Study of the Chianti and Chianti Classico appellations: Evaluation of enological potential of Sangiovese and complementary varieties by a multiparametric approach

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1. Curriculum

I was born on 28th of March 1985 in Zajecar, Serbia. I graduated from University of Belgrade, "Agrifaculty" obtaining a Master degree in viticulture and fruit science (2004–2011). After that I studied at International Vintage Master in France, Spain and Italy specializing viticulture, oenology and wine marketing (2011–2013) with a final Master thesis titled: "The roll of oxygen in enology: importance, measurements, winemaking processes, control and optimization strategies". In 2014 I worked as a cellar hand at "New Zealand Wineries" (Blenheim, New Zealand) and at "Vignerons Propriétés Associés" Générac (Languedoc Rousillon, France). From 2015 I started to work as winemaker in R&D department of Ruffino winery.

2. State of art

The ongoing climate change is expected to further impact the European viticulture in the future. The climate variables like air temperature, rainfall levels and distributions, humidity, winds, light intensity and cloud cover can affect the grape growing wine industry to large extent (Jackson and Lombard, 1963; Jones, 2007). In particular, the main effects of climate changes on the viticulture are the increasing sugar levels of grapes that leads to high alcohol in wine, the low acidity and the modification of varietal aromas (Jones, 2007; Mira de Orduña, 2010). The mean temperatures have a big impact on the length of the growing season for each variety, the grapevine physiology and the metabolism and fruit composition. Fraga et al. (2012) found that the higher night temperatures in combination with high diurnal temperatures during the grape maturation/ripening period could lead to lower tannins and anthocyanins formation that reduces the wine color and wine quality and it increases the volatilizations of aromas compounds. The annual precipitation is another critical factor of viticulture because the water stress can lead to small shoot growth, poor flower, cluster and berry development causing the decrease of grape yield and increased water demand due to the irrigation. On another hand, the excessive humidity during the early stages cause the denser canopies that leads to pests and disease problems requiring more intense plant protection and low wine quality (Fraga et al. 2012).

Wine typicity and wine quality parameters

The **t**ypicity of wine is defined as the physico-chemical and sensory characteristics that are considered representative for the Protected Designation of Origin (PDO) related to a terroir. There are three main factors that are usually considered to assess the global wine typicity of a PDO wine: the standard profile (i.e., the basic physico-chemical characteristic), the cultivar profile (i.e. the sensory aromatic characteristics coming from the grapes), the style profile (i.e., the characteristics that result from the winemaking methods). The relation between chemical characteristics of grapes and the chemical and aromatic profile of wine could be revealed using multivariate analysis like Partial Leas Squares (PLS) (Canuti et al. 2017).

The wine quality could be described in four notions: the excellence or superiority, the value, the conforming to specifications and meeting or exceeding customer expectations (Canuti et al. 2017).Well run taste-panels relied with the chemical analysis of wine would be an ideal wine quality evaluation model that can be defined by the following selected 'indicators' according to literature (Jackson and Lombard, 1963): soluble solids, organic acids, the pH, polyphenols and anthocyanins, amino acids and aromas.

3. Ph.D. Thesis Objectives and Milestones

The overall aim of the PhD study is to exploit the enological potential of Sangiovese grape – and additional complementary grape varietals – for the valorization of Chianti red wine. In this view, the following interrelated tasks are planned alongside the entire production chain: (i) understanding the impact of the climate changes at local level to tailor both the grape growing and winemaking practices to improve the wine quality with respect to the traditional regional winemaking regulations; (ii) development of the quality control processing procedures and analytical protocols to improve and ascertain the composition of wine from the grape growing, through the winemaking and aging processes, till transportation and consumption.

The PhD milestones are organized as follows:

A1) Literature search for updating the scientific literature related to the topic of the PhD project using both online electronic databases (e.g. Scopus, SciFinder, Vitis-Vea, Medline, ScienceDirect, Agricola, etc..) and the classic search on paper copy at libraries.

A2) Design of Experiment (DoE) as scientific approach to optimize the number of trials that later will be evaluated by statistical methods.

A3) Monitoring selected physical and chemical parameters along the whole production chain, from the production to the storage to identify the critical control points with respect to the climate change and wine evolution with time during processing and storage.

A4) Set up of improved analytical methods by using targeted and untargeted approaches to improve the quality control of wine.

A5) Statistical evaluation of data is carried out by specific tests (parametric and non-parametric, univariate and multivariate, linear and non-linear) depending on the experiment designed, which choice is based on the number and type of variables under investigation and whether they are normally distributed. Statistical open source and commercial softwares are available, including Unscrumbler and XLStat.

A6) At least two manuscripts on the topic of the PhD project will be prepared and submitted for publication onto a high impact factor international scientific Journal (ISI classification) with referees. Further communication of the results in form of technical papers, presentations and seminars are planned.

Table 1: Gannt chart of PhD activities

	↓Activity Month →	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36
A1)	***Literature review***																		
	Search on web, online database and paper collection in library																		
A2)	***Design of Experiment***																		
	Selection of variables and levels to develop model system approach																		
A3)	***Monitoring climate change and wine change during processing and storage***																		
	Online measurement, collection of meteo data and modeling																		
	Monitoring the time course change in chemical and sensory properties of wines																		
A4)	***Develop new analytical methods***																		
	Set up of HPLC and IR methods for targeted and untargeted wine analysis																		
	Determination of selected chemical and sensory markers in grapes and wines																		
A5)	***Statistical analysis***																		
	Univariate and multivariate approaches																		
A6)	***Publication of manuscripts and thesis***																		

4. Literature

Canuti V, Picci M, Zanoni B, Fia G, Bertuccioli M (2017) A multivariate methodological approach to relate wine to characteristics of grape composition: The case of typicality. Am J. Enol Vitic 68, 1, 49–59.

Fraga H, Malheiro AC, Moutinho Pereira J, Santos JA (2012) An overview of climate change impacts on European viticulture. Food Energy Secur, 1, 2, 94–110.

Jackson D, Lombard P (1993) Environmental and management practices affecting grape composition and wine quality – A review. Am J Enol Vitic 44, 4, 409–430.

Jones G (2007). Climate change: observations, projections and general implications for viticulture and wine production. http://www.cnpuv.embrapa.br/publica/anais/cbve12/56-67.pdf

Mira de Orduña R (2010) Climate change associated effects on grape and wine quality and production. Food Res Int 43, 7, 1844–1855.