Deliverable

SIXTH FRAMEWORK PROGRAMME

Area 1.2 - Task 1: Organic viticulture and wine processing

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Deliverable: D 5.8. **Proposal and recommendations for elaborating rules for organic wine in EU Regulation on organic production and labelling of organic products** (Commission Reg. EC 884/2008 based on Council Regulation EC 834/2007 repealing Regulation EEC 2092/91)”

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Introduction

This proposal for a regulatory framework for organic wine is based on work done in the ORWINE project, a European Research project focused on organic wine processing. The main objective of this project is to provide a scientific background for the development of an EU legislative framework for organic wine processing and labelling at the European level.

1 Scope of the report

As the project's final document, this report is a synthesis of outcomes in which scientific results are summarized and finalized for the use of policymakers. In other words, this report does not include a complete report of the scientific methodology used or the research results. That data is reported in depth in specific deliverables clearly indicated in the text. Here, only the main outcomes relevant to the regulatory purpose are summarized and adapted for regulatory use. In the most important areas for the regulation different scenarios have been developed, described and supported by scientific findings and stakeholder opinions, in order to allow decision makers to consider their decisions from all perspectives.

2 Project rationale

The project takes into account the following facts, identified as the proposal was being written:

- organic wine is an existing sector, with its own socio-economic importance, and must not be endangered through EU regulation;
- mainly private-label organizations with their own standards for organic wine have made substantial contributions to the current state of this sector in the last decades; the EU Commission should take their work and promotional efforts into account in developing new rules for organic wine;
- oenological research, low-input techniques developed over the last decade, and other innovations must be taken into account and combined with traditional knowledge;
- the legal definition of organic wine, necessary for the implementation of regulation, must take into account the current and future requirements and demands of all those involved, including not only producers but consumers and traders as well;

- wine production in the EU has a highly developed regulatory set, which organic wine must respect;
- organic wine is produced in many, very different parts of Europe, each with its own traditions. It is an important European product for the internal market as well as for export.

In order to reconcile the facts above with a scientific basis for the legal framework and achieve broad stakeholder support, the project will be divided into different work-packages, as shown in figure 1.

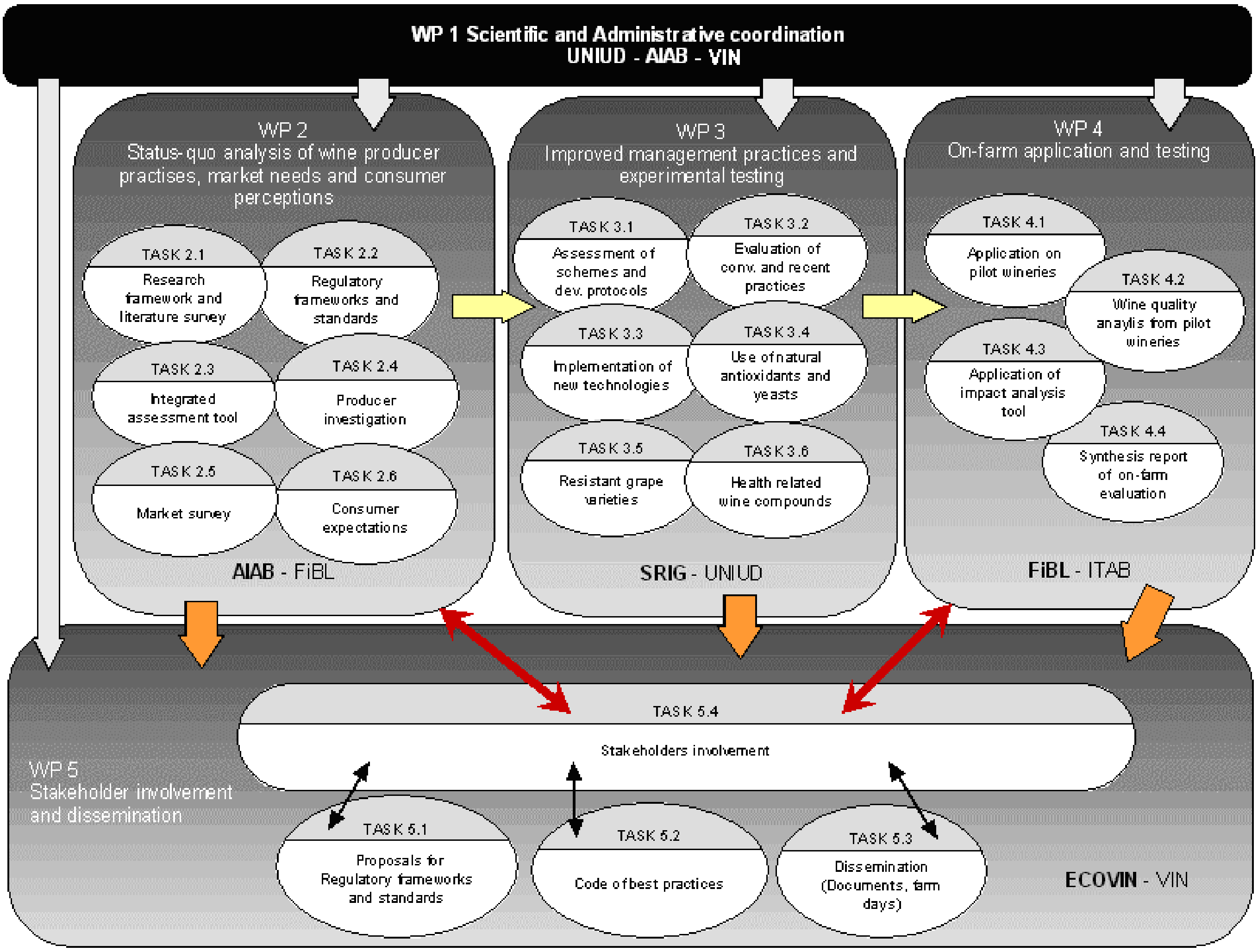
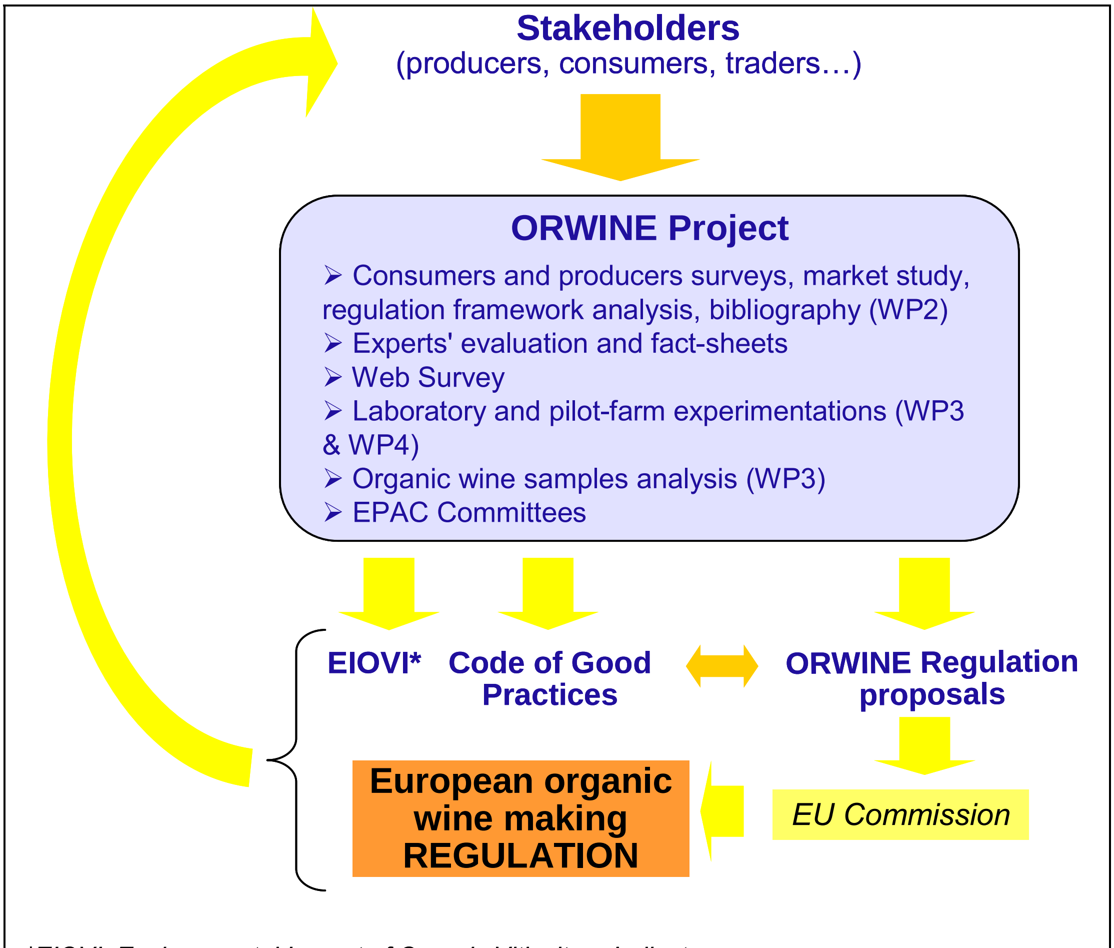


Figure 1: ORWINE project structure

The rationale flow of the project was as follows (see figure 2):

1. the current state of the art, including producer attitudes and demands, consumer and trader requests and expectations, and private-standard definitions have been structurally identified;

2. oenological research on innovative and traditional methods has been conducted in order to identify viable technical paths respectful of the organic concept;
3. technical winemaking protocols and strategies identified in a second step were applied at a select group of pilot farms in order to evaluate their applicability in different productive contexts and European regions;
4. many stakeholders have participated in various ways. Their opinions have been reported and included in the recommendations for a regulatory framework;
5. the code of good organic viticulture and winemaking practices has been developed as an accompanying and complementary tool to make applying the regulations easier through technical guidance.



*EIOVI: Environmental Impact of Organic Viticulture Indicator

Figure 2: Building the ORWINE contribution to the proposals for organic winemaking regulation

3 Sources of information

All findings reported in this document are based on results obtained by the ORWINE project (see Figure 1 and Annex 3: the list of all the deliverables of the project):

- scientific winemaking experimentation results from WP3 and WP4: Fitting conventional and recent practices to organic winemaking (Task 3.2). Implementing new technologies (Task 3.3). Optimizing the use of natural antioxidants and yeasts (Task 3.4). Resistant grape varieties (Task 3.5). Application and monitoring of recommended methods on pilot wineries (Task 4.1). Wine quality analysis through testing on pilot wineries (Task 4.2);
- stakeholder consultations in different countries: national and regional stakeholder forums; national workshops and farm days (Task 5.4);
- trader, producer and consumer survey results from WP2 (Task 2.4). Producer investigation about current oenological practices (Task 2.5). Market needs (Task 2.6). Consumer expectations;
- comparisons of national regulations and standards on organic winemaking: Research framework and literature survey (Task 2.1) and analysis of regulatory framework and standards (Task 2.2);
- expert evaluations and opinions. Experts from the EPAC (European Project Advisory Committee) were consulted during two meetings — in Stuttgart in 2007 and in Venice in 2008 — and were asked to give their opinion on ORWINE results and proposals;
- an expert consultation was organized to evaluate certain additives and processing aids, on the basis of 23 fact sheets summarizing the available technical data on those substances (see list of fact sheets in annex 2);
- a web-based stakeholder survey was conducted at the end of 2008, to complete other stakeholder consultations and collect as wide a range of opinions as possible, especially from organic wine producers, on the “hot issues” of the regulation proposals (use of additives and techniques, SO_2, enrichment, etc.).

4 Current definition of organic wine

There is currently no EU definition of organic wine, but there is a widespread basic concept that reflects the International Federation of Organic Agriculture Movement (IFOAM) definition of organic agriculture, including viticulture and winemaking, as a “holistic production management system that promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems" (IFOAM 2005).

This concept is translated into clear requirements in EC Reg. 834/07:

- organic wine is wine made exclusively from organically produced grapes;
- the organic winemaking process excludes the use of genetically modified organisms (GMOs) as well as additives or processing aids produced from genetically modified organisms.

More specifically, the guiding principles for processing in the above-mentioned regulation are also relevant for the process of winemaking. As stated in article 19, "organic processed products should be produced by the use of processing methods that guarantee that the organic integrity and vital qualities of the product are maintained through all stages of the production chain." Article 6 mentions "**specific principles applicable to processing of organic food**." In addition to the overall principles set out in article 4, the production of processed organic food shall be based on the following specific principles:

"(a) the production of organic food from organic agricultural ingredients, except where an ingredient is not available on the market in organic form;
(b) the restriction of the use of food additives, of non-organic ingredients with mainly technological and sensory functions and of micronutrients and processing aids, so that they are used to a minimum extent and only in case of essential technological need or for particular nutritional purposes;
(c) the exclusion of substances and processing methods that might be misleading regarding the true nature of the product;
(d) the processing of food with care, preferably with the use of biological, mechanical and physical methods."

Guided by these principles, the project strove for a more specific definition of organic wine, taking into consideration the demands, expectations and requirements of the various stakeholders.

4.1 What consumers expect from organic wines

According to a focus-group study (*D.2.7 Consumer expectations of organic wine – a qualitative consumer study*), most consumers, even connoisseurs of organic foods or wine, do not have a deep knowledge of winemaking. They nevertheless generally expect organic wine to be "healthy" and "authentic". Apart from discussing single additives and processing aids, consumers suggested three strategies for the setting of common organic-wine standards:

- general prohibition of all additives and processing aids that have negative impacts on human health and/or that can affect the taste of wines, thereby nullifying authenticity or naturalness;
- acceptance of a limited range of critical substances (such as sulphites) and techniques that are considered potentially dangerous for human health but are necessary to maintain the quality of wine; however, organic wines would be permitted lower levels of additives than conventional wines.

Consumer opinion on other additives and techniques is summarized in table 1.

Table 1: Consumer attitudes towards the use of single additives and processing aids in organic wine processing

Sulphites	Declined by the majority of consumers because of perceived risk; considered unhealthy and responsible for headaches; linked to bed taste and smell of wine; Accepted by a minority of participants, because of positive perception of the suppression of micro organisms and the current lack of any alternative for organic winemaking.
Enzymes	Lack of knowledge prevented several consumers from giving any judgement about their acceptance of enzymes in organic wine processing; Some consumers considered enzymes harmless, while others feared allergies and thus declined the use of enzymes in organic wine processing.
Selected yeasts	Mostly accepted by consumers, who perceived almost no risks.
Wood chips	Controversy among the focus group participants: - some accepted their use in organic wine processing, arguing that no health risks exist, that wood chips are a natural product, and that they reduced production costs; - others opposed their use for fear of impairing organic wine's authenticity and opening the door to the use of aromas and other additives in organic wine processing.
Gelatines	The majority declined gelatines, preferring a plant-based substitute.
Selected bacteria	Only a few statements and opinions; most were indifferent and excluded only genetically modified yeasts.

The majority of the consumers clearly expressed the need to be able to distinguish organic from conventional wines, which entails clear differences in production and easily identifiable labels.

4.2 Organic wine traders' opinions on organic winemaking regulation

A market study (D 2.4 *Analysis of markets needs)* involving a two-step survey of EU and International wine traders dealing with organic wine identified a strong demand for clear identification of organic winemaking.

All those interviewed expressed strong interest in organic wine. Turnover in organic wine sales was growing and the offered assortment expanding. The chief limiting factors for major growth remained lack of consumer knowledge and of market operators, especially retailers (none specialized in organic), for organic wines and organic farming. A related factor is the lack of global communication and marketing strategies for organic wines. A precise definition of organic wine would allow producers to make strong and clear claims for its promotion.

Market operators also point out the need to continue improving the sensorial quality of organic wines as well as their image (connected to a lack of communication).
A majority of operators preferred complete regulation, one that took into account both additives and technologies and existed within EU regulations on organic farming. As for the degree of autonomy of EU countries, they preferred a common EU regulation and certification, with no space for local or national derogations. For operators working with different countries, it would be preferable to refer to common EU rules, certification system and logo.

4.3 Oenological practices of organic wine producers

The attitudes, current skills, equipment and habits of organic wine producers, as well as their demands, were surveyed at several stages of the project and in several ways (D 2.5. *Applied technology, markets and production attitudes of organic wines producers*). In summary, it is possible to identify a general trend toward the recognition of the concept of minimum input but with wide national differences related to additive use and the techniques applied. While in Germany and Austria there is general support for the use of a wide range of additives, in Italy, Spain and parts of France there is a more restrictive vision of "what should be used/forbidden in organic wine," with enrichment and SO_2 use appearing as the most important issues.

All over the EU, organic cellars, even small ones, are generally well-equipped and have witnessed a significant rate of investment over the last 5 years. This suggests that the common view of organic wine producers as "small, simple and low-tech" enterprises does not represent the reality of the sector.

It is important to consider the extent of organic wine production in different countries. In 2006, the project's starting year, Italy was producing organic grapes on 34,000 ha, France on 19,000 ha, Spain on 16,000 ha, Germany on 2,800 ha and Austria on 2,500 ha. While the market for the first three countries is mainly export (in EU and outside), for Germany, Switzerland and Austria the market is almost exclusively domestic. In 2009 organic vineyards are expanding in all countries, especially in Spain, France, Austria, Germany and Central Europe (Hungary, the Czech Republic, etc.) with increasing export potential.

