DEFINING LAND AND VINTAGE IRRIGATION REGIMES

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Viticulturists are often worried with the availability of water when facing summer drought which is often the case in the Mediterranean. This attitude is more pronounced than one of the technical solutions, such as irrigation which is highly controlled during the vegetative cycle of the vine. In all cases the knowledge and diverse observations converge to the need that water constraints (in moderation) during the season will produce a grape harvest of high quality. It is therefore necessary to develop methods that will allow one to know the levels of moistures in the soil to meticulously know the quantity of the supply and how long it will last. With concerns of conservation with respect of wine typicity, the supply should be systematically limited so it will not comprise the vines/rootstock within its habitat. Irrigation should not be a technique used to plant vines in an area where it cannot happen naturally but to help sustain and ensure economic stability for a wine growing area. To do this it is important to identify the moisture levels in real time in evaluate the repercussions on the quality of the grape harvest. Studies were performed on this subject by I'ITV in collaboration with technicians from agricultural organizations and fundamental research environment.

Water restriction, vine growth and berry maturation.
The supply of water from the vine to the grape is a plays a large role in determining the quality of the grape harvest. Because of the diversity of the repercussions on vigour, development and berry maturation, mastering irrigation is essential for a high quality product. A progressive constraint appearing between flowering and veraison and creates a state of moderate stress at veraison (growth stops), is an undeniable necessity to obtain a maximal quality. This means there will be considerable exhaustion of the reserves of mature soil. There has to be irrigation control, with light defoliation to not cause damage in course of reaching maturation. With over watering the effects would systemically alter the quality of the harvest (higher yield; late maturation; dilution or inhibition of the syntheses of sugar, anthocyans and phenolics components; increase of malic acid; alteration of the microclimate and the development of parasites..). On the other hand not enough water can alter the yield, bloc maturation and cause loss of harvest due to dehydration of the grapes. It is important to find the right mix in the middle of not enough water and too much.

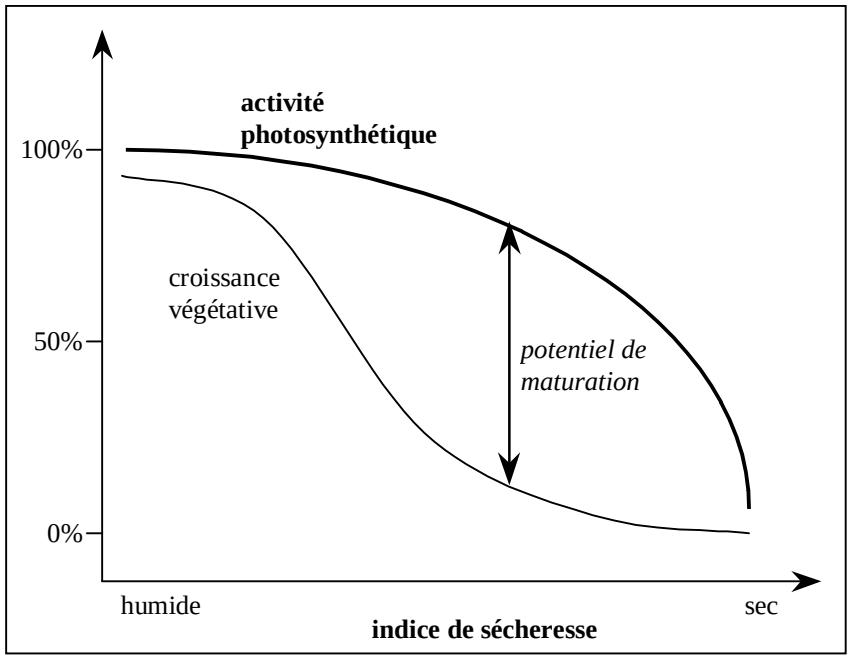


Figure 1 ***Evolutions comparées de la photosynthèse, de la croissance végétative et du « potentiel de maturation » selon un gradient de sécheresse croissant.*** *(illustration extrapolée de Carbonneau, 1998)*

Through the simplified representation, *figure 1* illustrates the effects of controlled irrigation on the potential maturation of the grapes in the vineyard. We can see an inhibition more important from drought on the vegetative grow than on the photosynthesis. With an absence on controlled irrigation the photosynthesis is at its maximum and the vegetative grow is important. The quasi totality of the synthesised sugars from the leaves are used for grow of the branches. The opposite happens in the case of drought, all vegetative grow is bloc and the plant can attain maximal maturation of the fruits.

