The digital Mediterranean farm: 6 years' experience of a model connected wine estate Part I: A project for training and cultural appropriation

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The concept of a professional digital tool is often perceived as something vague and difficult to put into practice. The reasoning behind the digital Mediterranean farm (Crestey and Tisseyre, 2019, 2020)[1, 2] is that the viticultural profession, training institutes and technical institutes need concrete examples to identify, assess and support the digital transition of viticulture professionals. The digital farm is an example of a working wine estate equipped with 15 latest-generation professional digital services. 6 years after the launch of the project, this technical note aims to provide feedback in two parts. This first part focuses on the value of the digital farm as a model and in educational terms.

Origin and organization of the project

The digital farm is led by a teaching and research team (UMR ITAP, Institut Agro Montpellier). This choice provides reassuring academic legitimacy for professionals and companies. The project is based at the Institut Agro Montpellier wine estate. It is funded under a sponsorship framework through a university foundation led by Institut Agro which allows companies to get involved in the project by making donations (funding, equipment, skills) that they can offset against tax. Sponsorship allows the project to be positioned on a pre-competitive basis, without direct returns to the companies.

The incorporation of digital solutions (Table 1) has been structured around two important issues for the regional wine sector: i) digital management and proper use of crop-protection products, and ii) digital management of quality and yields. These issues have made it possible to define two connected processes organized around commercial solutions in a coherent and complementary manner. This structure made the project more attractive to companies while preserving a complementarity of solutions. Indeed, none of the solutions is in competition with another or redundant. The project prioritized regional partners (eight of the 15 companies are based in the Occitanie region). The decision to add a new service (or admit a new company) is taken by a board of directors represented equally by the Institut Agro and the member companies.

A visitor site

Table 2 summarizes average annual visitor numbers to the digital farm by type of visitor. Most visitors are professionals and teachers.

Based on the qualitative feedback from visitors, the digital farm provides solutions for the digitization of viticultural production. In particular, it demonstrates the diversity of tools available and their utility, how they are deployed and used, and the value of connecting the tools to resolve professional issues. It helps to develop a strategic investment vision while perceiving the impact on farm organization. Visits also allow professionals to clearly identify and plan for constraints on the deployment of digital tools (skills required, prerequisites in terms of connection or organization, etc.). The digital farm thus raises awareness of digital tools among professionals and initiates a strategy for the digitization of production by incorporating the specificities and priorities of their farms.

The project remains limited, however, in that it is based on a Mediterranean estate and addresses issues specific to this context (large vineyard, tools for controlling water deficit). For professionals from other regions, it is therefore sometimes of limited interest as a model.

FIGURE 1. Continuing education in "Living my life as a connected winegrower" with digital services product managers - June 2021.

TABLE 1. Digital services and companies associated with the digital farm. The "Issue" column refers to 1) digital management and proper use of crop-protection products, or 2) digital management of quality and yields.

Company	Digital solution	Issue
Bayer	Movida Grape Vision	1) Decision-making support for crop-protection sprays
Agriscope	Agribase: Connected weather station	1) Real-time and archived measurement of agroclimatic parameters in the vineyard
CAP2020	CapTrap: Connected insect trap	1) Remote monitoring of vine pests
IFV	Optidose	1) Decision-support tool for dose reduction
SMAG	Agréo vigne et vin	1&2) Management of regulatory traceability in the vineyard and cellar
SIKA France	Picore	1) Spray management
SAMSYS	Equipment tracking box	1) Automatic traceability of mechanized work
Aptimiz	Aptimiz application	1) Diagnosis of working hours management on the estate
Geocarta	Soil resistivity mapping	2) Refining spatial knowledge of the vineyard and guiding soil sampling
ICV and TerraNIS	Oenoview: Vineyard vigor mapping	2) Refining spatial knowledge of the vineyard, guiding ripeness sampling and yields, and optimizing plot management during the harvest
Fruition Sciences	360viti	2) Incorporation of technical data from the vineyard (weather, cartography, sensors) for monitoring and decision-making
Fruition Sciences	Sap flow sensor	2) Management of water deficit of the vine
Pellenc Pera Oenoprocess	SmartPress	2) Control of pressing and must fractions
Vivelys	Dyostem	2) Ripeness monitoring and harvest decision-making
Vivelys	Scalya	2) Automated fermentation program for whites and rosés

TABLE 2. Annual visitor numbers by type.