4.4 Expert opinion

The experts:

- helped formulate criteria for the evaluation of processing methods: a select list of practices was evaluated case by case by the expert of the project team;
- helped evaluate additives through fact sheets. Some specific microbiological preparations and the substances not actually allowed for organic processing were evaluated by experts (oenologists and researchers from the different countries of the ORWINE consortium) case by case against the general principles and criteria of organic food processing (articles 19 and 21 of EC Reg. 834/07). The substances were evaluated on the basis of fact sheets, with regard to the need for them in winemaking and for their respect of organic faming principles. (See the results of this evaluation in Annex 1);
- were consulted twice at EPAC committee meetings for opinions, advice and criticisms concerning ORWINE's work and results.

The experts were not asked for a definition of organic wine but only for advice/opinions on specific issues.

4.5 Some scientific background to clear up common misconceptions about organic wine

Organic wines are often indicted as of lower quality than conventional wines, especially in regard to content of certain microbial metabolites which can be correlated to effects on human health.

Ochratoxin A (OTA) and biogenic amines (BA) are examples of this kind of compound; ORWINE has tried to determine the presence of these contaminants in wines from organic viticulture through an analytical survey of wine samples collected during three international organic wine competitions.

Ochratoxin A seemed to be not a real problem for “organic winemaking”; only 10 of the 204 samples analyzed for this pollutant showed an OTA level higher than the current EU limit (2 µg/L – EC Reg. 123/2005). Moreover, these 10 wines all came from specific regions in the South of Italy. OTA risk seemed therefore to be a problem not for organic productions in general but for certain specific EU areas.

The question about biogenic amines seemed somewhat more problematic: according to the results of the ORWINE analytical survey, some of these compounds (e.g. histamine, tyramine and putrescine) were sometimes present in high concentration in the analyzed wines.

The levels of biogenic amines were not significantly correlated either with free or with total sulphur dioxide, but the risk connected to the presence of BA in wines increases in cases of incomplete malolactic fermentation, high pH and high volatile acidity, which in turn may cause problems for the management of alcoholic and malolactic fermentations..

The project's code of good organic viticulture and winemaking provides guidance on avoiding or diminishing these risks.

The detailed results of this topic are presented in the project deliverable 3.4: *“Report of monitoring activity on health related wine compounds”*.

5 Structure of the regulatory framework

As wine (from grapes) was excluded of the scope of the previous EU regulation on organic farming (Reg EEC 2092/91), there has never been a legal definition for organic wine at the European level. All surveys of stakeholders (producers, consumers and traders) clearly attest to the need to regulate not only grape production but also the processing phase. Such regulation would allow the identification of “organic wine” and not merely the current “wine from organic grapes”.

5.1 Where to regulate organic wines

A basic question for the regulation of organic winemaking is “where to regulate organic wine”. The options are:

- inside the new EC regulation 889/2008 on organic faming, as an amendment to annex VIII, linked to the positive list of additives and processing aids allowed in organic processing, or as a specific wine annex

or

- inside the wine CMO as specific “organic wine “ annex or chapter.

While the first public consultation was being conducted, the EU Commission debated the matter. In accordance with the opinion of the majority of organic producers, it was decided that organic wine would be regulated within the organic agriculture regulation (newly adopted EC Re. 834/07 and the implementing rules laid down in EC Reg 889/2008) and not within the "wine CMO" regulation. It should nevertheless be stated that the wine sector (CEEV and COPA-COGECA) opposed that approach and would prefer to have organic wine regulated within the CMO. Misinterpreting the proposal, their fear that organic wines will not fulfil all the conventional wine requirements stated in the CMO regulation. There is no doubt, however, that organic wines will first have to follow the general regulations on wines, and then the rules for organic winemaking, which must have clear links to the CMO.

5.2 What to regulate in organic wines

It is obvious that the EC Regulation on winemaking must respect the objectives and principles of organic production (as defined by art. 3 and art. 4 of Council Regulation 834/2007). According to articles 6 and 19 of new EC Reg. 834/2007, the general rules for organic food processing include "substances and techniques" among the items that should or could be regulated. A majority of consumers, producers and traders are clamouring for regulations that take into account both additives and techniques. So it seems more relevant and closer to what producers and consumers demand to propose a complete winemaking regulation including all the aspects of winemaking process (additives, techniques and labelling of specific aspects related to wine).

Producers who would like to have their wines certified under stricter rules than the EU regulation would still be able to do so, with national or regional private standards. In this way, specific label claims (e.g., "sulphite free", "obtained without the use of selected yeast") will probably be allowed under the CMO that enters into force in 2009.

5.3 How to regulate organic wines

The regulatory framework needs to allow organic production of all types of wine, every year and in all the viticulture regions of Europe. That is the regulatory approach of the current European regulation on organic farming: the same regulation everywhere for every farm type, even if the new regulation on organic production leaves room for regional/national adaptation/derogation. In organic processing the current regulation comprises basic principles (already mentioned above) and positive lists of the permissible additives and processing aids. Positive lists have been preferred to negative lists so far, but the new EU regulation on organic production allows both. Scientific research and stakeholder consultations suggest that the most appropriate way to regulate organic winemaking is a combination of **positive lists** for additives and processing aids considered as useful and compatible with the organic principles — with any necessary limits on those considered essential but not totally acceptable (e.g., SO_2) — and a negative list of techniques not compatible with the organic principles

The negative list for techniques is preferred because it does not preclude the testing or implementation of innovations in organic processing while permitting prohibition of the few techniques that can hamper the production's integrity (respectful relationship between grape and the wine obtained). In order to identify which additives (with which limitations), processing aids and techniques are acceptable and useful in organic winemaking, a three-year oenological research program and a broad stakeholder consultation were launched in 2008.

In case of exceptional weather conditions, certain national or regional adaptations could be temporally permitted, with the agreement of (all) the EU member states, as commonly occurs within the wine CMO regulation.

5.4 Private standards and national regulations

As wine from grapes (but not from other fruit) was excluded from the scope of EEC Reg. 2092/91, organic wine-growers have developed specific approaches for processing their wines in ways they consider as compliant with organic-farming principles. These private initiatives in the producing countries have taken the form of standards more restrictive than the legal requirements for conventional wine, with limits on the use of additives and technical processes at all steps of wine processing, from grape picking to wine bottling and storage. They were developed by producer groups (Germany, France, Austria), organic-farming associations connected with certifiers (Austria, Germany, Greece, Italy, Switzerland), certifiers (Spain) and representative national platforms for the organic wine sector (Spain, Switzerland). In this last case, the participation of local and national public authorities gives quite an official status to the standards. They are mandatory for all organic winemakers in Switzerland, whereas in Spain the organic producers are free to follow or ignore the national standards.
Limits have also been introduced in the consuming European countries. For example, one concerns SO_2 rates in wine at consumption (UK, NL).

The comparison of these standards (*D 2.2 Analysis of regulatory framework and standards applied to organic winemaking in Europe*) was mainly focused on additives and processing aids, although techniques and general considerations were also taken into account. Substances reported in the private standards can be divided in two categories:

- ingredients, additives and processing aids, which are already allowed for fruit wines in Annex VI of EU Regulation (EEC) 2092/91 (taken up in Annex VIII of EC Reg. 889/2008) and which are mentioned by most of the private standards.
- substances (additives and processing aids) that are not mentioned in the organic processing positive list (often simply because they are used exclusively for wine, which is so far outside the scope of the regulation) and are either allowed by most of private standards or not mentioned or forbidden. These “new substances” have been evaluated by a staff of experts, and fact sheets have been compiled for each of them.

The following table (2) reports the different statuses of ingredients and additives used in winemaking as mentioned in national and private standards for organic winemaking (see Deliverable 2.2). It is an overview of the existing situation and served as one of the starting points for the discussion of substances to be considered as compliant with the organic concept. All the additives and ingredients presented in the following table are allowed by the CMO (EU Reg. 1493/1999).

Table 2: Additives status regarding standards and European organic regulation

	Allowed in Annex VII of EC Reg. 889/2008	**Not mentioned in Annex VII of EC Reg. 889/2008**
Allowed by all private standards	**SO_2 gas**, enzyme preparations**, ascorbic acid**, **selected micro-organisms (if non GM origin): dry yeasts, lactic acid bacteria and fresh lees**, casein, isinglass and egg-white albumin, **potassium carbonates**, **tartaric acid** (L+-), citric acid, **bentonite**, perlite, diatomaceous earth, charcoal**,** **tannins**, silicon dioxide (gel or colloidal solution), inert gases (argon**, O_2,** N_2, **CO_2**)	**Ammonium sulphate**
Allowed by at least 1 private standard	**Potassium meta-bisulphite**, potassium alginate**,** **gelatine, arabic** gum, potassium bitartrate , Ca carbonates, **cellulose, betaglucanase enzymes**	**Di-ammonium-hydrogen-phosphate** , di-ammonium sulphite, **yeast ghosts**, **metatartaric acid** , aleppo pine resin, potassium-hydrogen tartrate, double calcium malate and tartrate salt, **copper sulphate** , potassium caseinate, **thiamine**
Not mentioned in any private standards		**Plant proteins**, **yeast mannoproteins**, urease enzymes, copper citrate
Not mentioned or forbidden by at least 1 standard		**Wood chips, lysozyme**
Forbidden by all private standards		**Sorbic acid**, potassium ferrocyanide , **dimethyl dicarbonate,** calcium phytate, **PVPP**

In bold letters are the additives tested during WP3 and WP4, or for which a fact sheet has been written.

6 Main regulatory topics and ORWINE findings

A statement often made by producers as well as consumers and other stakeholders is that "producing organic wines is a complete process which starts in the vineyard and ends in the bottle." In other words, prevention is essential, and the first step to produce organic wine is to successfully manage the organic vineyard in order to obtain best quality grapes and avoid as far as possible the use of additives during the winemaking. The majority of stakeholders and producers emphasize prevention and limiting the "manipulation" of grapes between the harvest and the press (especially for white wines).

In the cellar, the principle concerning the use of inputs has to be the same as in the vineyard: as little as possible and only if necessary, and if all other the preventive means have been exhausted.

Nevertheless, it is common knowledge — and supported by evidence reported in the producer survey and summarized in Project Deliverable D.2.5 *("Applied technology, markets and production attitudes of organic wines producers")* — that weather conditions often do not allow to produce only "perfect grapes". In the cellar, the organic wine maker needs to apply strategies that respect the organic concept but include some additives and/or techniques.

6.1 The approach

6.1.1 Zero-input approach

The trader and producer surveys, conducted within the ORWINE project, show a widespread need for a stronger organic wine identity, which must be easily understandable by the average consumer. From 3% (Germany) to 26% (Spain and Portugal) of survey respondents asked for zero-input regulation, or organic winemaking without the use of any additives and processing aids, particularly SO_2 (see figure 3, below).

Zero-input regulation similar to that applied in the United States, for instance, might expose a significant number of European producers — in some regions and some years — to unacceptable levels of risk. With a zero-input approach, it would not be possible to produce high-quality organic wines every year, and such a policy risks discouraging producers who would like to convert their farm to organic-wine production.

6.1.2 The positive- and negative-lists approach

It is a common understanding that in organic winemaking the use of substances potentially harmful to human health should in principle be avoided. At the same time, scientific evidence and the common experience of producers show that at the present state of the art it is impossible to produce high-quality organic wine in a large range of qualities and cellar systems without the addition of some additives. So the aim is to allow certain oenological substances (with limits if necessary) that would help ensure good wine production, while still respecting organic principles in their choice and in the amount allowed. For example it is clearly possible to limit SO_2 use, as the majority of the private standards on organic winemaking allow a use of SO_2 significantly lower than the CMO. This shows the willingness of organic wine producers to reduce sulphite content in organic wines as much as possible.

On this basis, the principle used was to limit the use of certain additives (positive list) and/or practices (negative list) in comparison with conventional wines. It is supported by the results of the project web survey conducted in autumn 2008. Participants were asked to choose between three options:

- zero-input regulation for organic winemaking;
- limits on the use of certain additives and practices;
- no distinction between organic and conventional winemaking.

A large majority of 63% (Spain & Portugal) to 89% (France) agreed with the principle of limiting the use of certain substances or practices: i.e., having specific and stricter rules for organic winemaking (see figure 3). These limits should differentiate organic wine-making from conventional practices.

With this approach, the use of an additive not listed in the positive list, the use of a practice listed in the negative list, or non-respect for eventual limits on some additives would disqualify a wine from organic certification and from receiving the mention “organic wine”. At the same time the mention “wines from organic grapes” would not be used, in conformity with EU organic regulation for other products (e.g., juices, jams), where the use of organic ingredients but the lack of respect of the organic processing rules does not allow any “organic” claim on the label.

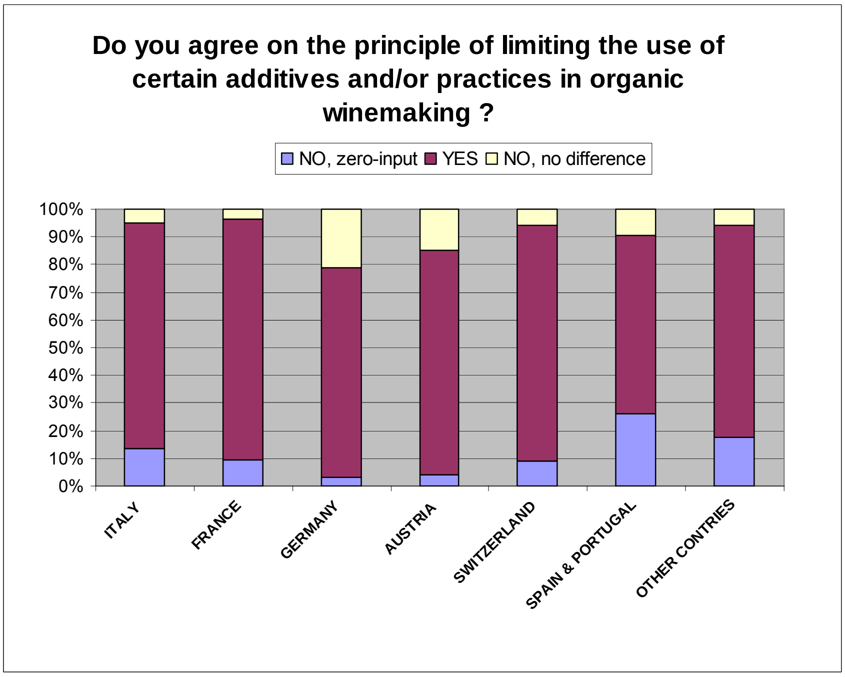


Figure 3: Outcome from the web survey on the principle of limiting the use of certain additives and techniques.

6.1.3 The “no limitation” approach

A small minority of 4% (France) to 21% (Germany) of survey participants indicated their opposition to the principle of limiting the additives and/or the techniques and asked for regulation that would not distinguish between organic and conventional wines. This would essentially maintain the status quo: only grape production could be considered organic, and organic winemaking would use the same techniques and abide by the same rules as conventional winemaking.

6.1.4 The need for local/annual variation/derogation

The new EU Council Reg. 834/2007 allows, in Flexibility article 22, a local and time-limited derogation under specific circumstances. An internal working group has checked the possibilities for derogation and flexibility in the use of additives and different regional limits, comparing them with the zonal derogation in the general wine regulation for enrichment or acidification. Thorough study revealed no option or possibility in EU Reg. (EC) 834/2007 for a regional and/or general derogation. It only makes possible a time-limited derogation under specific exceptions to the production rules. These exceptions to the production rules laid down in Chapters 1 to 4 of the article 22 shall be kept to a minimum and shall, where appropriate, be limited in time and may only be provided for in the following cases:

(a) where they are necessary in order to ensure that organic production can be initiated or maintained on holdings confronted with weather, geographical or structural constraints;

(c) where they are necessary to ensure access to ingredients of agricultural origin when such ingredients are not available on the market in organic form;

(e) where they are necessary with regard to the use of specific products and substances in processing, as referred to in article 19 (2)(b), in order to ensure production of well-established food products in organic form;

(f) where temporary measures are necessary in order to allow organic production to continue or recommence after a catastrophe.

The conditions for derogation are very strict and clear and limited by the Commission. This means that this article does not allow for a zonal/regional derogation or flexibility in comparison with the CMO rules, as proposed by the German stakeholders. Nevertheless, it must be considered that for sulphite use the CMO already grants a derogation system, although only for specific Member States and in years of particularly adverse weather, that allows for the use of an extra 40mg/l of sulphite beyond the CMO limit of the specific wine category. This derogation system could include organic producers and be reformulated to better consider their status.

For this purpose article 47 in the EU Commission Regulation (EC) 889/2008 could be amended with an additional subchapter related to temporary derogation for wine-processing, in particular for sulphite use in the case of extreme weather. It could allow a Member State to request, for the whole country or for a region that limits in the new EU rules on the use of sulphites for organic wines can be exceptionally raised if it can document a clear need for specific wine types. The raised limits would anyhow respect the official COM limits. In such cases:

a) a derogation given within the CMO to a country would apply in the same way to organic wine producers;
b) a Member State would be dealing with catastrophic circumstances affecting only organic wine producers, through extreme pressure and grape damage by disease (e.g., botrytis), and the problem would be insoluble by any permissible means of organic winemaking.

The procedure for such exceptional derogations, which have to be scientifically documented, would be the same as for the other flexibility rules under article 22 of EU Reg (EC) 834/2007.

