

Article

## Intercomparison of UAV, Aircraft and Satellite Remote Sensing Platforms for Precision Viticulture

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**Abstract:** Precision Viticulture is experiencing substantial growth thanks to the availability of improved and cost-effective instruments and methodologies for data acquisition and analysis, such as Unmanned Aerial Vehicles (UAV), that demonstrated to compete with traditional acquisition platforms, such as satellite and aircraft, due to low operational costs, high operational flexibility and high spatial resolution of imagery. In order to optimize the use of these technologies for precision viticulture, their technical, scientific and economic performances need to be assessed. The aim of this work is to compare NDVI surveys performed with UAV, aircraft and satellite, to assess the capability of each platform to represent the intra-vineyard vegetation spatial variability. NDVI images of two Italian vineyards were acquired simultaneously from different multi-spectral sensors onboard the three platforms, and a spatial statistical framework was used to assess their degree of similarity. Moreover, the pros and cons of each technique were also assessed performing a cost analysis as a function of the scale of application. Results indicate that the different platforms provide comparable results in vineyards characterized by coarse vegetation

gradients and large vegetation clusters. On the contrary, in more heterogeneous vineyards, low-resolution images fail in representing part of the intra-vineyard variability. The cost analysis showed that the adoption of UAV platform is advantageous for small areas and that a break-even point exists above five hectares; above such threshold, airborne and then satellite have lower imagery cost.

**Keywords:** precision agriculture; Unmanned Aerial Vehicle (UAV); remote sensing