CHARACTERIZATION OF VINE PERFORMANCE USING REMOTE SENSING TOOLS

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Today, a variety of remote sensing tools are used to characterise plant performance. However, the vine is rarely studied, as a major crop specificity is canopy discontinuity. Registered images of the vineyard are anisotropic, therefore difficult to analyse.
All current plant performance evaluation technologies pick up and record the energy of emitted or reflected electromagnetic radiation, and analyse information for later interpretation. Most importantly, they allow the expression of information in terms of spacial location. Application of these technologies in the vineyard differ considerably according to the tools used.
The different radiations recorded provide a wide range of information. The spectral behaviour of plant reflectance in the visible field (380 to 700 nm) is linked only to pigment composition. In this field, plants produce a low reflectance (around 15%) with a peak of 550 nm, mainly due to chlorophyll a and b pigments.
These pigments do not interfere with spectral response in the near-infrared field (750 to 1300 nm). The internal structure of leaf cells induces variations of the reflectance value. Estimating the health of the vine plant can be carried out utilising the near-infrared reflectance value. It is therefore possible to define different leaf indicators such as the Normalized Difference Vegetation Index (NDVI).
Thermal infrared radiation values indicate the energetic and hydrous status of the plant. Measures of thermal infrared radiation can be taken on the ground, close to the plant, by means of a thermal infrared gun or by airborne shooting. From these, it is then possible to construct a water stress index.
These data can then be exploited to analyse vineyard intraparcel heterogeneity. Data require the use of high resolution remote sensing tools (pixel representing a ground distance inferior to 20 cm).
Hyper-spectral bands, already used in cereal fields could reveal a spectral signature of diseases such as esca or eutypa before leaf symptoms are visible.
Whatever the captor, information quality depends on picture resolution. Today, the main difficulty in working on the vine comes from the anisotropic aspect of photographs. Above all, the researcher must be able to automatically distinguish vine rows. This is possible for vines growing on flat ground without grass but difficult for sloping vineyards with inter-row grass. The main risk lies in uniformly interpreting pixel values from different sources such as ground, grass or vine.
Different vehicles such as aeroplanes, satellites, helicopters and, of course, the vine grower’s tractor can be used, although not all captors can adapt to these different vehicles. In term of development, each captor/vehicle combination must be considered. Later, analysed and geo-referenced pictures will have to be integrated in the tractor onboard computer equipped with GPS. This is the way forward to allow tomorrow’s vine growers to apply real precision viticulture.