6.2 Additives and processing aids

The identification of oenological substances to be allowed or forbidden is essential to regulation, because it will determine the whole process of organic winemaking and will have potential consequences on the type of wine produced, its taste, its preservation and its production cost as well as the type of market where it will be sold. Eventually, it will influence the development of European organic viticulture.

6.2.1 Evaluation of oenological substances: proposal of a positive list for organic winemaking

To achieve an overview of the acceptance of the oenological substances from all possible points of view, they have been evaluated by various means:

- expert evaluation based on fact sheets;
- web survey;
- studies from WP2: consumer and producer surveys, comparison of private standards;
- stakeholder consultation;
- WP3 and WP4 experimental results.

The results reached through these multiple criteria and complementary approaches are presented in the following tables. A colour code is used to express the degree of estimated acceptability of each substance with regard to each type of evaluation: dark green for “positive evaluation”, green for “mainly positive evaluation”, yellow for “mainly negative evaluation” and orange for “negative evaluation”. Those substances whose use remains controversial (pros=cons) are represented in white.

Comments on eventual restrictions or specific conditions of use have been added.

Those substances whose use is conditioned by limits or restrictions are considered to have a “mainly negative” evaluation (yellow colour code).

For this evaluation the oenological substances have been divided in four categories.

- Substances already allowed for organic food processing (table 3). Almost all the substances already allowed by the EU Council Regulation 834/07 and EC Reg. 889/2008 on organic production received a positive evaluation and could be allowed for organic winemaking. Nevertheless, some of the products of this list are potentially allergenic, and the question of their use and/or limitation for organic winemaking must be asked. Such is the case for sulphites (see chapter 6.3) and products made from milk and eggs (see below: “case of allergenic substances”).
- Substances currently not allowed for organic food processing, mainly because (1) they are specific to winemaking, and (2) until 1 January 2009 wines were excluded from the European organic regulation but allowed by most private standards (table 4). Concerning

the substances of this category, there is general agreement to allow **thiamine hydrochloride, copper sulphate, yeast cell walls** (yeasts ghosts) and **di-ammonium phosphate**. The following three substances have received at least one negative evaluation:

  - **Ammonium sulphate**, because according to laboratory experiments of WP3 in white and rosé wines, it increases the production of SO_2, which is unfavourable in the context of SO_2 limitation
  - **Di-ammonium sulphite**: this product can be used for preservation (source of sulphite) but also as a yeast nutrient (source of nitrogen). It has been negatively evaluated by the experts because of this ambiguity of action. The other point against this product is that until now it has not really been considered in private standards: allowed only in the Bioland standard, forbidden by FNIVAB and Demeter France, not mentioned in the others.
  - **Metatartaric acid** has been negatively evaluated by the experts. It is allowed by Bio Suisse, all German private standards, Bio Austria and AIAB; it is forbidden by DIO, FNIVAB and Demeter; and it is not mentioned by the other standards.

- <u>Substances not allowed in organic agriculture or by the majority of private standards</u> (table 5). Some substances in this category, like sorbic acid, DMDC, potassium ferrocyanide and calcium phytate, were clearly rejected, whereas others, like PVPP and lysozyme (see bellow “case of lysozyme), were controversial. Plant proteins (if they don’t contain allergenic elements like gluten), yeast mannoproteins and oak wood chips have received mainly positive evaluations, although the use of wood chips was controversial in the web survey and in consumer opinion. Aleppo pine resins are accepted for Greek Retsina wines.

  The use of ion-exchange resins to modify wine and must pH is generally not accepted, but it is essential for the production of organic rectified concentrated musts.

  For DL tartaric acid (racemat), allyl isothiocyanate and calcium alginates, the information gathered, does not allow us to express an opinion.

- <u>Substances that are still not allowed in Europe</u> but that could be soon allowed by EU regulation on wines (table 6). Concerning these new substances, which could soon be allowed by European regulation on wines, the ORWINE consortium lacks evaluations and enough information for a proposal.

Table 3: Substances already allowed for organic processing

🟩 positive	▧ mainly positive	⬜ pros=cons	🟨 mainly negative	🟧 negative	▒ no evaluation

	Expert evaluation	Web survey	Stakeholder opinion	Fact sheets + technical data	Consumer survey (WP2)	Comparison of standards (WP2)	Laboratory experiments (WP3)	Pilot-farm experiments (WP4)	Comments
Gaseous SO_2	🟩	🟨 reduction requested	🟨 reduction requested by a majority of countries	🟨 allergenic	🟧 reduction / elimination	🟨 limitations in some standards	🟨 reduction possible	🟨 reduction possible	reduction is technically possible and required by a majority of (not all) stakeholders
P- Metabisulphite,	🟩	🟨 reduction requested	🟨 reduction requested by a majority of countries	🟨 allergenic	🟧 reduction / elimination	🟨 limitations in some standards	🟨 reduction possible	🟨 reduction possible	reduction is technically possible and required by a majority of (not all) stakeholders
Selected commercialised yeast	▒	🟩	🟩	▒	▒	🟩	🟩 useful; avoid high SO_2 productive strain	🟩 useful	No GM. Avoid high SO_2 productive strain
Selected lactic bacteria	▒	🟩	🟩	▒	▧	🟩	🟩 useful	🟩 useful	No GM
Pectolitic enzymes	▒	🟩	🟩	▒	▧	🟩	▒	▒	No GM
Betaglucanases enzymes	⬜ pros = cons	▧	▒	🟩	▧	🟩	▒	▒	No GM
Urease enzymes	▒	▒	▒	▒	▒	▒	▒	▒	No GM
Ascorbic acid (250 mg/l)	▒	🟩	▒	▒	▒	🟩 if natural origins	🟩 useful	▧	No GM
Arabic gum (Acacia)	▒	🟩	▒	▒	▒	▧ if natural origins	▒	▒	
Egg-white (ovalbumine)	▒	🟩	▒	🟨 allergenic	▒	🟩 organic egg-white requested in some standards	▒	▒	Allergenic
Lactalbumin	▒	🟩	▒	🟨 allergenic	▒	🟨 allowed only as skimmed milk in one standard	▒	▒	Allergenic
Casein	▒	🟩	▒	🟨 allergenic	▒	🟩	▒	▒	Allergenic
P-caseinates	🟩	🟩	▒	🟨 allergenic	▒	▧	▒	▒	
Isinglass	▒	🟩	▒	▒	▒	🟩	▒	▒	
Gelatin	▒	🟩	▒	🟩	🟨	🟩	▒	▒	Not a good image for consumers, but no technical reason to forbid it
P-bitartrate	▒	🟩	▒	▒	▒	▧	▒	▒	
P-bicarbonate	🟩	🟩	▒	🟩	▒	🟩	▒	▒	

	Expert evaluation	Web survey	Stakeholder opinion	Fact sheets + technical data	Consumer survey (WP2)	Comparison of standards (WP2)	Laboratory experiments (WP3)	Pilot-farm experiments (WP4)	Comments
Ca-carbonate	▨	🟩	▨	▨	▨	▧	▨	▨	
Tartaric acid	▨	🟩	▨	▨	▨	🟩	▧	▨	Have to be of agricultural origin (mostly coming from grapes) EU reg. 1622/2000. Only allowed in Zone C. Does it exist in organic?
Citric acid (1g/l)	▨	🟩	▨	▨	▨	🟩 from natural or non-GM origins	▨	▨	
Potassium alginate	▨	🟩	▨	▨	▨	▧ only for sparkling wines	▨	▨	
Bentonite	▨	🟩	▨	🟩	▨	🟩 if pure (no contaminants)	▨	▨	
Kaolin	▨	🟩	▨	▨	▨	▨	▨	▨	Not used
Charcoal	▨	🟩	▨	▨	▨	🟩 only for white wines	▨	▨	
Silicon dioxide as gel or colloidal	▨	🟩	▨	▨	▨	🟩	▨	▨	
Carbon Dioxide CO_2	▨	🟩	▨	▨	▨	🟩	▧	▧	
Nitrogen	▨	🟩	▨	▨	▨	🟩	▧	▧	
Argon	▨	🟩	▨	▨	▨	🟩	▨	▨	
Diatomaceous earth	▨	🟩	▨	▨	▨	🟩	▨	▨	
Perlite	▨	🟩	▨	▨	▨	🟩	▨	▨	
Cellulose	▨	🟩	▨	🟩	▨	🟩	▨	▨	
Wood tannins	▨	▧	▧ Some stakeholders against its use in some countries	▨	▨	🟩	🟩 useful	▨	Tannins are mostly allowed by all private standards, but no differentiation between wood or grape tannins
Grape tannins	▨	🟩	🟩	▨	▨	🟩	▧	▨	Tannins are mostly allowed by all private standards, but no differentiation between wood or grape tannins
Caramel (to reinforce the colour of liquors)	▨	▨	▨	▨	▨	🟩 Only for liquors	▨	▨	If organic

Table 4: Substances not allowed in organic but allowed by most standards

🟩	🟢	⬜	🟨	🟧	▨
positive	mainly positive	pros=cons	mainly negative	negative	no evaluation

	Expert evaluation	Web survey	Stakeholder opinion	Fact sheets + technical data	Consumers survey (WP2)	Comparison of standards (WP2)	Laboratory experiments (WP3)	Pilot-farm experiments (WP4)	Comments
Thiamine hydrochloride (0,6 mg/l)	🟩	🟩	🟩	🟩	▨	🟢	🟩 useful	🟩	
Di-Ammonium-hydrogenphosphate (1 g/l)	🟩	🟩	🟩	🟩	▨	🟢 With restrictions in some standards	🟩 useful	🟩	
Ammonium sulphate (1 gl)	🟩	🟩	🟩	▨	▨	🟢 With restrictions in some standards	🟨 increases SO_2 and H_2S production	▨	According to WP3 results, better to use Di-ammonium-hydrogen phosphate, to avoid production of SO_2
Di-ammonium sulphite (0,2 g/l)	🟨	🟢	🟢	▨	▨	🟨 Allowed only by one standard, not mentioned or forbidden in the others	▨	▨	
Yeasts cells walls (40 g/hl)	🟩	🟩	pros=cons	🟩	▨	🟢	🟩 useful	▨	
Metartaric acid (in wine,100 mg/l)	🟨	🟩	pros=cons	🟩	▨	🟢	▨	▨	
Copper sulphate (in wine, 1mg/l)	🟩	🟩	pros=cons	🟩	▨	🟢 With restrictions in some standards	▨	▨	

Table 5: Substances forbidden in organic and by the majority of standards or not mentioned

🟩 positive	🟢 mainly positive	⬜ pros=cons	🟨 mainly negative	🟧 negative	▨ no evaluation

	Expert evaluation	Web survey	Stakeholder opinion	Fact sheets + technical data	Consumers survey (WP2)	Comparison of standards (WP2)	Laboratory experiments (WP3)	Pilot-farm experiments (WP4)	Comments
Sorbic acid as P. Sorbate	🟧	🟧	🟧	🟧	▨	🟧 forbidden at least once or not mentioned	▨	▨	
Potassium ferrocyanide	▨	🟧	🟧	▨	▨	🟧 forbidden at least once or not mentioned	▨	▨	
Dimethyl dicarbonate (DMDC)	🟧	🟧	🟧	🟧	▨	🟧 forbidden at least once or not mentioned	▨	▨	
Calcium phytate (in wine, 8 g/hl)	▨	🟨	🟧	▨	▨	🟧 forbidden at least once or not mentioned	▨	▨	
Calcium tartrate (in wine, 200 g/hl)	▨	🟢	🟧	▨	▨	🟧 forbidden at least once or not mentioned	▨	▨	
PVPP (80 g/hl)	🟨	🟨	🟨	🟢	▨	🟧 forbidden at least once or not mentioned	▨	▨	Synthetic substance can complete but not replace casein or gelatine action. Totally neutral.
Lysozyme (500 mg/l)	🟨	🟨	⬜ pros=cons	🟨 allergenic	▨	🟧 forbidden at least once or not mentioned	🟩 useful to reduce the use of SO_2	🟩 useful to reduce the use of SO_2	Not positively evaluated, but allows reduction in use of SO2, especially for wines without malolactic fermentation. Guarantee required that not produced by GMO or from organic egg-white
Plant proteins	🟩	🟩	🟩	🟨 allergenic if contains gluten	▨	▨	▨	▨	No allergenic if gluten free, can replace some other allergenic fining agents
Yeast mannoproteins	🟩	🟢	🟢	🟩	▨	▨	▨	▨	Remains in wine. Not really essential.
Wood chips	🟢	⬜ pros=cons	🟢	🟩	⬜ pros=cons	▨	▨	▨	Controversial evaluation, always, almost 50% pro and 50% con!
Aleppo pine resin	▨	🟩	▨	▨	▨	▨ Allowed in Greek standard, not mentioned in the others	▨	▨	Only for Greek Retsina wines

	Expert evaluation	Web survey	Stakeholder opinion	Fact sheets + technical data	Consumers survey (WP2)	Comparison of standards (WP2)	Laboratory experiments (WP3)	Pilot-farm experiments (WP4)	Comments
Ion-exchange resins	▨	pros=cons	only for RCM[1]-production	▨	▨	▨	▨	▨	Shouldn't be allowed to modify wine or must pH, **but should be allowed for RCM making**
DL-tartaric acid (Racemat)	▨	▨	▨	▨	▨	▨	▨	▨	No evaluation, no information
Allyl isothiocyanate	▨	▨	▨	▨	▨	▨	▨	▨	No evaluation, no information, only allowed in Italy with restrictions
Ca alginate	▨	▨	▨	▨	▨	▨	▨	▨	No evaluation, no information

Table 6: Substances not allowed by current European regulation on wines, but to be allowed in new regulation

positive	mainly positive	pros=cons	mainly negative	negative	no evaluation

	Expert evaluation	Web survey	Stakeholder opinion	Fact sheets + technical data	Consumers survey (WP2)	Comparison of standards (WP2)	Laboratory experiments (WP3)	Pilot-farm experiments (WP4)	Comments
Malic (L-)acid	▨	🟨	▨	▨	▨	▨	▨	▨	
DL-Malic acid	▨	▨	▨	▨	▨	▨	▨	▨	No evaluation, no information
Lactic acid	▨	🟨	▨	▨	▨	▨	▨	▨	
Copper citrate (20 g/hl)	▨	pros=cons	positive appreciation from German stakeholders, no evaluation from the other countries	better than copper sulphate with lower copper content	▨	▨	▨	▨	
Polyvinylimidazole	▨	▨	▨	▨	▨	▨	▨	▨	No evaluation, no information,
Carboxy-methyl-cellulose	▨	▨	▨	▨	▨	▨	▨	▨	No evaluation, no information

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[1] RCM: Rectified Concentrated Musts

The table (7) below presents a summary of the additives and processing aids evaluation. These have been divided in two categories: those which received only positive evaluations, and those with at least one negative evaluation (allergenic proprieties have been considered as a negative evaluation).

Table 7: Summary of oenological substances evaluation

	Positive evaluation	**At least one negative evaluation**
Already allowed for organic processing	Selected yeasts and bacteria, enzymes, ascorbic acid, P-alginates, arabic gum, isinglass, P-tartrate, P-bicarbonates, Ca-carbonates, tartaric acid, citric acid, bentonite, charcoal, CO_2, argon, N_2, diathomeous earth, perlite, cellulose, wood and grapes tannins, caramel	SO_2 gas, gelatine, P-metabisulphite, casein, egg-white (ovalbumin), lactalbumin, P-caseinates
Not allowed in organic but allowed by most of the standards	thiamine, copper sulphate, di-ammonium-hydrogen-phosphate, yeast ghosts	Ammonium sulphate, di-ammonium sulphite, metatartaric acid
Not allowed in organic and by the majority of standards or not mentioned	Ca-tartrate, plants proteins, yeasts mannoproteins, wooden chips, aleppo pine resin	Sorbic acid, P-ferrocyanide, DMDC, Ca-phytate, PVPP, lysozyme, plants proteins, ions exchange resins
Still not allowed by European regulation on wines, but will be allowed in the new regulation		Malic acid, lactic acid

6.2.2 Focus on oenological substances included in experimental work during ORWINE project and/or whose use is controversial

Allergenic substances from eggs and milk

The use of additives derived from milk and eggs (fining agents like casein, ovalbumin, etc.), because of their allergenic potential, will be reported on the label in the near future, when EU regulation on potentially allergenic food additives makes it compulsory. They could to a certain extent be replaced by other fining agents, like gelatine, isinglass or plant proteins, since their use is negatively perceived by consumers and market actors.

Considerations of their origin and production methods: because they are obtained from milk and eggs, their origin is acceptable (they could even come from organic production), but they are potentially allergenic and if used as fining agents during winemaking can potentially introduce allergenic proprieties into wines. However, recent scientific work suggests this may not be so, as their allergenic potential is extremely low compared with that of the raw material they come from. For now, it is considered that there remains a risk.

No research was done on these substances during ORWINE Project, as they lie outside the main scope. They were nevertheless considered in the market study and during stakeholder discussions.

Producer acceptance: these substances are commonly used and well accepted by all producers, because of their natural origins and traditional use.

Private standards: with the exception of lactalbumin, they are allowed without restrictions by most of standards. Some standards require organic origins.

Consumer acceptance: in general, consumers have little knowledge of the specific substances used in winemaking and negatively perceive all allergenic substances reported on the label. Buyer reactions can therefore be problematic.

