

Smartphone: The winegrowers' Swiss army knife

>>> Mobile applications have found their rightful place in the working world. It is of course equally the case in the winegrowing sector! Whether it be to help the winegrower identify weeds, to estimate the porosity of foliage or share their observations, these applications represent a real tool in their daily life. <<<

Today, the smartphone that we all carry around is an indispensable element in our daily life. Surprisingly, winegrowers are better equipped than are traditional farmers since, according to the Vitinautes 2019 study undertaken in France by HyltelDatagri for Vitisphere, 85 % of winegrowers possess a smartphone, which is 16 % more than other farmers.

Today, there exist around fifteen sensors such as, amongst the most common, the camera, the microphone and the GNSS antennae. The most advanced models that are adapted to field professionals, due to their sturdiness, even become veritable toolboxes: thermometer, hygrometer, rangefinder, sensors of volatile organic compounds, thermal cameras are integrated into the latest models of the Caterpillar brand (CAT S 61) and Blackview (Bv 9900 Pro).

■ Smartphones have become genuine decision-making tools

Thanks to several free, downloadable applications via different platforms such as Google Play or Apple Store, smartphones have become veritable decision-making tools. The simplest viticultural applications allow the user to visualize data in applications that are, for example, linked to weather stations or to vine-located sensors. Others permit the user to input data so as to directly integrate it into the traceability software.

These applications play a crucial role when capable of assisting the winegrower in their daily decisions.

Thus, to facilitate grassing-growing management, the winegrower can rely upon the applications *DicotID* and *PlantNet*, that can help establish flower readings between the rows by identifying weeds, and in the *Canopeo* application that evaluates the quantity of vegetative cover. For the recognition of disease and insect pests, winegrowers may use *Diagnoplant vigne* that provides access to a knowledge base made up of information sheets relating to the biology of pests and diseases involved in the malady or the *Natutec Scout* application, awarded at the Sival 2020 exhibition, that permits the counting and identification of insects captured in chromatic traps.

Several services may equally be proposed from a photograph. It is the case for *xarvio Scouting* that, thanks to the image analysis, permits the user to identify the plants, the insects and the diseases but also to estimate the leaf damage and to evaluate the nitrogen absorption rate.

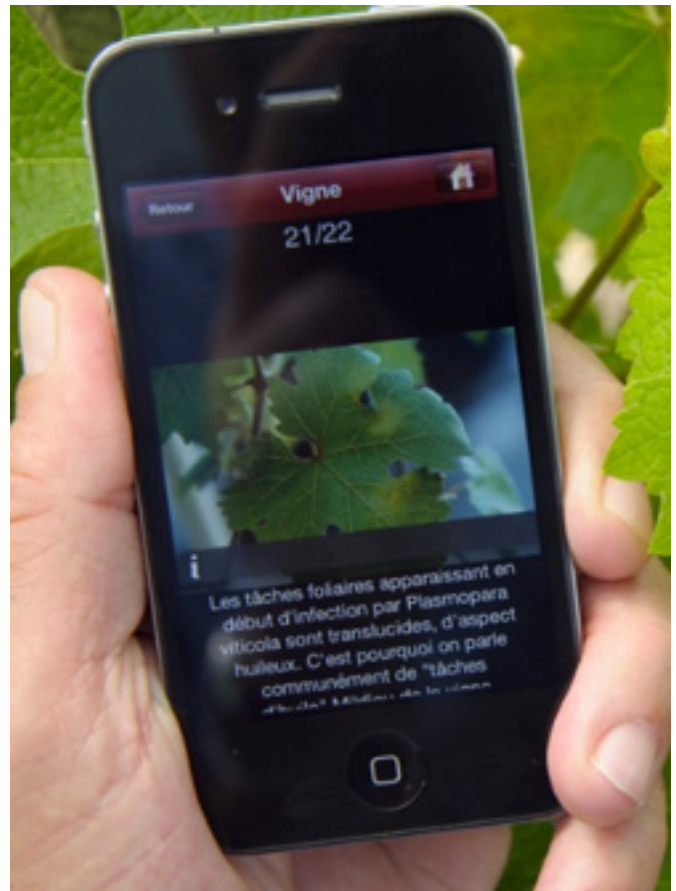


Figure 1. The *Diagnoplant Vigne* application helps to identify vine diseases. (source: INRAE UMR SAVE).

