

INDUSTRY / UNIVERSITY COLLABORATION IN PRODUCT FOCUSSED OENOLOGICAL RESEARCH IN PORTUGAL - THE SOGRAPE / UCP ESB PARTNERSHIP 1995 - 1998.

Guedes, P.; Pina, C.; Santos, C.; Vasconcelos, I.; Silva, M.C.; Couto, J.A. & Hogg, T.

Universidade Catolica Portuguesa - Escola Superior de Biotecnologia, R. António Bernardino de Almeida,
4200 PORTO, Portugal

Cabral, L.; Vieira, M.; Pessanha, M.; Graça, A. & Soares Franco, J.M.

SOGRAPE Vinhos de Portugal, Aldeia Nova de Avintes, 4400 V. N. GAIA, Portugal

Abstract

A innovative model of collaboration between a wine company and a university research group is presented. A protocol was established as a response to the perceived need to, on the part of the university, (i) focus research on specific scientific bottlenecks which would have a real impact in the producing industry and, on the part of the company, (ii) to have access to the scientific capacity to conduct in-depth studies to approach specific technical challenges. A closely managed programme was jointly established and the major characteristics are presented here together with the main results obtained during the first 2 and a half years of operation.

Key words: industry / university collaboration

Introduction

Portugal is a country with a long history of wine production and commercialisation, and is certainly one of the "traditional" wine producing nations of Europe. Being a traditional wine producing nation certainly does not remove the need for innovation-directed and problem-solving research, all wines must compete in the same marketplace independent of their origin. Many wine companies in Portugal are, in terms of technical and winemaking skills and installations, independent. This is to say that they possess in-house the capacity to produce and package wine with all the necessary considerations of analysis and control. Many companies also have considerable programmes of experimentation which are executed with skill and care and the results absorbed directly into winemaking practices almost invariably with some gain. It is however, very rare in Portugal that a wine company possesses dedicated research personnel and installations which would enable such experimentation to be undertaken with the scientific rigour and analytical support which many companies desire. Wine producers who perceive the need of research skills and resources most often rely on collaborations with Universities or Institutes both in Portugal or abroad. This general field of Industry / University collaboration is considered both a priority and problematic in Portugal and considerable resources are dedicated to promoting both the general idea and specific projects.

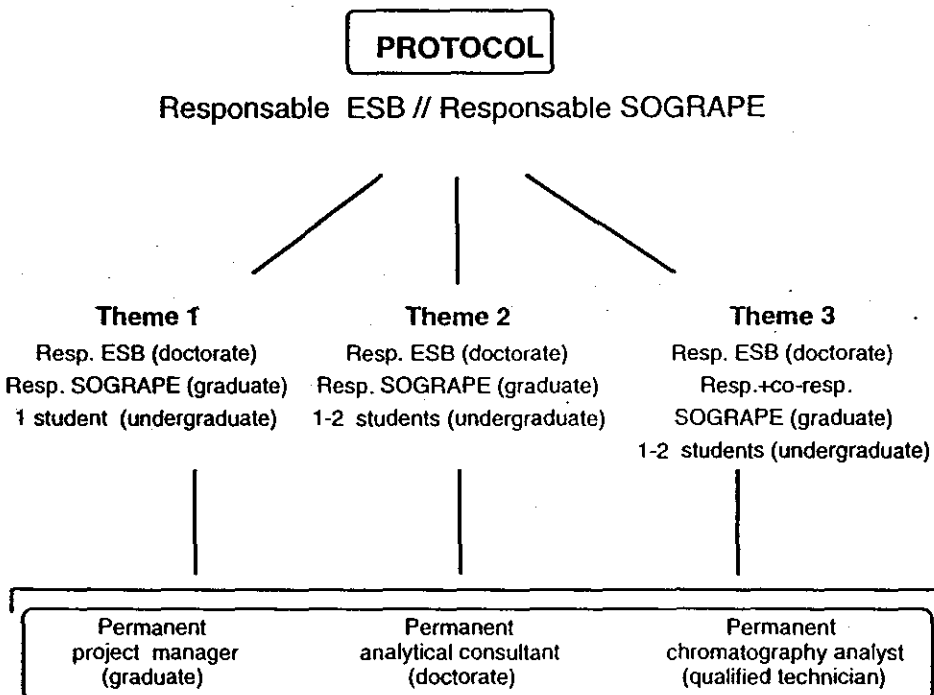
The project presented reports on the experience of a 3 year pilot protocol between a major wine producer and a University faculty and intends to be a contribution to the discussion of University / Industry collaborations in the wine sector. The protocol itself derives in part from a perceived necessity (as referred to above), on the part of the company to have access to research which is more involved and complex than their in-house resources allow. From

the point of view of the University research group, one of the major motives for this collaboration was the perceived need to validate and make credible studies undertaken on wine by having access to the company. In this way, it is not only the first class grape and wine material is made available in exactly the conditions required but also the winemaking team is participating directly in the experiments sharing their experience and expertise with researchers.

A protocol of collaboration with an initial duration of 3 years, was defined based on three major themes:

- The technology of Port wine maturation
- Bottle ageing capacity of Portuguese white and rose wines
- Characterisation of Portuguese grape varieties

To approach these themes a specific management structure was drawn up consisting of two main components: (i) definition of responsibility and competences; (ii) definition of plans and evaluation documents. Of (i) the scheme below indicates the structure created.