Ammonium sulphate and di-ammonium hydrogen-phosphate

Considerations on origin and production methods (fact sheets): nothing contrary to the organic concept in the origin. (Fact sheet available for di-ammonium hydrogen-phosphate)

WP3 scientific work: in some cases, depending on the yeast strain, the use of ammonium sulphate can increase the level of SO_2. This was demonstrated by research trials of IFV with production of white and rosé wines. An increase of total SO_2 is possible if ammonium sulphate is used to improve the level of nitrogen that can be easily assimilated in grape must, but the formation of SO_2 from sulphate is strongly dependent on yeast strain.

Di-ammonium hydrogen-phosphate was used in different WP3 protocols to improve the behaviour of alcoholic fermentation; the correct management of selected yeast nutrition (e.g., nitrogen supplementation during inoculation) can be useful in reducing the risk of stuck and sluggish fermentations. Although nitrogen supplementation alone seemed inadequate to completely replace sulphites before alcoholic fermentation, a well-acclimatized selected yeast strain seemed very useful for this purpose.

WP4 application in pilot farms: When musts lack nitrogen, on cold or altered maceration or when the grapes are affected by botrytis, di-ammonium phosphates can contribute to regular fermentation and help prevent a lack of frankness even at the fermenting stage, as was confirmed in the ORWINE trials. Used on most of the common yeast stems, di-ammonium and phosphates can contribute to lower the total SO_2 content.

In Switzerland, although many producers would like to use them, the Bio-Suisse association retracted ammonium-phosphates from the list of authorised additives for white and red wine; it is only allowed in sparkling wines, to reliably achieve the sparkling. However, if it is generally authorised in organic vinification in Europe, it would be necessary to examine production methods and ensure the quality of the primary material.

The WP4 pilot wineries having preferred di-ammonium phosphate, so no ammonium-sulphate was used in WP4, as it increases the natural production of SO_2 by yeasts (see results of WP3).

Producer acceptance: both products are accepted and used by organic-wine producers; the use of one product or the other is more a matter of habit than a technical matter.

Private standards: ammonium sulphate is allowed by a majority of the private standards, not mentioned in Swiss and German and Austrian standards, and forbidden by Demeter.

D-ammonium sulphate is allowed by ECOVIN, IFOAM and Italian and Greek private standards, but not by other considered standards. It is forbidden by Demeter and FNIVAB.

For both products, the allowance is often subject to restrictions.

Consumer acceptance: no specific mention.

Selected yeasts and bacteria

Considerations on origin and production methods: nothing contrary to the organic concept either in the origin or in the production methods as long as GM origin is avoided.

WP3 scientific work conducted by SRIG, IFV and UNIUD demonstrates that through the choice of the most adequate strain of selected yeast it is possible to manage the fermentation process easily, avoiding the dominance of high SO_2 producing strains. Research work also demonstrated that the choice of the strain must be decided by wine type and grape/must composition.

WP4 application in pilot farms demonstrated that it is easily applicable in any kind of winery and that costs are acceptable. On all implemented trial protocols that used selected dry yeasts, there was no mention of “fermentative off-flavours”. The selected yeasts ensured regular alcoholic fermentation with a high rate of sugar transformation to alcohol. However, their influence on flavour and taste in compared with that of wild yeasts has been debated for more than 30 years, especially their effects on varietal typicity and on *terroir* expression.

Producer acceptance: their use is widespread among organic wine producers except for small groups, which prefer to use spontaneous fermentation (some biodynamic groups and many French producers).

Private standards: allowed by all considered standards.

Consumer acceptance: widely accepted.

Ascorbic acid

Considerations on origin and production methods (fact sheet): nothing contrary to the organic concept either in the origin or in production methods as long as GM origin is avoided. This product is commonly used in organic food processing. Few standards allow only ascorbic acid sources derived from natural origin but not used for wine (e.g., Bio Suisse).

WP3 scientific work: Ascorbic acid proved to be a powerful tool to partially replace sulphites, especially in the early steps of winemaking. Normally this additive is used in addition to sulphur dioxide (to scavenge the peroxides issues from ascorbic acid oxidation); added to the must during crushing, this mixture contributes to generate a reductive environment, which protects the juice itself from oxidations (hyper-reductive winemaking). In ORWINE trials the use of sulphites on the grape must was compared with that of a mix of ascorbic acid and grape tannins; the results demonstrated that such a mix of alternative antioxidants can successfully replace SO_2 before alcoholic fermentation, even for varieties (e.g., Sauvignon) whose aroma is particularly sensitive to the effects of oxygen.

WP4 application in pilot farms: From the point of view of hygiene, ascorbic acid is compatible with organic production. Its important reduction capacity helps to lower doses of SO_2. Used on red wine, it also allows a reduction of polyphenols which could possibly lead to a loss of colour. In the framework of WP4, it was implemented in association with tannins on white wine (too few cases to draw clear conclusions).

Producer acceptance: widely accepted by the organic wine producers

Private standards: allowed by all private standards except Demeter and Bio Suisse

Consumer acceptance: no specific mention

Tartaric acid

Considerations on origin and production methods: according to the EU reg. 1622/2000, the tartaric acid must be of agricultural origin (mostly grapes). It is only allowed in Zone C.

WP3 scientific work: Research trials conducted by the French partner IFV demonstrated that the addition of tartaric acid can decrease pH levels in must and wine. This can prevent or reduce the development of undesired microbial contamination. Furthermore the effect of sulphites is higher at lower pH values. Tartaric acid can be added to musts and wines (respecting the limits required by the European regulation on wines) only in certain geographic areas. The acidification has to be managed carefully to avoid negative taste modifications. In some red wines, for example, it increases of the “hardness” of the tannins.

WP4 application in pilot farms: no application in the pilot-farm network.

Producer acceptance: accepted by a majority of producers.

Private standards: allowed by all private standards, not mentioned by German and Austrian standards, because these countries are not in the zone where it is allowed.

Consumer acceptance: no specific mention.

Tannins (grape and wood)

Considerations on origin and production methods: nothing contrary to the organic concept either in the origin or in production methods. There is no fact sheet on this product, as it is widely known and comprises relatively simple substances.

WP3 scientific work: Grape tannins were tested in WP3 to replace SO_2 in hyper-reductive technology; in combination with ascorbic acid, these additives proved to be a suitable alternative to sulphur dioxide, preserving the aromatic characters of certain oxygen sensitive varieties (e.g., Sauvignon). Moreover, research studies from other research units indicated that tannins can have a certain scavenging effect on some sulphur off-flavours.

WP4 application in pilot farms: The addition of tannins is not a common practice. It can be reserved to certain vintages for red musts rich in proteins, so long as these proteins don't precipitate the natural tannins, which would mean a loss of quality. Under organic aspects, it would be preferable to use tannins from grape seeds and adapted maceration methods. In the framework of WP4, it was implemented in association with ascorbic acid on white wine (too few cases to draw clear conclusions).

Producer acceptance: mainly accepted, on the web survey a near-majority in some countries (France, Austria, et al.) rejected the wood tannins.

Private standards: allowed by German, FNIVAB, Spanish and IFOAM standards, and not mentioned in the others. In the standards there is no differentiation between grapes and wood tannins.

Consumer acceptance: no specific mention.

Thiamine

Thiamine as Thiamine-hydrochloride (vitamin B_1) is used as a yeasts nutrient.

Considerations on origin and production methods (fact sheet): nothing contrary to the organic concept either in the origin or in production methods as long as GM origin is avoided

WP3 scientific work: thiamine is a fundamental vitamin for the fermenting yeasts, because it is a co-factor for different enzymes. Thiamine was used in various WP3 protocols for optimizing the activity of selected yeasts. Its addition is useful to reduce the concentration of some SO_2-binding compounds (e.g., acetaldehyde, pyruvic and α-ketoglutaric acid), increasing the ratio between free and total SO_2, and optimizing the activity of this additive.

WP4 application in pilot farms: thiamine can significantly influence the metabolism of the yeasts. Theoretically thiamine has the advantage of limiting the formation of cetonic compounds by bonding strongly to SO_2 where there is a relevant fraction of free, and thus "active", SO_2. In the preceding tests in WP3 thiamine confirmed its capacity to reduce the combined SO_2. It is difficult to estimate the efficacy of this vitamin when it is applied in the musts of different WP4-protocols for red and white wine. This is because it was associated to the *pieds de cuve* or the extracts of the yeasts, respectively.

Producer acceptance: mainly well accepted by a majority of producers.

Private standards: allowed by AIAB, Greeks and German standards, not mentioned in the others, forbidden in French standards.

Consumer acceptance: no specific mention.

Yeasts cells walls

Considerations on its origin and production methods (fact sheet): nothing contrary to the organic concept either in the origin or in production methods as long as GM origin is avoided.

WP3 scientific work: Yeast cell walls are useful tools to manage yeasts and lactic acid bacteria growth and prevent stuck and sluggish fermentations. These products are a source of assimilable nitrogen and sterols, and they can also reduce the presence of toxic metabolites, such as C_6 -C_{10} free fatty acids. They have been used in different WP3 protocols to increase selected yeasts dominance.

WP4 application in pilot farms: no application tested in the pilot-farms.

Producer acceptance: accepted by a majority of producers.

Private standards: allowed by Italians and Germans private standards, not mentioned in the other, forbidden in French standards.

Consumer acceptance: no specific mention.

Lysozyme

The preservative lysozyme is extracted from egg whites, and is already widely used in the conventional food industry. However, lysozyme is presently not admitted in the organic food sector. The use of lysozyme may help in avoid/limit bacterial contamination in high pH juices and wines, where SO_2 is less effective, and so reducing its use.

Considerations on its origin and production methods (fact sheets): nothing contrary to the organic concept either in the origin or in production methods as long as GM origin is avoided. Nevertheless, this product, of egg origin, is potentially allergenic, and it will be compulsory to mention its use on the label.

WP3 scientific work demonstrated that it is a useful additive in replacing SO_2 in the control of lactic acid bacteria pollution, especially in wines with high pH, where sulphur dioxide is less effective.

Because different stakeholders do not agree as regards its use in organic winemaking, the addition of lysozyme during yeast rehydration, to reduce lactic acid bacteria contamination, was tested as a low-impact use winemaking strategy (e.g., a low amount of lysozyme was added only to the part of juice which is used for yeasts acclimatization – *pied de cuve* – and not to the whole lot of must); results demonstrated that this practice can increase the dominance of selected yeasts, even when sulphites are avoided before alcoholic fermentation.

WP4 application in pilot farms demonstrated that it is easily applicable, in any kind of winery, and costs are acceptable. The bacteria-reducing effect of lysozyme is well known, and it could be a (partial) replacement for SO_2. In contrast to SO_2, lysozyme increases its activity with rising pH. The enzyme could therefore be an interesting additive. In the last ten years, there has been a general tendency to increase pH in the musts. However, this enzyme has also disadvantages: because its radical “lyzes” the gram-positive bacteria, its use would require a rather interventionist oenological practice.

Indeed, if lysozyme reduces bacterial diversity, the use of lactic bacteria would become imperative. Also, lysozyme remains in traces in the liquid and has to be bound (e.g., with bentonite) to prevent a possible clouding of the wine. Accepted for conventional winemaking since August 2001, lysozyme could provide an alternative to reduce the use of SO_2 against oxidation and for stabilisation in organic wines. Because lysozyme is extracted from egg whites, a specific declaration on the label will probably be required.

Producer acceptance: in countries where it is not commonly used, because of the kind of grape/wine obtained (i.e., Germany and partially in France), its use is not welcomed by producers. Producers in Southern Europe that have had the chance to try it have widely accepted it. As it is a relatively new product, many producers do not really know it or how to use it.

Private standards: mentioned only by the Italian ones.

Consumer acceptance: no specific mention.

Possible scenarios: two scenarios can be proposed.

- to allow lysozyme with no further restrictions besides CMO ones;
- not to allow lysozyme.

Pro the allowance of lysozyme: experimentation showed the ability of this product to reduce the use of SO_2. It could be a very useful tool in the step wise approach of the limitation of SO_2 amounts.

Cons the allowance of lysozyme: it is a potentially allergenic product. Its use increases the amount of bentonite needed for protein-stabilisation with the possibility of quality loss. Some doubts remain on its production process (use of GMO). Nevertheless, it is possible to produce lysozyme from organic eggs.

6.2.3 Point of discussion on additives and processing aids

During meetings with stakeholders (especially producers and market operators), three recurring issues were discussed:

- **The origin and production process of oenological substances**

In order to evaluate a substance to be used for organic processing it is essential to know its origin and how it was produced (no GMO origins, synthetic or natural, social issues, risks of contaminants or chemical residues, etc.).
For oenological substances, the fact sheets compiled give some data on theses issues but cannot be sufficient for all products, as some information on the production process are not easily assessable and sometimes under IPR protection. Even for the substances already allowed for organic processing (e.g., yeasts, citric acid, ascorbic acid) some questions remain about their origins and method of production.

Organic wine stakeholders (especially producers) expressed a need for reliable information on the origin and production process of oenological substances to inform their decision.

- **Use of oenological substances or use of mechanical or thermal practices/methods**

Some mechanical or thermal practices help avoid or reduce the addition of some additives (like SO_2), but they can be costly in terms of energy, can induce greenhouse gas emissions, can sometimes be difficult to implement, and can sometimes be ill adapted to small cellars. For example, flash-pasteurization can be used in certain cases to lower the level of SO_2, but it cannot totally replace the use of SO_2. And some producers, considering it too invasive, prefer to avoid the technique and use more SO_2. Another example: the use of cellulose gums for tartaric stabilization helps avoid thermal methods, which are very energy demanding, but cellulose gum production needs chemical products. The allowance or not of a certain technique must therefore be connected to the allowance of specific additives (and the limits imposed on these) used for the same purpose. Even if the organic regulation on food processing were to recommend mechanical or thermal methods, this principle would have to be moderated for winemaking, because techniques only permit a reduction in the use of some additives (particularly SO_2), not their complete replacement.

- **Which additives for which type of wines?**

It is very well known that some additives or processing aids can modify or even totally change the taste of a wine. A segment of producers think that they have to adapt their wines to the demands of the market. They elaborate “technological wines” (more like industrial processing), with regular and standardized quality, for which they need suitable additives, processing aids and techniques.

Another group of producers prefer to make wine expressing the *terroir*, with as few additives, processing aids and techniques as possible. In the second option, the taste and the quality of the wines will depend heavily on the year's weather, with very few opportunities to eventually “correct” a flaw with the use of an additive or a technique. This variability should be explained to the customer, who should in turn understand and accept it.

Because of the diversity of the market and consumer demand, both strategies could be relevant. Nevertheless, needs concerning additives, processing aids and techniques differ totally. Between the two strategies and the future regulation of winemaking, one could favour one strategy or the other for the additives and/or the techniques allowed and the limits imposed.

6.3 SO_2 issue (proposed scenarios)

The use of sulphite is one of the main issues of ORWINE project. From the data collected during the consumer and the trader surveys (see part 4), it proved to be an important issue. SO_2 was intensively discussed during national and regional stakeholder meetings and the two web surveys of producers. It was the focus for experimental work conducted in laboratory and in the pilot-farm network. The results of these projects suggested different scenarios as well as the advantages and disadvantages of each. The main results are summarized below and served as a basis for developing scenarios.

6.3.1 Reminders about trader and consumer demands

Consumers ask for “authentic” and healthy wines. They mainly consider that organic wines should have SO_2 levels lower than conventional wines and contain fewer additives. Several consumers don’t have a very good image of organic wines and demand that wines be good before being organic.

Concerning the question of additives in general and SO_2 in particular, the opinion of the market operators is particularly divided on aging wines. Those who are looking for traditional wines wish for a regulation that reduces the number of additives and also the level of SO_2. Traders of more classical aging wines, or importers (exporters) of high quantities of organic wines to be transported or stored a long time, insist on the importance of some additives, especially SO_2 for the quality and the preservation of wines, fearing the risk of using low levels of SO_2.

Nevertheless, a majority of traders underline the importance of having a clear differentiation between organic and conventional, and the SO_2 amount can participate to this differentiation. Non-

European traders, who are importing European organic wines from origins and producers who face international markets, point out the importance of having a common European regulation and certification on organic wines.

6.3.2 The producers' position

Web surveys results

According to the data obtained in ORWINE project, it is possible to produce dry white and red wines of good quality with a final total SO_2 content much below the EU limit for conventional wines.

Web survey participants were therefore asked to indicate which limit would be acceptable for them in the Organic Wine Regulation for each category of wines. The levels of SO_2 are expressed in percentages of the actual CMO limits.

For dry white wines, a large majority of answers from Italy, France, Spain and Portugal, as well as parts of Switzerland, proposes to limit the total SO_2 in dry white wines to 50% of the maximum allowed for conventional wines (105 mg/l instead of 210 mg/l).

Germany and part of Austria have a very different position, with 70% for Germany and 45% for Austria of the survey participants asking to keep the same SO_2 limits for organic and conventional wines (Figure 4).