It is indispensable to exhaust cultivating techniques to an optimal adaptation for the vineyard in its environment. These techniques can be preventative, such as it is indispensable to exhaust cultivating techniques to an optimal adaptation for the vineyard in its environment. These techniques can be preventative, such as the preparation of the soil and the choice of vine/rootstocks for the plot of land, the density of the plantation, also the choice of cultivating and the soil, growth operations… In all cases the vine must suffer to produce a quality wine product:
"Like with man, one who is given comfort is one of dullness and without interest…" (Bessis and Adrian, 2000)*.

Knowing the state of irrigation and characterizing the vintage and the land

The first step consists to define a "diagnostic tool for hydro stress" to identify at any moment the intensity of the duress. All measurement realised on the plants will be the same as the land: flurometer, micromorphometer, leaf temperature, physiological measurements, using a pressure chamber. The last technique is conducted today at the office of reference and is perform by technicians (price 3800 Euros). The methodology consists of enclosing a leaf in a hermitic chamber, where pressure is put on the exterior

of the limb to extract sap from the petiole section. Higher the pressure, the plant is under more water stress.

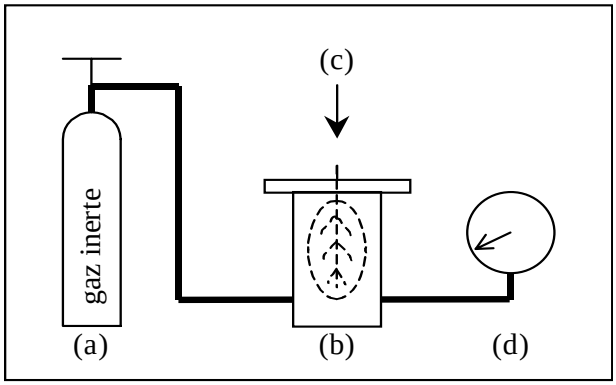
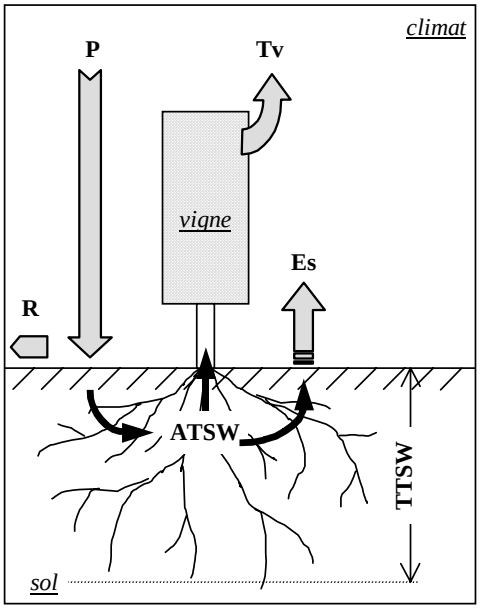


Figure 2 ***Principe de fonctionnement d'une chambre à pression.***
Un gaz sous pression (a) injecté dans une chambre hermétique (b) contenant une feuille permet une exudation de sève à l'extrémité du pétiole (c). Lecture de la pression (d).

This stress diagnostic tool gives precise and instant information. During a growing season this machine would give numerous measurements. Utilisation of a water balance as well is proposed to palliate this disadvantage **(**Riou and Lebon, 2000 ; Riou and Payan, 2001; Payan and Salancon, 2002 ; Pellegrino, 2003). The principal consists of simulating the evolution of the water reserves in the soil with basic information: meteorological information (precipitation, temperatures and evaportranspiration) and measurements of the size of the vegetation (to quantify the quantity of water transpired).

