

Preventing ESCA in *Vitis vinifera* by proscribing vine training systems or mutilating pruning methods

Sourced from the articles “Conduite de la vigne et esca” (Phytoma - La santé des végétaux n° 739, december 2020)^{1,2} and “Esca of grapevine and training practices in France: results of a 10-year survey.” (Phytopathologia mediterranea, 2018)³.

>>> To illustrate the influence of vine training systems or pruning methods or regimes on the development of the grapevine wood disease, ESCA, a synthesis has been realized from the results obtained within the framework of two projects, one called V1303 and financed by CASDAR/CNIV funds (2013-2017) and ‘GTDfree’ that was financed by the ANR and the Hennessy company (2016-2021). A major conclusion was found that the extremely simplified vine training systems and pruning regimes that were too severe should be proscribed within the framework of the prevention and management of ESCA, notably for susceptible grapevine varieties. <<<

ESCA is a grapevine wood disease that is today one of the main causes of the decline and disappearance of the vines. Its development is dependent on a great number of factors, including the so-called cultural factors that have a major role^{3,4}. The consequences of ESCA are extremely variable depending on the vineyard parcels. It is precisely these contrasting parcel situations that concerned the Scientists of the UMR SAVE of the INRAE center in Bordeaux in their reflection on understanding this disease. To specifically examine the role of the vine training systems, or of the pruning of the vine on ESCA, a study was initiated in France fifteen years ago.

Two approaches were used: (i) a descriptive approach, in the form of a survey, and (ii) an analytical approach, with samples and laboratory analyses, with the aim of explaining the role of the necrosis and the lignicolous fungi in the grapevine wood^{2,5}. Only the descriptive approach will be addressed in this article. It consisted of researching by prospection, the already existing experimental designs or the parcel couples that presented a comparable agronomical profile. The selected parcels had the same age or a very similar age (unless if the youngest parcel was the most affected), the same grape varieties (or of sensibly equivalent), if possible, identical root stocks, and of similar soil and climatic conditions.

The focus of this study was that these parcel couples presented different vine training systems or pruning regimes. In these parcels, the ESCA was always the predominant wood disease. The symptoms observed on the leaves and on the wood, were noted at the end of the growing season, in September or beginning of October, using a previously validated procedure⁶. The prospections were realized principally in the Gironde, the Gers, the Languedoc, the Jura, the Burgundy and the Charentes areas (GTDfree Project). In total, 39 parcel situations permitted the comparison of 20 couples :17 comparing the vine training methods and 3 with different pruning systems or pruning qualities, e.g.: virtuous pruning of the Poussard system (that is to say that respect the main sap trajectories) vs mutilating pruning that induce necroses of the conducting system. In this article, the tables 1 and 2 present the results emanating from the three experimental

Table 1. The impact of wood diseases (principally ESCA) in the 3 different experimental designs located in Gironde, that compared the training systems ‘Espalier-Guyot’ to other forms such as ‘Low Cordon’ or ‘Lyre.’ The numbers in bold indicate the highest percentage of unproductive vine plants within the comparison (CASDAR/CNIV V1303 Project). * Only the final year of the observation period is presented here. The complete results are published elsewhere^{1,2,3}. ** The unproductive vine plants are all dead origin, replaced, or not, since the plantation (I). (E) identified all the vine plants whose wood was altered⁶.

Parcel, Commune, Plantation Grapevine variety, Design Observation period	Vine training system	Year*	N° of plants examined	Unproductive vine plants (I+E) ** and ESCA-symptomatic(F) (%)		
				I+E	F	Total
				Grand Parc, Latresne, 1997	‘Espalier Guyot’ Short branch 20-30 cm	2016
Cabernet Sauvignon, 4 blocks 2010-2016	‘Espalier Low Cordon’ Long branch 40-60 cm	638	13.8	11.9	25.7	
Lagrange 2, St Genis du bois, 1980	‘Espalier Guyot’ Short branch 10-30 cm	2014	482	37.6	3.1	40.7
Merlot, 3 blocks 2012-2014	‘Lyre’ Long branch 40-80 cm		441	17.0	7.9	24.9
Lagrange 3, St Genis du Bois, 1978	‘Espalier Guyot’ Short branch 20-30 cm	2014	665	33.4	3.5	36.9
Merlot, 2 blocks 2012-2014	‘Lyre’ Long branch 40-80 cm		686	5.5	8.6	14.1

systems located in the Gironde area and those concerning the parcel comparisons located in the Charentes area. The complete results that were obtained from the 20 parcel couples are presented elsewhere^{1,2,3}. In general, the high annual variability of the foliage symptoms did not permit a solid interpretation of the data obtained from this variable. Conversely the variable that regrouped all the unproductive vine plants (dead vine plants, replanted, cut back or with only one branch) were the most pertinent since they were coherent from one year to the next. All the comparative distributions were significantly different.

Table 2. Impact of wood diseases (in majority ESCA) on the Ugni Blanc cultivar in the Charentes region (GTDfree project). Parcel couples prospected in 2016 and 2017. The numbers in bold indicate the highest percentage of unproductive vine plants within the comparison.