100% (210 mg/l)
90% (189 mg/l)
80% (168 mg/l)
70% (147 mg/l)
60% (126 mg/l
50% (105 mg/l)
40% (84 mg/l)
30% (63 mg/l)
20% (42 mg/l)
< 10 mg/l

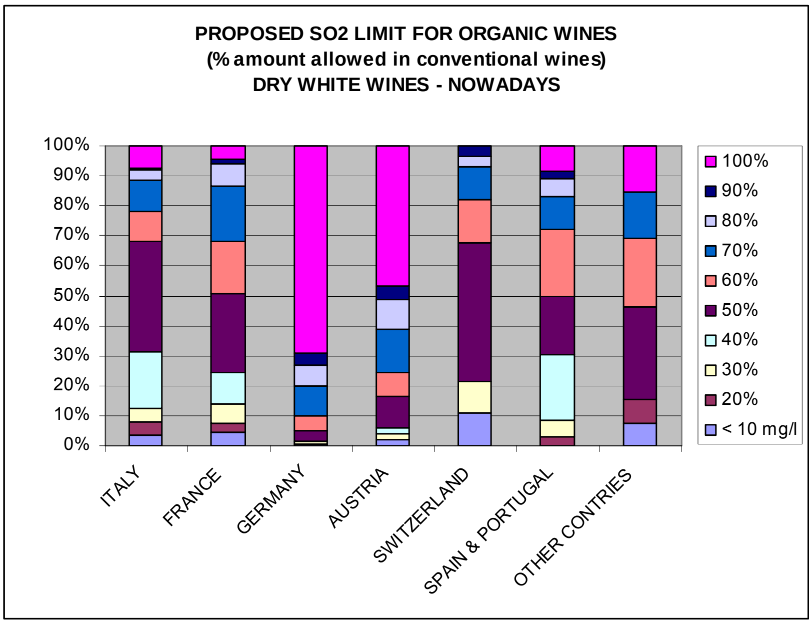
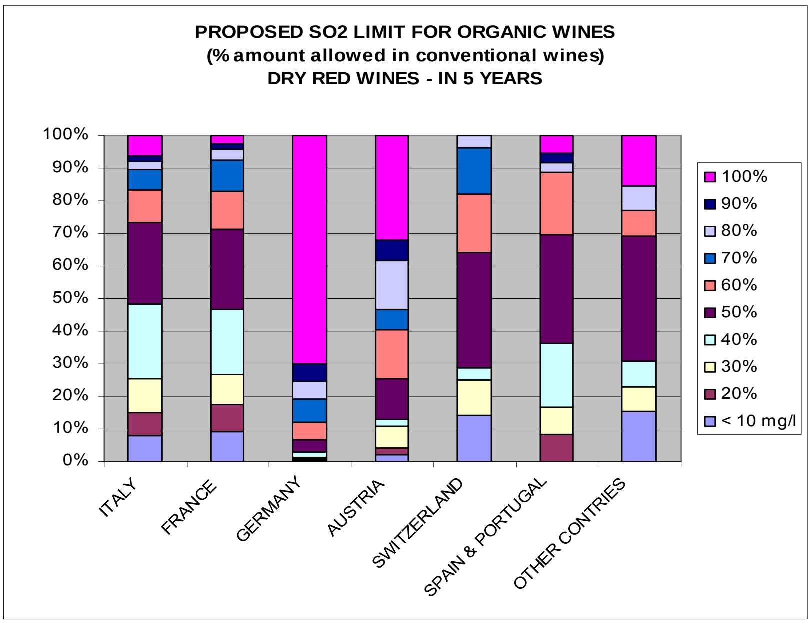


Figure 4: Proposed SO_2 *limits for dry white wines*

For dry red wines, the results are almost the same, aside Germany and Austria, there is a large consensus on the immediate SO_2 limitation to 50% of the conventional wine for red wines.

Austria expresses a percentage close to the majority, which asks for SO_2 reduction by 30%. For Germans even a 30% reduction would be accepted only by 15% of the interviewees. (Figure 5)



100% (160 mg/l)
90% (144 mg/l)
80% (128 mg/l)
70% (112 mg/l)
60% (96 mg/l
50% (80 mg/l)
40% (64 mg/l)
30% (48 mg/l)
20% (32 mg/l)
< 10 mg/l

Figure 5: Proposed SO_2 *limits for dry red wines*

For sweet white wines, the 50% reduction is immediately applicable only in Italy and partly Switzerland for the majority of the sample. 40% reduction would be a more consensual rule. Germany and, partially, Austria show the same opinion here as in other categories.

For sweet red wines, the proposal appears more prudent: 50% reduction (or more) has the majority only in Italy and “Other countries”. We observe a larger consensus on 40% reduction (or higher) in France, Spain and Portugal and other countries. This last proposal of 40% reduction hardly reaches 27% consensus in Austria and 10% in Germany.

Discussion of web-survey results

The proposal of 50% reduction for dry wines and 40% reduction for sweet wines expressed by a majority of web-survey participants, except Germans and Austrians, seems to be really ambitious, especially for sweet wines. Producers answering the survey are focused on their own production and probably do not consider the situation of their colleagues. Most European producers try to reduce SO_2 amounts significantly (often with success), but here they might have overestimated their capacity to reach this goal every year and for all of their wines, and undervalue the potential consequences: no organic certification in case of SO_2 rate above the limit.

On the other hand, producers certainly felt freer to express themselves in the web survey than during a meeting where they could be influenced by the other participants or feel uncomfortable to express their own opinion.

As for Germany, 100% of German organic producers answered this web survey, so there is an indisputable consensus against any SO_2 limitations.

Stakeholder opinion

In France, the majority of producers agree to the strict regulation and limitation of SO_2, but being aware, they have to apply the regulation every year and that could lose their certification in case of non-compliance with this regulation, they mainly propose a reduction of maximum 20% or 30%. Although a majority of producers are already below these limits, they prefer to have “breathing room” in case of bad harvesting conditions or bad grape quality. Even if they do not need high levels of SO_2 for their own wines, because of the nature of their wines and their weather, they are aware that the future common regulation should allow all European producers to make organic wines. The majority of producers use very few additives, and more than 50% of them use indigenous yeasts. In case of drastic reduction (40% and more), many producers stated that they would have to use other additives and perhaps selected yeasts. A large majority prefer to have limits be stricter on additives than on SO_2. At the national level a workgroup organized by INAO (Institut National de l’Origine et de la Qualité) on organic wines proposed a positive list for oenological substances but no limits (stricter than CMO limits) of SO_2 amounts. This proposal was validated by the national wine committee and the national organic farming committee.

German stakeholders are completely against any limits on SO_2 amounts beyond those of the CMO. The results of stakeholder discussions are the same as the web survey. The following alternatives were discussed by the German stakeholders as scenarios to avoid limits on $SO_{2,}$ but no decisions have been taken; they remain proposals for further discussion:

- mandatory declaration. In case of no SO_2 limits in comparison with conventional wines, it should be mandatory for organic wines to declare the final SO_2 content at bottling on the label;
- average SO_2 level per cellar or wine-type with the possibility to have some wines with a higher amount of SO_2;
- splitting of SO_2 levels per wine-growing zone in accordance with enrichment and de-acidification / acidification.

In Italy the opinions reported during producers’ meetings were very consistent with the position build up with the web survey. The large majority of producers is in favour of drastic reduction (50%) of SO_2 use, and a significant group even supports the zero-input approach (no additives at all). They support such a position on the basis of two facts:

- they already use low amounts of SO_2 and are confident they can lower it further through the application of appropriate techniques;
- if they want to face the market (national, EU and international) successfully they need, besides a good product, a clear distinction from their competitor (conventional wine).

The opinion of Greek producers is similar to that of Italian ones, because both have the same motivations.

The Swiss producers expressed opinions similar to the French producers, with an acceptable limit of SO_2 from 20% to 30% of current CMO limits.

The Spanish stakeholders agree on a reduction of around 30% of the current CMO. This reduction has to be progressive and in agreement with the other European producing countries.

The ORWINE project also organized two meetings of the EPAC (European Project Advisory Committee), where prominent stakeholders from organic wine sector — consumers associations, farmers unions, environmental associations, Member States representatives, etc. — expressed their opinions on the project's content and proposals. For the majority of the issues raised during EPAC meetings, the national positions described above were confirmed with two further specific points of view deserving attention:

- German traders (exclusively dealing with organic wines) requiring a clear and significant difference between organic and conventional wines in the processing phase as an essential marketing tool;
- conventional wine union (but including organic producers) strongly supporting the 0 approach.

Discussion on these results

It is interesting to note that, while German and Italian producers were consistent in the web survey and during the stakeholder meeting, French, Spanish and Swiss producers were not, being stricter in the web survey than during the discussions at the meetings. Possible explanations include the influence people can have on one another during meetings and the tendency not to disagree publicly with the few leaders who express themselves. On the other hand, the discussions gave participants a deeper understanding and led them to take into account elements they wouldn’t have considered by they own.

During the stakeholder meetings, the consumer demand was also discussed. On the one hand, a majority would like to have as little SO_2 as possible and asked at least for a limitation. A few consumers even favoured sulphite-free organic wines. On the other hand, many consumers still have a bad image of the sensorial qualities of organic wines and want wines which suit their taste. The producers have to deal with this apparent contradiction: how to improve the sensorial qualities and image of their wines while at the same time reducing SO_2 levels and the use of potentially harmful (allergenic) additives? Nowadays, the quality of organic wines is very much improved, their diversity is increasing and many famous wineries are now working organically, so several stakeholders in the different countries expressed the view that the organic wine sector have to be careful not to stop this development through excessively drastic SO_2 limits without due preparation and alternatives. They insist on the need to have the technical tools to both preserve the sensorial qualities of their wines and answer to the increasing consumer demand for healthier and more natural wines.

6.3.3 Laboratory experiments (outcomes from WP3)

At the beginning of ORWINE's scientific activity, a survey on the composition of organic wines competing for several national and international awards were performed by ORWINE partners (University of Udine, Italy, and State Research Institute of Geisenheim, Germany) and SO_2 levels were monitored. 1.014 samples from different European countries were collected and analyzed. The results showed that almost all the analyzed wines had a total SO_2 level 20% or even 30% lower than the current EU limits (considering different wine categories: red, white, sweet and dry wines). Similar results are in agreement with those from the producer survey as well as from the analysis of current private standards. The preliminary survey offered the basis for setting up the scientific plan of research for the following three vintages

The aim of most of experiments performed in laboratories (WP3) and in the pilot-farms (WP4) was to test different tools to reduce the amounts of SO_2 during the overall winemaking process. These tools were the use of other additives like lysozyme, or ascorbic acid, and/or the use of alternative practices such as those related to oxygen management (hyper-oxygenation, and hyper-reduction), flash-pasteurization and cross-flow filtration. Optimization of the use of selected yeasts and lactic bacteria cultures were also considered (e.g., co-inoculation yeasts – lactic bacteria; use of the technique of *pied de cuve* for yeast acclimatization). The contribution of different yeasts strains to SO_2 final rates was also evaluated.

To reach the goal of winemaking with lower SO_2 amounts and improved quality, it is possible to work on three different ways, simultaneously or not (Figure 6).

All the details of the laboratory experiments and results are presented in the project deliverable D 3.6: "*Improved management practices in winemaking and experimental results*".

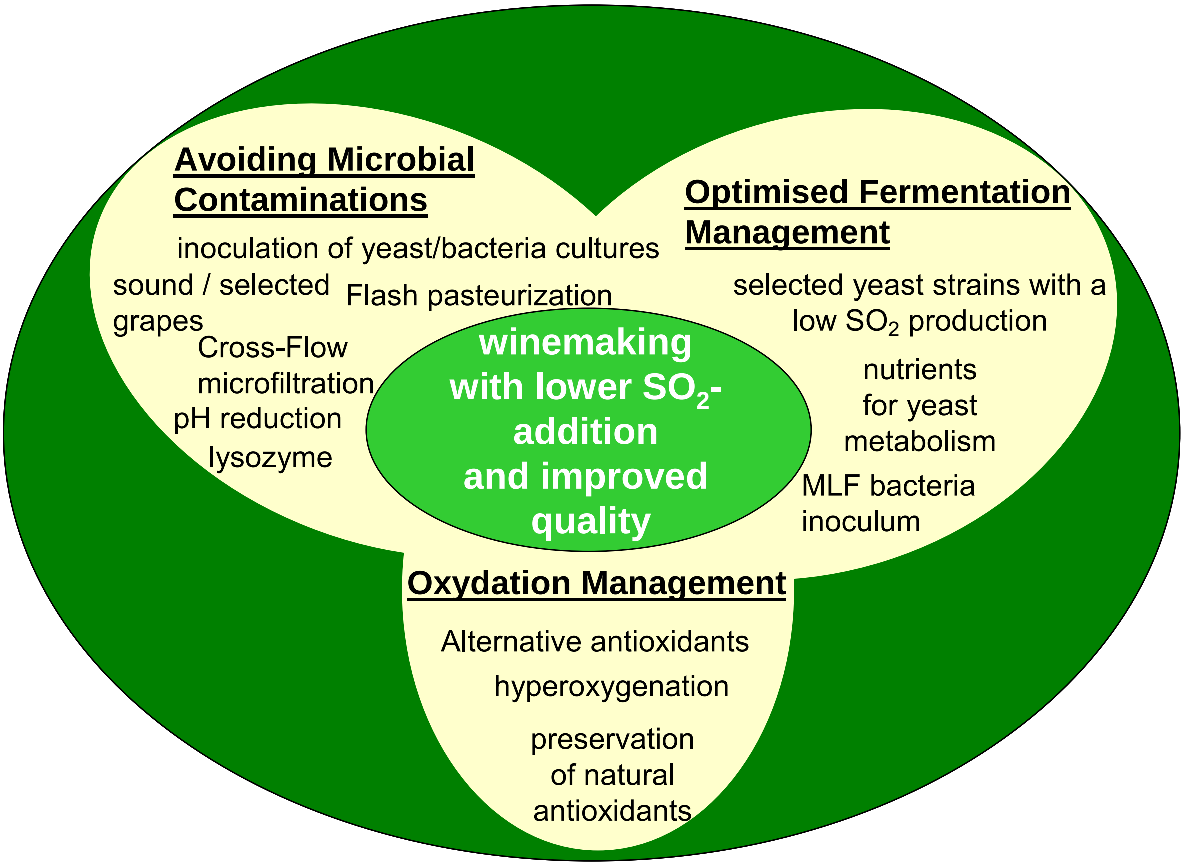


Figure 6: Winemaking strategies with lower SO_2 addition and improved quality.

(Source: SRIG, research area of WP3 in ORWINE Project)

6.3.3.1 Optimised Fermentation management by use of selected yeast strains with low SO_2 production and yeast nutrients

Commercial wine yeast strains showed different fermentation behaviour and important differences in SO_2 production by the grape variety. But some yeast strains also consistently produced more SO_2 in all situations. Figure 7, below, shows the SO_2 production of 22 commercial yeast strains used in Europe. Numbers 1 to 21 were recommended by the yeast producers as low SO_2 producers. Number 22 is a reference strain with a higher SO_2 production. The fermentations were performed with 2007 Riesling must, which was pasteurized in order to eliminate any undesired micro-organisms. The fermentation temperature was 18°C; the inoculation dosage was 30 g/hL pure dried yeast. Rehydration was done by water (35°C) for 25 minutes. The results show mainly two groups of yeast strains. One group produced under 10 mg/L total SO_2. The other group produced between 10 and 20 mg/L total SO_2. Only one yeast strain reached a concentration of 57 mg/L of total SO_2. These results show that there is a large amount of selected yeast strains available, which permit a SO_2 reducing strategy during fermentation.

The addition of both ammonium and thiamine can help optimize fermentation and avoiding sluggish fermentation, which varies by must composition.

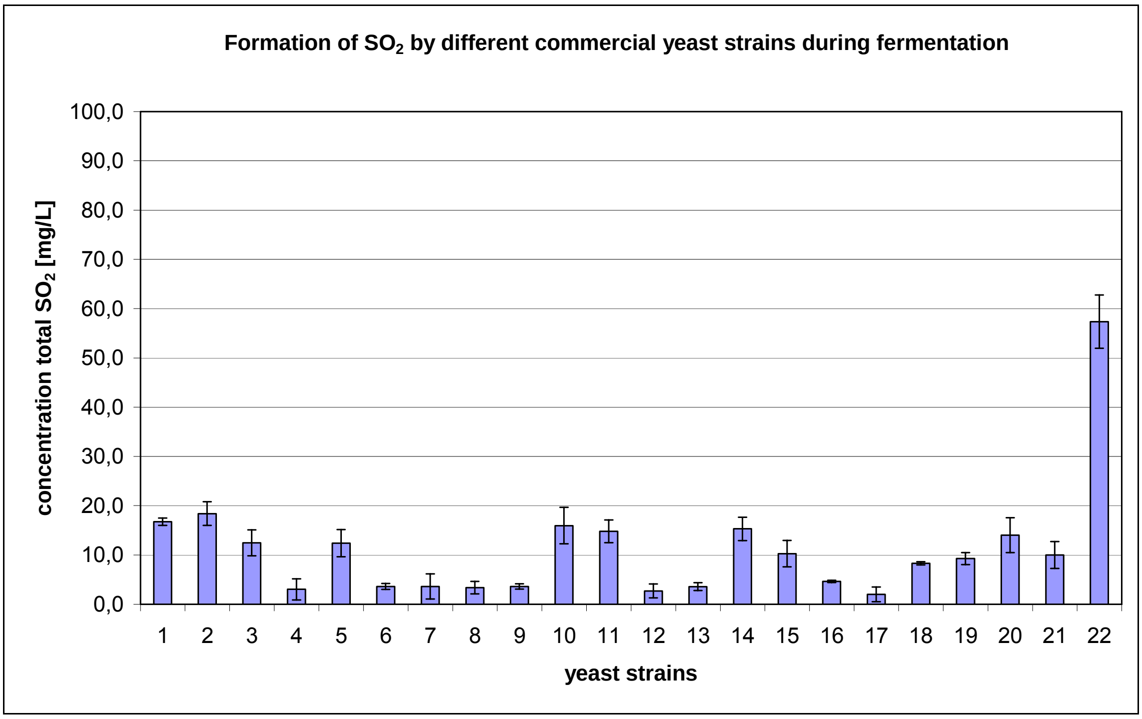


Figure 7: Production of SO_2 by 22 commercial yeast strains during fermentation. Mean value of the triplicate. Bars show the standard deviation. (Source: SRIG)

The type of yeast nutrient can also influence SO_2 production, depending on the yeast strain. The addition of ammonium sulphate can increase the final rate of SO_2. Therefore it might be better not to recommend the addition of ammonium sulphate; it would be preferable to use di-ammonium-hydrogen-phosphate in order to avoid SO_2 production, in case of a yeast strain able to produce SO_2 from the SO_4. Figure 8 shows the effect of two different yeast strains on SO_2 production. NT112 strain produces more SO_2 than L4882 strain. The SO_4 coming from ammonium sulphate can be used to produce more SO_2 in addition to natural occurring SO_4 L4882 strain seems unable to use SO_4 to produce SO_2 in appreciable amounts.