We may also refer to *4Grapes* from which one may identify the vine diseases and estimate the yield.

Much more than just helping recognition, mobile applications can also assist in the monitoring of the vine growth. For example, the *VitiCanopy*¹ application allows the user to measure the foliage surface of the vines to obtain the LAI and the porosity of the leaf canopy.

Thanks to a simple counting system, the *Apex Vigne*² application permits the enumeration of the apices at different stages in order to calculate the vegetative growth index, then to estimate the water constraint.

WineOz SmartGrape application counts the number of berries and estimates their size and colour.

It is equally possible for winegrowers to evaluate the spraying quality of their equipment thanks to the *DropLeaf* application that permits the user to analyze the photo of a water-sensitive paper placed in the foliage before spraying. After the passage of the sprayer, the distribution and density of the droplets found on the paper provide an estimate of the quality of the spraying.



Figure 2. The Apex Vigne application provides growth monitoring and an estimation of the water constraint (source: UMR ITAP).

■ Share so as to inform and react rapidly

Predicting plant health problems in order to evaluate the risk and consequently act is one of the difficulties encountered by the majority of winegrowers. Discussing and exchanging with one's neighbors about the damage suffered provides a broader vision and allows the winegrower to prepare for the arrival of the disease or insect pest. Mobile applications such as *Companion*, *Geoinsecta* or *Agricommunity*, facilitate these information exchanges by geo-localizing and dating them.

A community can, therefore, share field observations (diseases, insect pests, phenological stages...) on the basis of photographs, comments and position indications and thus can predict, as early as possible, the health risks thanks to integrated alerts. Consultants, in particular, may easily share their observations with all winegrowers within a defined zone.



Figure 3. The Flir One external sensor is a thermal camera that could estimate the water status of the vines. (source: Flir).

■ Digital viticulture, a sector in perpetual evolution

Thanks to the evolution of smartphones and their sensors, notably external ones, there exist new insights on the horizon for viticulture. Take, for example, the monitoring of water stress. Research³ has shown encouraging results regarding the use of the FlirOne sensor, an infrared camera that connects to a smartphone to estimate the water status of the vines. The SMURF⁴ research project at Rice University (USA) in partnership with Microsoft Corporation, is seeking to evaluate the level of water stress by estimating the level of humidity as well as the soil's electric conductivity from wifi waves. So far there is no tool adapted to smartphones, but it is one of the goals of this project.

These are, of course, exploratory techniques that should become part of large-scale validation regarding their efficiency and showing their advantages and reliability. It is common to take existing tools or technologies from other domains and apply them to agriculture. The external sensors for smartphones are no exception to this rule. For example, *GoSpectro* used in gemology is a portable spectrometer that attaches to a smartphone camera. One can imagine that this tool could have an interest in viticulture, notably for the monitoring of the maturation.

The smartphone is a simple tool that possesses unsophisticated sensors but, nevertheless, offers numerous features. With technological improvements and the imagination of corporations and researchers, we may, therefore, easily envisage that new uses will appear. ■

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- 1 De Bei, R., Fuentes, S., & Collins, C. (2019). Vineyard variability: can we assess it using smart technologies?. *IVES Technical Reviews, vine and wine*. <https://doi.org/10.20870/IVES-TR.2019.2544>
- 2 Pichon, L., Brunel, G., Payan, J. P., & Tisseyre, B. (2020). Apex-Vigne: A mobile application to facilitate the monitoring of growth and estimate the hydric state of the viticulture plots. *IVES Technical Reviews, vine and wine*. <https://doi.org/10.20870/IVES-TR.2020.3558>
- 3 Petrie, Paul & Wang, Mickey Yeniu & Liu, Scarlett & Lam, Stanley & Whitty, Mark & Skewes, Mark. (2019). The accuracy and utility of a low cost thermal camera and smartphone-based system to assess grapevine water status *ScienceDirect. Biosystems Engineering*. 179. 126-139. 10.1016/j.biosystemseng.2019.01.002.
- 4 Ding, Jian & Chandra, Ranveer. (2019). Towards Low Cost Soil Sensing Using Wi-Fi. 1-16. 10.1145/3300061.3345440.