to their extension throughout the Mediterranean basin. They have a high energy content with sensory characteristics that are very appreciated by consumers, which is why they are widely used in the food industry. At the same time, it has a high nutritional value due to its high protein, mineral, and fatty acid content. However, its commercial production is impacted by many factors that can affect production. Moreover, climate change can potentially reduce yield and quality. Therefore, tools such as remote sensing can help in monitoring pistachio orchards.

This study aimed to assess the efficiency of a set of vegetation indices acquired by multispectral aerial imaging for non-destructive determination of nut yield and quality under different irrigation treatments. To that end, experiments were performed in two orchards in the region of Castile and León (Spain) planted with cv. Kerman pistachio trees, in which two different irrigation treatments were applied. A Micasense ALTUM sensor mounted on a UAV was employed to collect multispectral imagery in two flights. Then, several Vegetation Indices (VIs) were generated, and Pearson correlations were calculated between VIs and agronomic and quality parameters.

Results show that all VIs are strongly correlated with agronomic parameters such as yield and cluster number and, in addition, NDRE (Normalized Difference Red Edge) and CWSI (Crop Water Stress Index) are well correlated with quality parameters. Furthermore, the VIs correlated stronger i) with the yield at the grain formation phenological stage and ii) with the quality of the nuts when the ripening was closest. The experiment is very interesting because it suggests that there is a close relationship between multispectral and thermal images and agronomic parameters of pistachio. However, further investigation is needed to fully understand the relationship with quality parameters, as it appears to be more complex.