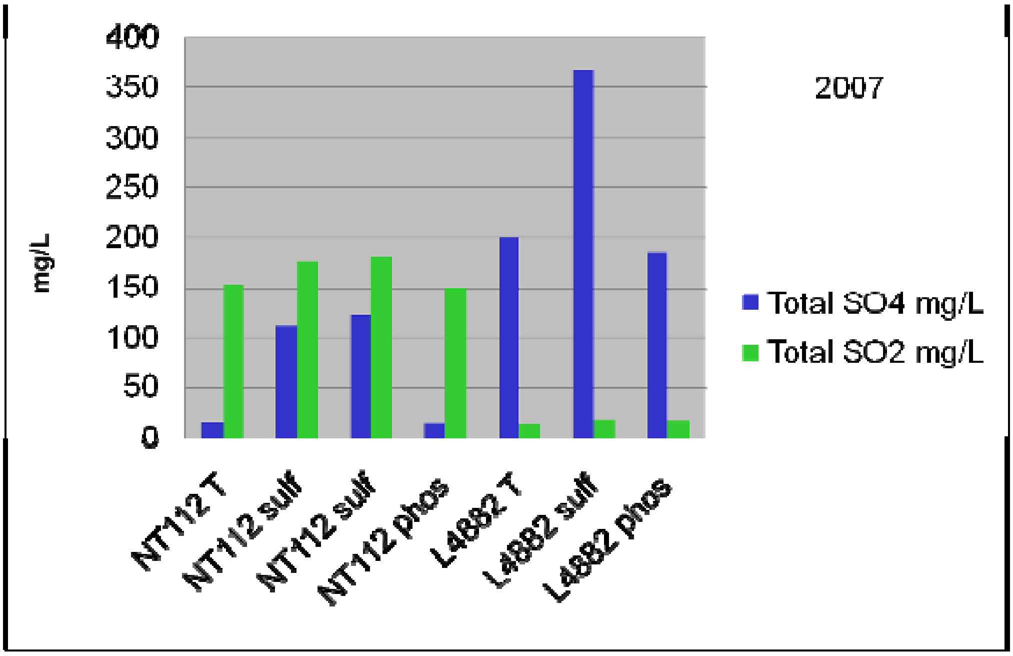


Figure 8: Influence of yeast different strain and yeast nutrient on SO_2 production Chardonnay fermented with different fermentation activators (thiamine = T, di-ammonium-hydrogen-phosphate = phos and ammonium sulphate = sulf). Two yeasts with high (NT112) and low (L4882) producing capacity of "natural SO_2 ". Winemaking without SO_2 before the end of alcoholic fermentation. (Source: IFV)

Besides having a positive effect on the fermentation course, nutrients can also lower the need for sulphur dioxide (SO_2) by reducing SO_2 binding compounds. Many carbonyl compounds besides acetaldehyde can act as a binding partner for SO_2 in the wine. The higher the total concentration of binding compounds, the lower the amount of active free SO_2 in the final wine at a given addition of sulphur dioxide.

Concerning the nutritional composition of the must, thiamine plays a key role in the formation of SO_2-binding compounds such as acetaldehyde, pyruvate and 2-ketoglutarate. Certain factors, like heat treatment of the must or Botrytis activity on the grapes, can lower the natural concentration of thiamine in the must. Figure 8bis shows the effect of the addition of nutrients (ammonium and thiamine) on the concentration of SO_2-binding compounds in a pasteurized Riesling must after alcoholic fermentation.

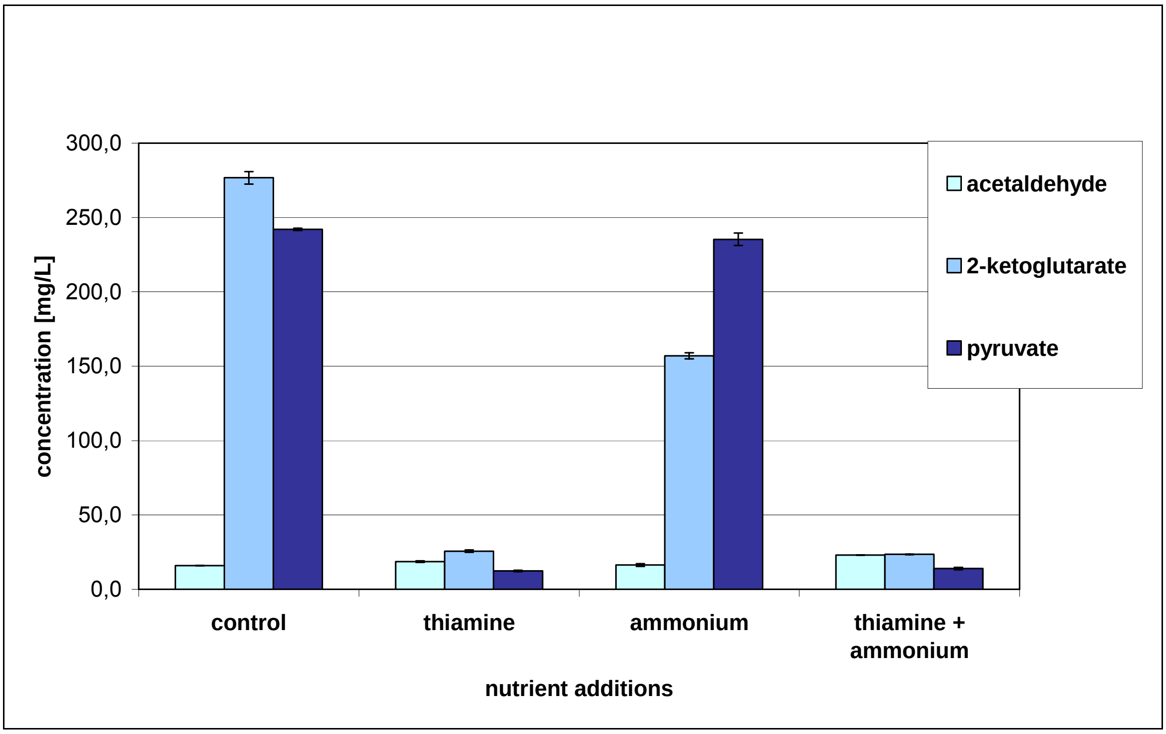


Figure 8bis: Effect of the addition of di-ammonium hydrogen phosphate (0.5 g/L) and thiamine (0.6 mg/L) on the concentration of acetaldehyde, pyruvate and 2-ketoglutarate in the final wine. Fermentation was performed by Saccharomyces cerevisiae *in a pasteurized Riesling must. Mean value of the triplicate. Bars show standard deviation. (Source: SRIG)*

The positive effect of ammonium and thiamine on the reduction of the SO_2–binding compounds can be demonstrated very clearly. The concentration of the substances could be reduced very much, even though the SO_2–binding substances could not be eliminated. Additionally the fermentative activity of the yeast could also be improved by both substances. With its particular concentration of carbonyl compounds, each wine has a different need for SO_2 in order to guarantee consistent quality and stabilisation. In general, reducing sugars, such as glucose and fructose, which are present in sweet style wines, also significantly increase binding potential. Furthermore, the pH-value and the temperature of the wine play an important role in the balance of free and bound sulphur dioxide.

6.3.3.2 Avoiding microbial contaminations

Several methods have been tested to reduce the risks of microbial contaminations.

The use of an active and well-acclimatized culture of selected yeasts was shown to be useful in reducing SO_2 before alcoholic fermentation.

Moreover, the co-inoculation of yeast and lactic acid bacteria was also a suitable to avoid sulphites in the early steps of winemaking process, even controlling biogenic amines formation (Table 8).

Normally, malolactic bacteria are added at the end of alcoholic fermentation (classic inoculation); co-inoculation consists in the anticipated addition of bacteria just 12-24 hours after the selected yeasts' inoculation: i.e., at the beginning of alcoholic fermentation. These practice allowed a good control of biogenic amines formation, even when sulphur dioxide was not added or was present at very low levels. Results of trials repeated in two years (harvest 2006 and 2007), show that both the chemical composition and the sensory characters of the co-inoculated wines were similar to those of the compared sulphited samples.

Table 8: levels of biogenic amines detected in wines produced by different techniques for the management of malolactic fermentation *(source: UNIUD)*

Merlot 2006: alcoholic strength 12.00% v/v; samples collected during on lees storage (23/01/2007); histamine was not detectable (n.d.) in the three trials.

Sample	Tyramine (mg/L)	Putrescine (mg/L)	Total (Free) SO_2 (mg/L)
Classic inoculation SO_2	0.8	1.9	16 (4)
Classic inoculation NO SO_2	1.3	5.2	1 (*n.d.*)
Co-inoculation NO SO_2	0.8	2.8	1 (*n.d.*)

The use of lysozyme, pH reduction (tartaric acid addition), and certain innovative techniques, such as flash pasteurization and cross-flow micro-filtration, were also useful to reduce SO_2 in controlling microbial populations (see below).

Use of lysozyme, Flash-pasteurization (FP)[2] and Cross-Flow microfiltration (CF-MF)[3] to stop contamination.

These different methods have been tested on white wine just after alcoholic fermentation to stop lactic acid bacteria fermentation. This trial has been made in laboratory with inoculation of three

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[2] *With Flash Pasteurization (FP) the juice / wine is heated for a very short time to kill contaminant micro-organisms without affecting wine quality*

[3] *Cross-flow microfiltration (CFM) allows elimination of contaminant cells from wine*

levels of lactic acid bacteria (no bacteria, 10^2, 10^5) and with different amounts of SO_2: 0 mg/l, 10 mg/l and 30 mg/l. The results are presented in the following table (Table 9).

Table 9: Effects of use of SO_2, lysozyme, Cross-Flow Microfiltration and Flash-Pasteurization to stop malolactic fermentation, on white wines (source: IFV)

SO_2 - addition mg/L	**CFM**			**FP**			**SO_2**			**Lysozyme**		
	0	**10**	**30**	**0**	**10**	**30**	**0**	**10**	**30**	**0**	**10**	**30**
No Bact.	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Bact . 10^2	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**
Bact. 10^5	**++**	**++**	**++**	**++**	**++**	**++**	**++**	**++**	**++**	**++**	**++**	**++**
MLF	**>>**	**N**	**N**	**90d**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
MLF	**90d**	**N**	**N**	**45d**	**>**	**N**	**50d**	**N**	**N**	**N**	**N**	**N**
MLF	**40d**	**70d**	**N**	**30d**	**60d**	**N**	**40d**	**80d**	**N**	**N**	**N**	**N**

MLF: Malolactic Fermentation

N: No Malolactic Fermentation

Bacterial contamination is the same for the four methods: SO_2 addition, Cross-Flow Microfiltration, Flash Pasteurization and lysozyme.

The variant with lysozyme is the only one that is totally stable without SO_2 addition; the two physical methods cannot stop malolactic fermentation.

To receive the same level of free SO_2 in the finished wine, the decrease of total SO_2 is under 20 mg/l. Only lysozyme, then, eliminates the need for SO_2.

In the second trial a wine with residual sugar was been artificially contaminated with yeasts. Flash-Pasteurization and Cross-Flow Microfiltration and Di-Methyl Dicarbonate (DMDC) allowed a decrease of yeasts and avoided the development of secondary fermentation with lower addition of SO_2. In this case yeasts of the species *Saccharomyces cerevisiae* were added, but other species are also able to restart fermentation if sugar is available.

As reported above, the addition of lysozyme was tested also during selected yeast rehydration; given the position of various stakeholders, this practice could be interesting to reduce the impact of this additive in organic winemaking.

The technique gave good results on the starter cultures (*pied de cuve*), increasing the dominance of the *Saccharomyces* yeasts; nevertheless, it could originate some problems, because the additional time needed for lysozyme action during *pied de cuve* preparation represents a time delay during which the rest of the must is unprotected (particularly when sulphites are not used).

If this delay is too long, in certain musts highly contaminated by wild micro-organisms, spontaneous fermentations can occur, leading to the consumption of nutrients which will then not be available for the inoculated yeast.

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6.3.3.3 Oxidation management

Two methods have been tested to reduce the risks of oxidations:

- use of antioxidants like acid ascorbic acid and grape tannins (hyper-reduction)
- use of hyper-oxygenation

The preservation of some natural antioxidants related to the use of these techniques was also assessed.

Hyper-oxygenation and hyper-reduction

Hyper-oxygenation is based on the massive addition of oxygen to the grape must in such a way that all the unstable - oxidizable substances (e.g., phenolic compounds) are eliminated before alcoholic fermentation, in a moment when volatile aroma compounds should be theoretically protected in form of “precursors” (and thus only weakly affected by the oxygen treatment).

Hyper-reduction, meanwhile, is based on the opposite principle, an addition of antioxidants (e.g., ascorbic acid and tannins), with the aim of preserving the unstable compounds as well.

Caftaric acid is one of the most oxidizable molecules in white must. The results of the ORWINE WP3 trial, shown in the Figure 9, demonstrated that the addition of tannins and ascorbic acid avoided must oxidation, preserving such volatile compounds, while hyper-oxygenation consistently reduced its concentration before alcoholic fermentation. The addition of ascorbic acid and tannins (5+5 g/hl) protected the must even better than the addition of 30 mg/L of sulphur dioxide.

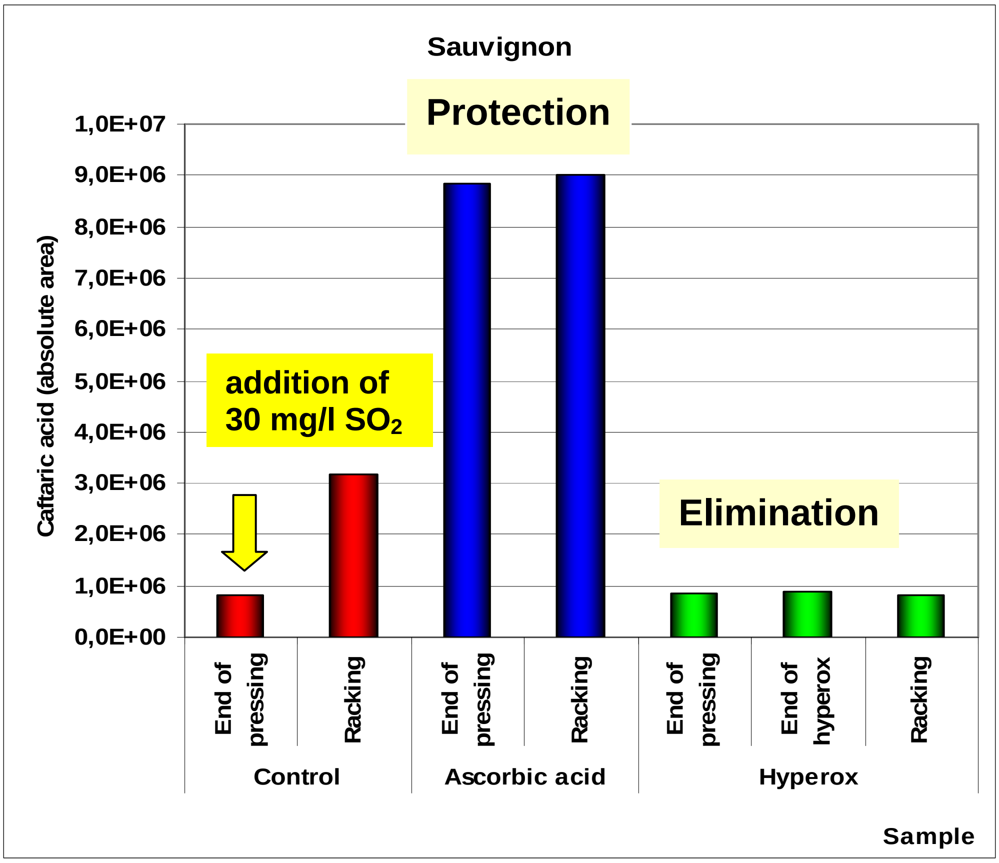

Figure 9: Comparison of the effects of hyper-oxygenation and hyper-reduction with those of sulphur dioxide (source: UNIUD)

ORWINE results demonstrated that hyper-oxygenation is an easy-to-use practice which can give a good stabilizing effect in comparison with sulphites; nevertheless, it has been shown to be unsuitable for certain varieties, whose aroma is very sensitive to the effects of oxygen (e.g., Sauvignon); in these cases, it would be preferable to use hyper-reductive technologies, which can be more appropriate to preserve the varietal notes of such products.