Region, Departement Commune	Parcel, Plantation	Vine training system	Year	N° of plants	Unproductive plants (I+E) And symptomatic (F) (%)		
					I+E	F	Total
N ^{lle} Aquitaine Charente Saint-Preuil	Maine Ménod, 1986	‘Espalier Guyot-Arcure’	2016	551	60.4	5.6	66.1
		‘Espalier High Cordon’		543	40	8.7	48.7
N ^{lle} Aquitaine Charente Saint-Preuil	10 Journaux, 1986	‘Espalier Guyot-Arcure’	2016	423	62.6	2.4	65
		‘Espalier High Cordon’		418	50.7	9.8	65.8
N ^{lle} Aquitaine Charente-Maritime Clion/Seugne	Fontaine, 1989	‘Espalier Guyot-Arcure’	2017	612	40.5	5.2	45.7
		‘Espalier High Cordon’ Mechanical Pruning		1190	5.0	12.1	17.1
N ^{lle} Aquitaine Charente Lignières-Sonneville	La Davore, 1971	‘Espalier Guyot-Arcure’	2017	668	64.4	8.8	73.4
		‘Espalier High Cordon’		1075	18.5	19.5	38

In Gironde, the analysis of the results obtained in the 3 experimental systems (Table 1) showed that the vine plants conducted in Guyot Espalier were more severely impacted by ESCA (the % of unproductive vine plants varied from 28 to 37%) as compared to those conducted in Espalier Low Cordon. or in Lyre (% variation from 5 to 17 %).

These results confirmed the formerly observed trend by Lecomte *et al.* in 2012⁶. All the other results showed a significant advantage of the forms with long structures. (e.g.: Espalier - Low or High - Cordons, Lyres Espaliers Double Guyot with long branch) as compared with shorter structures, sometimes inexistant (e.g.: Espalier Simple Guyot – similar to a severely pruned willow head), or those with inversions (e.g.: Guyot Lépine, Guyot Arcure). For example, the parcel couples that compared different pruning systems or qualities, in Burgundy or in the Jura, were respectively confirmed i) The advantage of Guyot-Poussard pruning system (Lafon, 1921) as compared to the classical Simple Guyot pruning or ii) the advantage of the classical Simple Guyot pruning but respecting the sap trajectory as compared to a mutilating pruning (Figure 1). However, the forms with the long branch structures show a slower decline, often expressed more foliage symptoms (and for a longer period) than the forms with the short branches where there is a higher and more rapid mortality. One must equally note that a form that has undergone little or no pruning (minimal or mechanical pruning) shows less disease effect than a form that is regularly pruned manually (the case of parcels observed in the Occitania or Charentes areas).



Figure 1. The forms to proscribe on susceptible grape varieties: Vine plants conducted in ‘Espalier Simple Guyot’ without branches, or with very short branches, showed several pruning wounds located in the plant head with, sometimes, very large wounds and only one sap feeding system. From left to right, a Gironde Cabernet Franc showing a striking ESCA symptom, a Colombard from the Gers and a Burgundian Pinot Noir (From de Lecomte *et al.*, 2018, 2020a)^{1,3}.

This parcel approach, whether based on experimental or on simple comparison of neighboring parcel systems showed the same trend: The less the vine plant is pruned (minimal or no pruning) the fewer ESCA symptoms it will present. Equally, the better the vine plant is pruned, the slower it will decline. Given similar pruning quality, the vine plants conducted in Espalier with long branch structures, such as the Lyre, Low or High Cordon, are always less impacted by ESCA than are the vine plants with short branches such as the Guyot (simple or double), Guyot Arcure or Lépine pruning techniques.

It was also shown that the Guyot types with well-formed long branches, such as the Poussard, are less impacted as compared to the short branch Guyot types, absent or regularly shortened, confirming other observations^{7, 8}. Thus, it seems that there exists a hierarchy of vine training methods, from the most simplified to those that best respect the natural bearing of the vine where the vine plant has a free form permitting a large leaf canopy development (e.g., Overhead Trellises, pergola, or Espalier High Cordon). The ‘trunk forms’ or the Simple Guyot forms are not recommended for the sensitive grape varieties (Figure 1).

■ Conclusion

The results obtained over for last fifteen years permit us, at least in part, to explain the progression of ESCA in France over the last 3 decades.

The climate change is another explanatory factor that must be taken into consideration. Viticulture has also considerably evolved since the end of the last century, often favouring a simplification of practices. The mechanization of pruning, such as with the electric shear, has enormously contributed to this change in practices. It is therefore in our opinion to correct the orientation that had consisted, with the very simple Guyot forms (‘trunk forms’) in concentrating all the pruning wounds on the plant head. It seems very judicious to avoid this form-type, particularly for the grape varieties that are sensitive to wood disease. In certain vineyards, one will have to undoubtedly re-think the plantation distance in the row, distances that are sometimes determined to fulfil the technical specifications that impose minimal densities per hectare (without proposing minimal densities in the rows). Effectively many winegrowers who are not in a position or who do not wish to change their agricultural equipment and thus unable to reduce the distance between rows, reduce the distances between vine plants, implying that they must move from a Double Guyot with long branches to a Simple Guyot with short branches or even without branches. This change was catastrophic for wine farming. It would be useful to review and adapt the technical specifications of appellations within the framework of a global reflection on plantation densities, vine training systems and pruning methods, these three elements work in unison. ■

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