The model, illustrated by *figure 3,* considers the soil like a reservoir and replenishes itself with precipitation (P) and loses water by transpiration of the vine (Tv), soil evaporation (Es) or run-off (R). The estimate of the quantity of water remaining in the sol (ATSW) allows us to construct a graphical representation showing the evolution of the moisture levels of the land (*figure 4),* these 3 components which are precocity, intensity and length. This precise characterisation of the moisture levels allows for comparisons between different vineyards and years. The main obstacle with this application is knowing the maximum reserve of the water levels in the soil (TTSW). This study is based on the measurements taken from the plants to estimate this reserve. The combination of the water balance (table) with the utilisation of the pressure chamber present an advantage applicable to the scale of the land because of the measurements taken directly from the plant.



ATSW = TTSW + P – Tv – Es – R

Figure 3 ***Schématisation des flux et des quantités d'eau considérés par le bilan hydrique.***
ATSW = quantité d'eau accessible dans le sol à un moment donné ; TTSW = quantité maximale d'eau utilisable dans le sol ; P = Précipitations ; R = Ruissellement de surface ; Tv = Transpiration de la végétation ; Es = Evaporation du sol

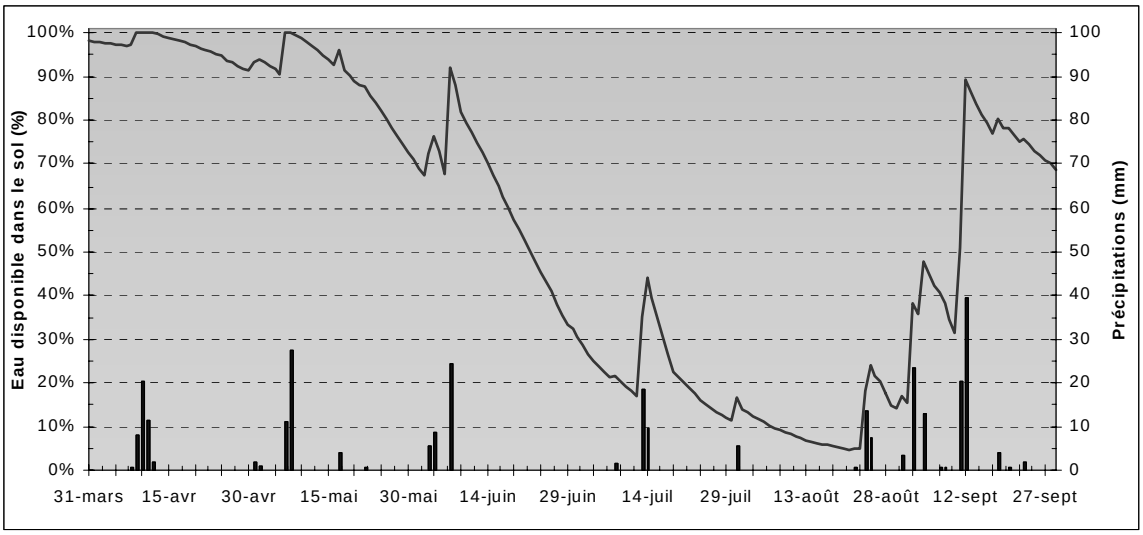


Figure 4 ***Exemple de bilan hydrique.***
Evolution de la fraction d'eau du sol sur une parcelle de grenache de La-Londe-les-Maures en 2002.

Conclusion

The techniques presented allow one to measure the moisture levels of the vine and of the land and vintage. The research of the moisture levels will help assure a quality grape harvest, these tools will serve as a base for the definition of < optimal moisture itinerary> This will allow to put in relation these viticulture situations clearly identify with quantitative and qualitative characteristics of the grape harvest to be able to plan an objective cultivation intervention for the land.

*References are available at the Centre de Recherche et d'Expérimentation sur le Vin Rosé