Hyper-oxygenated musts are sometimes subjected to sluggish fermentations, because of the proliferation of wild micro-organisms and the consequent consumption of assimilable nitrogen during the treatment. The problem can be easily overcome by a simple reintegration of nitrogen nutrients: e.g., adding di-ammonium hydrogen phosphate.

Finally, the wines produced by hyper-reduction, are quite sensitive to further oxidations; for this reason, for such kind of winemaking, it would be better to reduce the oxygen contact during the whole winemaking process.

Preservation of natural antioxidants

Glutathione is a powerful sulphur-containing antioxidant, naturally present in grapes and wine yeasts. Glutathione is easily oxidized in the must, reducing the oxidation of other compounds (e.g., polyphenols), and thus browning enzymatic reactions. For this reason, this compound can be considered as a marker of oxidative stress for the must.

The preservation of such natural antioxidant has been assessed in different protocols; the addition of ascorbic acid and grape tannins to the grape juice (hyper-reduction) maintained slightly higher levels of glutathione in the wine than did sulphitation (Figure 10).

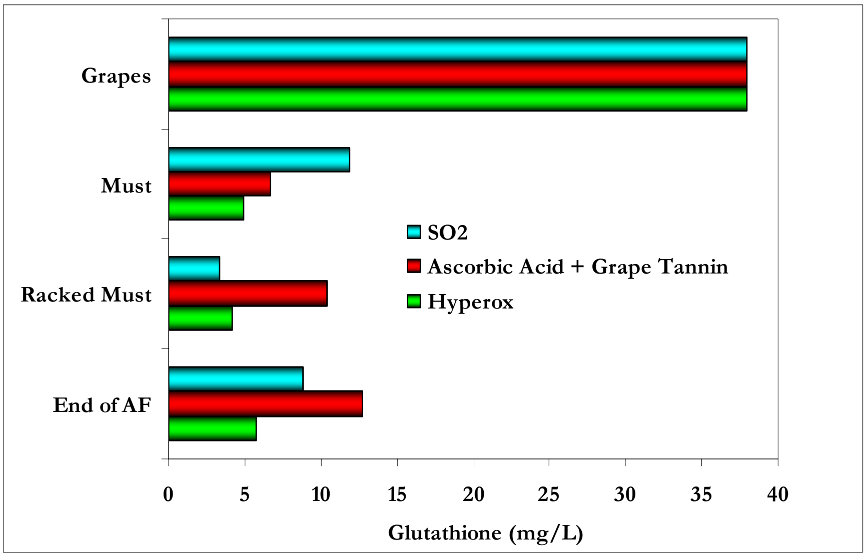

Figure 10: Effects of sulphitation, hyper-oxygenation and hyper-reduction on glutathione levels in the wine. (Source: UNIUD)

Discussion of WP3 outcomes

The main outcomes of WP3 research, with a special focus to lower the use of sulphites, are:

- reduction of SO_2, as specified later more in detail, is technically possible with certain techniques and alternative additives which are in tune with the organic principles and are admitted by both CMO and organic regulations, as well as accepted by the majority of organic wine-makers (see chapter 6.3.5);
- the effect of certain oenological tools on SO_2 is influenced by grape variety, grape must composition and wine type;
- potential for implementing SO_2 reducing strategies is higher in pre-fermentative steps than during wine storage and aging;
- strategies to reduce SO_2-binding compounds offer a more favourable ratio between free and total sulphur dioxide, and lead to a better efficiency of each SO_2 addition;

- new techniques were tested with positive results that are not yet allowed for conventional wines (yeast spraying, bipolar membranes, etc.);
- an optimized combination of oenological tools is necessary (see the Code of Good Practices and the experiments of WP4) to maintain and to avoid a negative effect on wine quality.

The following table (10) offers an overview of SO_2 reduction strategies and additives tested within WP3:

Table 10: Overview on SO_2 reduction strategies from laboratory and on-farm testing

Production step	Practice	Lab or experimental scale results (WP3)	Tested in pilot wineries (WP4)	Remarks/Effect
Grape defence against moulds	Yeast spraying	**Positive**		Lower risk of OTA formation in wine, by inhibition of A*spergillus carbonarius* infections on grapes
Grape processing	Reductive winemaking - addition of tannins and ascorbic acid	**Positive**	YES	Reduction of oxygen activity in juice and consequently good alternative to SO_2 addition for musts protection
Juice processing	Hyper-oxygenation	**Positive**	YES	Stabilization of grape juice by oxidation of unstable phenolic compounds; indicated for some varieties
Alcoholic fermentation	Use of selected yeasts	**Positive**	YES	Reduction of the dominance of wild micro-organisms or high SO_2 producing strains
	Activated yeasts starter cultures	**Positive**	YES	Prevention of microbial contamination by giving competitive advantage to selected yeasts
	Thiamine supplementation	**Positive**	YES	Reduction of the formation of SO_2 binding compounds - higher free SO_2 available
	Ammonium phosphate addition	**Positive**	YES	Good yeast activity and reduction of the risks of microbial contamination
	Ammonium sulphate addition	**Negative**		Can be metabolized by yeasts to produce SO_2, better to use ammonium phosphate
	Use of lysozyme	**Positive**	YES	Reduction of lactic bacteria contamination; useful in high pH juices and wines, where SO_2 is less effective
Malolactic fermentation	Use of selected bacteria	**Positive**	YES	Correct management of MLF
	Co-inoculation yeasts – lactic bacteria	**Positive**	YES	Prevention of microbial contamination, reduced biogenic amines formation even with low SO_2
Wine storage & preparation	On lees storage	**Positive**	YES	Limitation of oxidations; risk of BA pollution if MLF is incomplete or occurs spontaneously
	Bipolar membrane treatment	**Positive**		Effective in pH reduction, and higher (more favourable) free/total SO_2 ratio, but not allowed and expensive; HTH addition is equally effective
	Cross-flow microfiltration	**Positive**		Physical elimination of micro-organisms
	Flash-Pasteurization	**Positive**		Physical elimination of micro-organisms
	Glutathione (GSH) supplementation/ Preservation	**Positive**		Antioxidant effect, not allowed (useful: strategies for the preservation of natural GSH contents)

6.3.4 Pilot-farm experiments (outcomes from WP4)

The main task of WP4 was the implementation of the winemaking protocols developed in WP3 in the pilot-farm network. The main goal was the evaluation of the practicability and effectiveness to lower the use of SO_2 during the process (on farm situation), from the harvest till bottling. This evaluation based on the comparison between the farm and the ORWINE modalities, was done by analyzing the obtained wines for chemical and sensorial aspects.

On the chemical analytical side, different quality criteria to identify the specific effects of SO_2 reduction have been considered. The analysis shows that in both wine types, red and white, the trial-modalities reduced the absolute and relative SO_2 contents in a similar way. However, compared with commercial European organic wines, the SO_2 level in both the farm and the ORWINE modalities was very low in nearly all wines produced in the framework of the project. All other main chemical parameters like pH, alcohol, residual sugars, volatile acidity, total acidity and acetaldehyde are not affected by the protocols, even if there are differences found in single case studies.

Then, the samples have also been evaluated on different sensorial criteria. During all triangular tests, the wines could clearly be differentiated one from the other in the great majority of the comparison pairs. The panellists' answers showed that both modalities of a comparative pair were preferred in nearly equal parts: 50-50 with a slight preference of the trial modalities. Further, no single sensorial parameter showing a significant difference for all compared wine pairs could be defined. The conclusion of the sensorial evaluations is that in general the reductions of SO_2 as proposed by the trial-protocols change the wine profile but not generally in a negative or positive sense. They simply lead to wines different from the ones obtained by the farm protocols. The complete description of the on-farm experiments and their results are available in the project deliverables 4.5 and 4.6.

6.3.5 Proposed scenario for the SO_2 use

Taking into account these different results, three scenarios for SO_2 use can be proposed:

- scenario 1: SO_2 not allowed in organic winemaking;
- scenario 2: no specific limitation on SO_2 use in organic winemaking (limits as from CMO for conventional wines);
- scenario 3: a step-wise limit on SO_2 use that must be significant compared with that in conventional winemaking and that allows the sustainable production of "good" organic wine. Furthermore the progressive decrease should be based on yearly monitoring by EU Member States.

For each scenario the pros and cons are presented, based on the above presented data.

Scenario 1: SO_2 not allowed

Pros. For some consumers, organic wine is a wine made without any additives, and particularly without SO_2. They ask for organic wines without SO_2, for health reasons and also because they meet a desire for totally natural products.

Cons. Even if some producers make some types of wines (particularly dry red wines) without SO_2, the opportunity to elaborate those sorts of wines depends heavily on yearly weather and on the quality of the harvest. That means that it is not possible to produce good quality wines without SO_2 every year. The prohibition of SO_2 use for organic winemaking could compromise the development of the European organic viticulture. Therefore, this scenario seems to be definitively unrealistic. It would oblige producers to take excessively high risks and stop the development of the high-quality organic wine production.

This first scenario has been rejected by almost all stakeholders (even if a small minority supports it), because it does not allow any guarantee on the good preservation of wines or the production of high quality wines

Scenario 1

Consensus agreement against the total prohibition of SO_2 for organic winemaking

Scenario 2: no specific SO_2 limits

Pros. For the following reasons, some producers and traders remain opposed both to SO_2 limitations and SO_2 labelling:

- the SO_2 rates in conventional wine are already lower than CMO limits; therefore on this point there is not such a big difference between organic and conventional wines. SO_2 rates do not constitute a strong enough argument to differentiate organic and conventional;
- wines transported in bulk can be damaged if they are not sufficiently protected, because of excessively low SO_2 rates;
- producers of sweet wines and special wines do not agree on SO_2 limitations, because even if they already use less SO_2 than authorized they prefer not to take any risks on the preservation of their wines;
- producers of long-storage wines, which will not be sold for four or more years, are worried that SO_2 limits will not take into account the specific needs of their wines.

Cons. The second scenario would not permit a distinction between organic and conventional wine, so as to answer to the strong demand from consumers who expect organic wines to be "natural" as long as quality is maintained and preservation remains possible. It is also opposed by Italian, Spanish, and the large majority of French and Swiss producers but strongly supported by all German and, to a lesser extent, some Austrian producers.

Scenario 2

No specific limits for SO_2 contents in organic wines supported mainly by German and Austrian producers but opposed by consumers and producers in Italy and Spain as well as a large majority in France and Switzerland.

Scenario 3: step-wise limit

For the scenario 3 of a step-wise limit, a proposal could be formulated only for the main wine categories (red and white wines with less than 5g/l of residual sugar and red, white and rosé wines with more than 5g/l of residual sugar). It is proposed that "special wines" be regulated at a later stage and/or at a Members State level. (See part 6.6)

SO_2 limits have been expressed (in mg/l) as a percentages of the **current** CMO limit. The different SO_2 limits per type of wine and per scenario are presented in the following table (11).

Table 11: Proposed SO_2 limits*

	Actual CMO	20%reduction	30% reduction	40% reduction	50% reduction
Red wine < 5g/l sugar	160	128	112	96	80
White wine < 5g/l sugar	210	168	147	126	105
Red wine > 5g/l sugar	210	168	147	126	105
White & Rosé wine > 5g/l sugar	260	208	182	156	130

**The SO_2 rates are expressed in mg/l*

It should also be taken into account that in case of "bad climatic conditions" a Member State can ask the Commission for a derogation of CMO limits and use an extra amount of 40 mg/l for all wine categories (for example, as requested by Germany for the 2006 vintage). This possibility remains valid for organic wines as well and may be further detailed for organic producers. (See chapter 6.1.4).

Reductions from 20% to 50% are proposed, with results taken into account for analyses of more than 1000 samples of organic wines from the main European producing countries. Not all types of wine and not all wine-producing countries in Europe are significantly represented in this sample (especially wines with sugar residues >5%), and it may be argued that wines participating to competitions have are of higher quality than average, but these results are very informative on the issue of SO_2 limits.

The following tables report, for different countries, the total number of samples analyzed for sulphur dioxide (not including special wines), the number of wines showing a sulphur dioxide level higher than the reduced limit, and the percentage of the samples below the proposed limit. (See Table 12: limit of 20%, table 13: limit of 30% and table 14: limit of 50% of the current CMO limit per wine type).

Table 12: Comparison of wine samples analysed (per country), related to SO_2 limit of 20% of specific CMO limit

Residual Sugars	< 5 g/L						> 5 g/L					
Wine Type	White			Red			White			Red		
CMO Limit * (mg/L)	210			160			260			210		
Limit with a 20 % reduction	168			128			208			168		
	N.	H.	%	N.	H.	%	N.	H.	%	N.	H.	%
France	46	1	98	211	3	99	20	1	95	6	0	100
Italy	111	0	100	298	5	98	24	0	100	35	0	100
Germany	13	0	100	21	1	95	31	0	100	5	0	100
Austria	21	0	100	18	0	100	11	0	100	2	0	100
Switzerland	2	0	100	9	0	100	1	0	100	1	0	100
Spain	3	0	100	23	0	100	1	0	100	1	0	100
TOTAL	196	1	99	580	9	98	88	1	99	50	0	100

* EU Reg. 1493/99

N. Total number of samples

H. Number of samples with SO_2 higher than the reduced limit

% Percentage of samples below the reduced limit

Table 13: Comparison of wines samples analysed (per country), related to SO_2 limit of 30% of specific CMO limit

Residual Sugars	< 5 g/L						> 5 g/L					
Wine Type	White			Red			White			Red		
CMO Limit * (mg/L)	210			160			260			210		
Limit with a 30 % reduction	147			112			182			147		
	N.	H.	%	N.	H.	%	N.	H.	%	N.	H.	%
France	46	1	98	211	3	99	20	1	95	6	0	100
Italy	111	0	100	298	9	97	24	0	100	35	0	100
Germany	13	0	100	21	2	90	31	0	100	5	0	100
Austria	21	0	100	18	0	100	11	1	91	2	0	100
Switzerland	2	0	100	9	0	100	1	0	100	1	0	100
Spain	3	0	100	23	1	96	1	0	100	1	0	100
TOTAL	196	1	99	580	15	97	88	2	98	50	0	100

* EU Reg. 1493/99

N. Total number of samples

H. Number of samples with SO_2 higher than the reduced limit

% Percentage of samples below the reduced limit

Table 14: Comparison of wines samples analysed (per country), related to SO_2 limit of 50% of specific CMO limit

Residual Sugars	< 5 g/L						> 5 g/L					
Wine Type	White			Red			White			Red		
CMO Limit * (mg/L)	210			160			260			210		
Limit with a 50 % reduction	105			80			130			105		
	N.	H.	%	N.	H.	%	N.	H.	%	N.	H.	%
France	46	2	96	211	18	91	20	4	80	6	0	100
Italy	111	19	83	298	34	89	24	1	96	35	4	89
Germany	13	3	77	21	7	67	31	6	81	5	0	100
Austria	21	5	76	18	5	72	11	1	91	2	1	50
Switzerland	2	0	100	9	0	100	1	0	100	1	0	100
Spain	3	0	100	23	6	74	1	0	100	1	0	100
TOTAL	196	29	85	580	70	88	88	12	86	50	5	90

*** EU Reg. 1493/99**

N. Total number of samples

H. Number of samples with SO_2 higher than the reduced limit

% Percentage of samples below the reduced limit

A great majority (from 95% to 100%) of the analyzed samples have SO_2 rates bellow the limit of 20% and 30% reductions (Tables 12 and 13).

With a reduction of 50% (Table 14): while a large majority of wines from France, Spain and Switzerland remains below the limits, such is not the case for Austrian and German wines. However, the number of German samples was relatively low compared with that in Italy, France and, in part, Spain.

To compensate limited German samples, data from the German Quality Wine System of Rhineland - Palatinate (one of the main German wine regions) of three years was taken into account. It includes all organic AOC wines from the considered area (around 10,000 organic wines analysed). The data (years 2006 and 2007) compared with that obtained in the ORWINE survey, are presented below, in Tables 15 and 16. The reported percentages represent the portion of the samples which could be included among “organic wines” if a future limitation for SO_2 in organic wine regulation were set to be 20%, 30% or 50% lower than that of the current EU regulation; the percentages are calculated on the basis of data either from the ORWINE survey or from the German database

Table 15 shows that for the vintage 2005 (analysis made in 2006), with a limitation of 30% of the actual authorised SO_2 levels in a normal year, 16% of all analysed wines are excluded. With a limitation of 50% of the SO_2-level, 63% of the analysed wines could not be labelled and sold as organic wine.

Table 15: Comparison of German wines (vintage 2005) related to SO_2 limit of 20%, 30% and 50%, and ORWINE results. *(Source: Landwirtschaftskammer RLP)*

Sugar residues	CMO limit	Reduction 20%	Reduction 30%	Reduction 50%	ORWINE 20%	ORWINE 30%	ORWINE 50%
<5	160	85	69	27	**95**	**90**	**67**
	210	93	83	26	**100**	**100**	**77**
>=5	210	93	82	35	**100**	**100**	**100**
	260	97	91	42	**100**	**100**	**81**
	300	96	90	54	-	-	-
	350	92	83	38	-	-	-
	400	68	42	4	-	-	-
% of samples below the limits		**93**	**84**	**37**	**99**	**97**	**77**

SO_2 levels are expressed in mg/l

In a year with exceptional weather like vintage 2006, when all German wines got derogation on CMO limits and were permitted an extra 40 mg/l of SO_2 (analysed year 2007). 28% of the analysed wines would be excluded by a limit of 30%. 73% of the analysed wines would be excluded by a limit of 50% of the current SO_2 levels for wine (Table 16). It is thus important, as outlined in subchapter 6.1.4, to grant that organic wines could benefit of the same derogation granted for conventional wines in exceptional years.