The second component in the management scheme can essentially be presented as a hierarchically system of orientation documents in which the initial protocol itself is the guiding document, necessarily with little specific detail. Below this are the yearly plans that are more detailed, based on the protocol, but allowing for some alterations for new ideas, changing plans and the recognition of blind alleys etc. Below the yearly plan, more practical plans, procedures and methodologies are drawn up and monitored. The structure can be summarized as follows:

In the two years of functioning of this protocol a number of studies have been initiated, in some cases completed, and a substantial quantity of data has been generated. These studies, the data and conclusions drawn from them are summarised theme by theme below

Key studies and major results

Theme 1 - Technology of fortified wine maturation

The subject dealt within this theme concerns the uncommon but inconvenient problem of bacterial spoilage of sweet fortified wine. This problem has been described as low level

Protocol document	General guiding document of established at project initiation.
Year plan	Yearly orientation established prior to harvest in a plenary meeting. (i) General objectives for year and (ii) specific experiments at harvest are defined
Six-monthly review	Evaluation of results of preceeding 6 months and corrections in analytical or experimental approaches in plenary meetings. Reports produced - full report and executive summary for wider circulation.
Three-monthly reports	Brief reviews of major results, considerations for intervening in the next 3 months period. Reports produced - Brief (5-6 pages) report.

endemic, but occasionally epidemic and of which the producing industry as a whole is ill prepared for. The ESB has a long term research initiative in this area and the studies undertaken under this protocol made use of this accumulated experience.

Selected studies and results

- Sources of contamination by spoilage bacteria were studied throughout the production chain (vinification-maturation-bottling). A number of contact surfaces were identified as being critical points in the control of wine contamination. Hygiene practices focussed on these critical points significantly reduced the number of positive results (presence of bacteria) at these points.
- Rapid detection of spoilage bacteria is considered highly desirable where decisions can be made based on results e.g. test for presence in vessels before filling. A method based on the direct epifluorescence filter technique (DEFT) for the detection of viable organisms on contact surfaces was developed and its application in the verification of hygiene levels is being evaluated.

Theme 2 - Bottle ageing capacity of white and rose wines

The essential aims of this theme are to identify the underlying reasons for longevity in white and rose wines. Many generic factors are known to influence the capacity of wines to age, e.g. the acidity and specific phenolic content are most often cited. Specific factors vary from variety to variety and these are of greatest interest here. The approach employed here is based on (i) setting up ageing trials of wines with known analytical profiles and monitoring them over time, and (ii) to study the chemical and sensorial characteristics of white wine made from selected varieties of *Vitis vinifera*.

Selected studies and results

- Analytical and sensorial characterization of wines have shown that Maria Gomes, Fernão Pires and Loureiro were the most aromatic varieties (with higher levels of free terpenic compounds) from Bairrada, Douro and Vinhos Verdes regions respectively.
- Fermentation of Bairrada wines in oak with different levels of toasting didn't show significant analytical differences either for volatile fermentation compounds or free terpenic compounds. The medium toast was, however, preferred by the taster panel.
- The influence of PVPP and casein in wine stabilization was studied; treated wines were, however, considered of lower quality than control wines on a sensorial basis.

- Hiperoxygenation of musts of Bairrada region was found to decrease the levels of volatile fermentation compounds of wines.
- Trials with the variety Bical from Bairrada region (utilization of different yeast strains, addition of ammonium sulphate and copper sulphate) showed a preference for wines fermented with the strain EC1118 with addition of ammonium sulphate.

Theme 3 - Characterization of noble varieties of *Vitis vinifera* from the Dão region.

The studies undertaken within this theme have the general objective of defining the aroma and flavour active compounds and sensory characteristics of monovarietal Dão wines (red and white) and to relate these to winemaking considerations.

Selected studies and results

Influence of grape maturation level on aromatic and flavour characteristics

- The most appreciated white wines were those made with the variety Encruzado at a level of grape maturation of 13.5° baumé), these were considered to be the most fruity and with the most aromatic persistence, these characteristics were coincident with an appreciable content of acetates of superior alcohols.
- The most appreciated red wines were made with the variety Touriga Nacional at between 12 and 13° baumé), being those with the highest concentrations of ethyl esters of fatty acids, acetates of superior alcohols and free fatty acids. Red wines from Touriga Nacional at a lower level of grape maturation (11° of probable alcohol) and from Jaen were considered acidic, with vegetal characters and were found to be relatively poor in fermentation derived compounds.
- Wines made with poorly matured grapes were distinguished by the presence of a high content of hexanol and were classified as the most acid wines.

Influence of inoculation of starter cultures of *Oenococcus oeni* on wine properties after malolactic fermentation (namely volatile acidity).

- In all the wines tested (inoculated and control) the concentration of acetic acid increased during malolactic fermentation. This variation was not from citric acid degradation, being probably due to bacterial sugar metabolism.
- It was not possible to confirm whether the malolactic fermentation was conducted by the starter cultures used or by the natural malolactic flora of the wine.

Conclusions and comments.

Independent of the specific theme, the studies undertaken within this protocol are of two generic types, (i) short-term problem solving experiments whose results directly influence winemaking practices and (ii) long term descriptive initiatives which provide enabling data for directly applicable studies. In practice these studies are run in parallel and differ only in their outputs. In this way a number of studies have been successfully concluded in that useable results have already been obtained - this is the case for all three of the protocol's themes. It is also true that the descriptive studies are incomplete and that the only conclusions which can be drawn are of a methodological nature i.e. the methods and approaches employed are apparently valid for the types of study in question.

The industrial and university teams involved in the project have established a workable relationship in which the management procedures, documents and meetings are essentially automatic. The establishment of a culture of collaboration has enabled other studies which lie

outside of the protocol to be initiated and in some cases completed. The company has had access to sophisticated analytical data, scientific methodologies and statistical analysis which enable winemaking options to be taken with a sound scientific base.

From the point of view of the university, the team has gained in-depth knowledge of winemaking practices (vinification, cellar practices and bottling) adding constant value to personnel and adding credibility and applicability to all wine related activities.