Visitor type	Number of visitors (average/year over 6 years)
Professionals (technicians, winegrowers)	243
Teachers, students (including continuing education)	315
Researchers	94
Companies	8
Journalists	12
General public	45

A training site

By providing access to a set of always up-to-date digital solutions, the digital farm is a favored site for training. The training courses vary widely in their form and purpose: i) one-day visit to show the range of professional tools currently available, ii) generation of case studies to show the contribution and/ or potential of tools (disease models, vigor maps obtained by remote sensing, soil mapping, etc.), iii) practical work intended to make trainees operational in using certain digital services. These training courses apply to initial training and continuing education without distinction (Table 3).

TABLE 3. Training provided on the digital farm.

Type of training	Number of people trained (average per year)
Training of technical education teachers	9
Continuing education (advisors, developers, etc.)	25
Technical education students (two-year Higher Education diploma)	45
Higher education students (postgraduate level)	210

The digital farm also makes it possible to initiate new training courses, such as continuing education in "living my life as a connected winegrower", for example, specifically aimed at developers of digital services. This training course was designed with partner digital services companies, to make IT professionals aware of the features specific to viticulture so that they can take them into account when developing new services. The farm is also a place of educational innovation, where tools are made available to teachers to give them a better understanding of new sources of information and decision-making tools (Wiki, virtual tour, Pic@ at http://lemasnumerique.agrotic.org/).

A place to observe the appropriation of professional digital tools

With 15 digital services deployed, the digital farm is a place for life-size experimentation allowing:
- identification of the skill-building challenges for optimal appropriation of services by the various players (tractor drivers, wine merchants, vineyard managers and also consultant technicians). A simple and often underestimated example is the use of the smartphone which, although mastered in a private or leisure context, requires the use of more advanced features when it comes to a professional application,
- identification of the added value of communication between solutions (when they are interoperable), for example a weather station connected to a powdery mildew-downy mildew disease model allows for more precise predictions specific to the climate of the monitored plots,

- perception of the constraints relating to the use of several digital tools, for example the need to enter the same information two, three or even four times is a source of rejection. These observations are fed back to the digital farm's partner companies as part of a continuous improvement approach and to move towards sustainable digitization for professionals.
- experimentation with the way professional digital tools impact farm organization or how certain tools are diverted from their initial functions to meet specific challenges. The example of a spraying operations traceability tool is an interesting case. The farm manager has appropriated this tool, more for the ease and reliability of communicating the spraying schedule to his tractor drivers, via paper printouts, than for the traceability of the operations themselves. The digital farm is thus a place for bringing to light new uses associated with digital technology.

Conclusion

The digital farm offers answers to professionals and teachers who collectively wish to take part in a successful digital transition. The facility has its weaknesses, however, as it preferentially addresses Mediterranean viticulture. For professionals from other wine-growing regions, its value as a model may therefore be limited. The authors therefore recommend the development of similar facilities in other wine-growing regions. Projects of the same type have already emerged in Bordeaux[3] and Burgundy[4]. Beyond training and cultural appropriation, the digital farm meets other challenges related to the development of professional digital tools for viticulture. These challenges are presented in the second part of this technical note. ∎

1 Crestey T., Tisseyre B., 2020. The digital Mediterranean farm in the south of France: a model farm to facilitate the appropriation of precision farming tools and methods for wine growers and advisors, Chapter 7.1, In: Agricultural Internet of Things and Decision Support for Precision Smart Farming. Eds. A. Castrignano, G. Buttafuoco, R. Khosla, A. Mouazen, D. Moshou, O. Naud. Academic Press, ISBN 9780128183748.

2 Crestey T., Tisseyre B., 2019. Comment construire une exploitation en agriculture numérique : retour d'expérience du Mas numérique dans le Sud de la France, Revue Science Eaux & Territoires, Agriculture numérique, une (r)évolution en marche dans les territoires ? 29, 52-57.

3 DigiLab 2022., https://digilab.agro-bordeaux.fr/

4 VitiLab 2022, https://www.vinipole-sud-bourgogne.fr/actu_une-nouvelle-structure-arrive-a_73.html