Table 16: Comparison of German wines (vintage 2006) related to SO_2 limit of 20%, 30% and 50%, and ORWINE results. *(Source: Landwirtschaftskammer RLP)*

Sugar residues	CMO limit	Reduction 20%	Reduction 30%	Reduction 50%	ORWINE 20%	ORWINE 30%	ORWINE 50%
<5	160	81	63	26	**95**	**90**	**67**
	210	81	63	15	**100**	**100**	**77**
>=5	210	84	73	32	**100**	**100**	**100**
	260	90	78	27	**100**	**100**	**81**
	300	93	84	40	-	-	-
	350	80	65	33	-	-	-
	400	59	41	5	-	-	-
% of samples below the limits		**86**	**72**	**27**	**99**	**97**	**77**

SO_2 levels are expressed in mg/l

The results of this comparison demonstrate that the ORWINE survey gives quite a good representation of the German situation if one considers a 20% SO_2 reduction as possible scenario, but it underestimates the real German situation for a 30% or 50 % reduction (due to the relatively low number of samples available from Germany for ORWINE survey).

Pros SO_2 limits: this scenario should allow a response to consumer demands for wines with lower SO_2 content without imposing too much risks for wines production. SO_2 limits represent a good marketing claim and a good way to differentiate organic and conventional wines. Of course, these limits must guarantee the production of high-quality wines.

Cons SO_2 limits: In difficult years / areas, there are risks of low-quality wine production or wine with preservation problems. Potential unfair production conditions exist between the different European wine productions areas and depend on weather and the types of wine produced. For some cellars, it could be difficult to manage traceability and control with wines that exceed the limits.

A step-wise approach would be necessary particularly for a high reduction of SO_2 (e.g., of 40-50 %), to verify feasibility and allow the wine producers to adapt and improve their practices. Regulation should be a tool to help producers to improve the quality of their production, to provide consumers with guarantees and to serve as a realistic framework for the development of organic wine production. The limits must therefore be progressive, with yearly evaluation, and producers must receive technical support to deal with them.

Which limit to start with and what time frame to consider in reviewing limits are political questions, to be settled with the data presented above (data from the competitions and German data). Clearly, the higher the starting point for an SO_2 limit, the more difficult it will be for some producers to adapt. On the other hand, starting with an insignificant reduction will not contribute to consumer trust and to the satisfaction of most producers. The following steps in the reduction approach should be based on large-sample analysis conducted by Member States and must consider technological innovation available.

6.3.6 SO_2 labelling

In the second web survey, conducted in November 2008, participants were asked to indicate if they agreed with the proposal of including on the label of organic wines the final amount of total SO_2 at bottling to distinguish them from conventional wines. This SO_2 labelling was proposed without any connection with SO_2 limitations. The three proposals were:

- organic wines should use the same labelling as conventional wines (“contains sulphites” when it is more than 10 mg/l);
- it should be compulsory for organic wines to state SO_2 content as a percentage of the maximum limit for conventional wines of the same category (i.e. 50% of the SO_2 allowed by law);

- it should be compulsory for organic wines state the total SO_2 content at bottling expressed in mg/l.

A large majority of participants from Germany, Austria, Switzerland and Spain/Portugal, don't want to have the obligation to declare SO_2 content on the label.

In France, the majority, 55%, is opposed to the declaration of SO_2 content on the label, and in Italy opinion is split equally between the two options (declaration / no declaration).

For participants from "other countries", a strong majority (around 77%) favoured the declaration of SO_2 content on the label. (Figure 11)

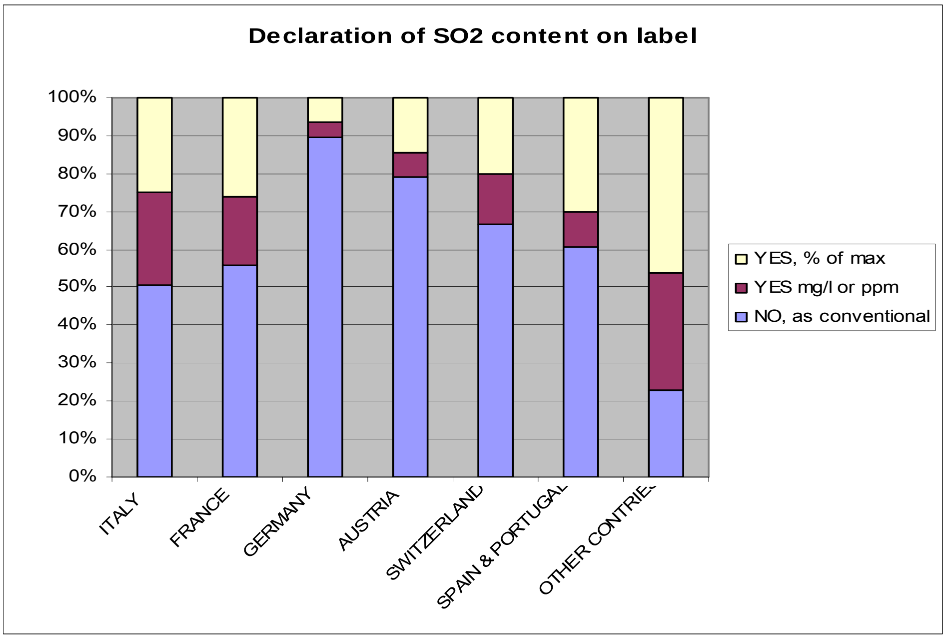

Figure 11: Web survey results concerning the declaration of total SO_2 content on organic-wine labels

Stakeholder meeting discussions produced the same results: the proposal of SO_2 labelling was rejected by the majority, with two main arguments: it is technically complicated to label each wine lot, and, above all, almost nobody wants to label the SO_2 rates if it is not mandatory for conventional wines as well, since it will negatively influence organic wine perception.

Then, some stakeholders suggested a mandatory labelling of the total SO_2 content, at bottling, instead of a limitation of SO_2 amounts. That's mean that specific SO_2 limits for organic wines would not be required but the total SO_2 content at bottling will have to be mentioned on the labels. However, a comparable non-organic wine would only have to label "contains sulphites" (when it is more than 10 mg/l). (Figure 12)

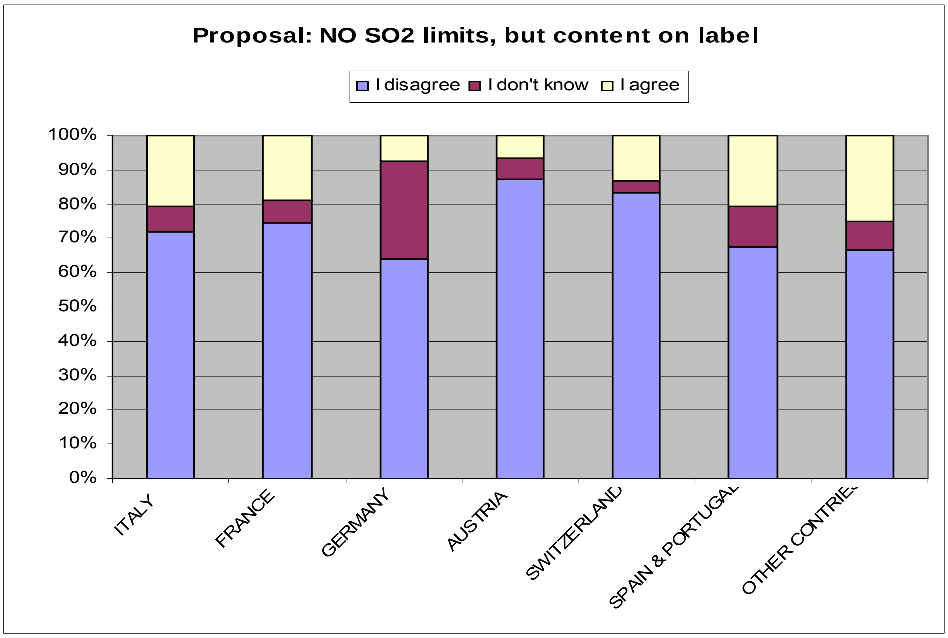

Figure 12: Web survey results concerning the non-limitation of SO_2 amounts if the total SO_2 content declared on the organic wines label

According to the results of the web survey, a strong majority of the interviewed persons – in every country – disagree with the proposal of having both no SO_2 limits and the obligation to declare the amount on the label

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A majority of producers are against labelling total SO_2 content without SO_2 limits

6.3.7 Summary of the SO_2 issue

WP3 laboratory testing: the overall results from WP3 indicate that for main wine categories it is possible to use combination of techniques and additives that allow the reduction of SO_2 use in the pre-fermentative phase and in the post-fermentation phase to certain levels, which depend on factors such as the composition of the grape must, the winemaking procedure, the wine style, etc. Of course the limited time available did not allow for testing of the reduction on all wine types and conditions. Nevertheless, when other scientific literature besides ORWINE work is taken into account, the potential for reducing SO_2 use is clear.

It is also clear that complete avoidance of its use does currently allowing for the production of good-quality organic wine in an acceptable range of cases. Certain producers do manage to obtain good organic wines without it, but only in specific years, with specific varieties and in certain parts of wine growing areas.

WP4 pilot farm application: in general pilot farms involved used amounts of SO_2 well below CMO limits, and ORWINE protocols generally allowed further reductions (to different extents) without negatively affecting wine quality. However, longer storage tests over several years were not performed, because of project time limits.

Considerations on origin and production methods (fact sheets): sulphite is a potentially allergenic product, and its use in all food processing is gradually decreasing while competent authorities are revising all legal limits in order to reduce its use in any food product.

Producer acceptance: small groups of producers already claim that it is possible to produce organic wine without sulphites; they are generally accepted, but there is a clear trend towards reduction.

Private standards: allowed by all considered standards but in general with stricter limits than CMO.

Consumer acceptance: negatively perceived, because of health impact, but awareness of its importance for wine quality.

ORWINE outcomes on SO_2 issue

►Scientific research demonstrates that, so far, it is not possible to produce “good” organic wine without any addition of sulphites in a significant range of areas, wine types and years.

►Consumers demanded SO_2 reduction, considering it an additive with negative effects on health.

►A majority of producers supported a reduction of its use in organic wines.

►Scientific research and application in several pilot farms in different wine production areas demonstrated that for several wine types and areas it is technically possible to reduce SO_2 levels.

►As proved on several pilot farms and stated elsewhere, a large majority of organic wines already have SO_2 rates much lower than CMO limits.

Producers' opinions on the proposed scenarios are reported below.

Scenario 1: in many countries a small group of producers (<10%) is in favour of a complete prohibition of SO_2.

Scenario 2: the majority of German producers and a consistent group of Austrian producers oppose SO_2 limits stricter than CMO limits. In other countries this scenario gets the consensus of around 10% of producers.

Scenario 3: The majority of producers in Italy and Spain is in favour of this approach and proposes reductions higher than 50% compared with present CMO. In France and Switzerland the majority of producers is in favour of a reduction of 20%-30% less than that for conventional wines.

If a country (one or more regions) is confronted with catastrophic or extreme weather in one year in or more regions, the option for an exceptional derogation under the current CMO system and/or under the derogation system of the new Council (EC) Regulation 834/2007 should be foreseen. These cases should be very limited and should follow a given procedure.

6.4 Enrichment

Enrichment is a practice allowed in the EU for conventional wines. Depending on the regions, addition of dry sugar or concentrated must is allowed up to a certain level. Evaporation, Cryoconcentration and Reversal Osmosis are also allowed for the same purpose. The new CMO has limited the increase of alcohol degree by enrichment to a maximum of 3% in Zone A, 2% in Zone B and 1.5% in Zone C. In exceptional years this limit can be increased by 0.5%.

Concerning organic winemaking two issues should be considered:

- whether to allow, forbid or limit enrichment;
- if case of enrichment, which ingredients/tools should be allowed?

Although no experiments were conducted during the ORWINE project, the issue has been discussed in several stakeholder meetings, and the web survey asked some questions about it.

6.4.1 Web survey results on enrichment

Four scenarios (no enrichment allowed, enrichment allowed as in conventional and limits of 30%-50% and of 50%-80%) were proposed, and the participants were asked to choose the scenario they considered the most relevant. (Figure 13)

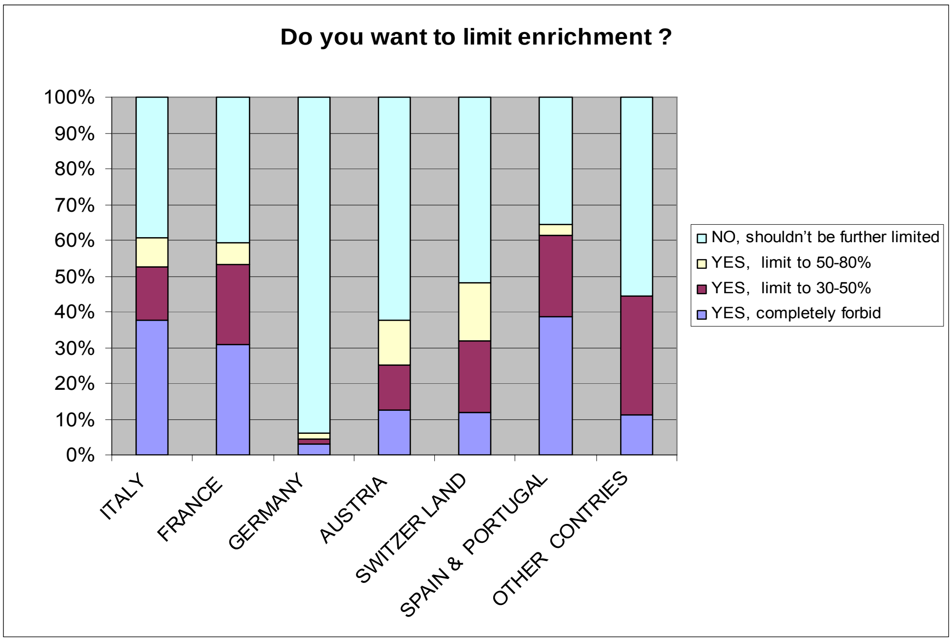
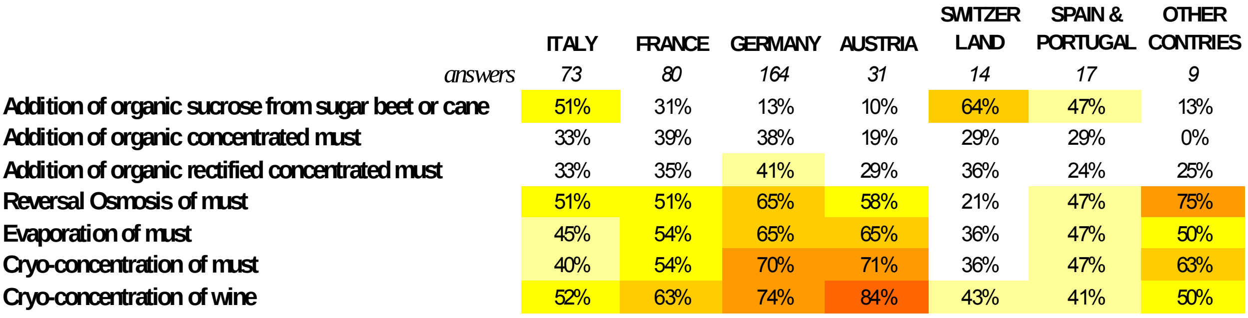


Figure 13: Web survey result concerning the principle of enrichment and its limitation

In Italy, France and Spain & Portugal there is a clear preference (around 60% in favour of limiting or prohibiting enrichment) for regulation which imposes stricter limits on the enrichment of organic wines. The situation is the opposite in Germany (95% in favour of no further limitation), Austria (63% in favour of no further limitation), Switzerland (52% in favour of no further limitation) and "other countries" (56% in favour of no further limitation).

Afterwards, the participants were asked about the techniques of enrichment for organic winemaking. (See Table 17, below).

Table 17: web survey results for enrichment techniques



	ITALY	FRANCE	GERMANY	AUSTRIA	SWITZER LAND	SPAIN & PORTUGAL	OTHER CONTRIES
answers	*73*	*80*	*164*	*31*	*14*	*17*	*9*
Addition of organic sucrose from sugar beet or cane	51%	31%	13%	10%	64%	47%	13%
Addition of organic concentrated must	33%	39%	38%	19%	29%	29%	0%
Addition of organic rectified concentrated must	33%	35%	41%	29%	36%	24%	25%
Reversal Osmosis of must	51%	51%	65%	58%	21%	47%	75%
Evaporation of must	45%	54%	65%	65%	36%	47%	50%
Cryo-concentration of must	40%	54%	70%	71%	36%	47%	63%
Cryo-concentration of wine	52%	63%	74%	84%	43%	41%	50%

Those who want to limit enrichment would prefer to limit also the way to increase the alcohol potential in wine: several physical practices are in general seen by a majority as not suitable for organic wine production. Reversal osmosis of must and cryo-concentration of wine are rejected by the majority (except in Switzerland and in Spain & Portugal). Evaporation of must and cryo-concentration of must are considered acceptable only in Italy, Switzerland and Spain & Portugal. In some countries there is also an indication to avoid the addition of dry sugar.

Note: for these two questions about enrichment the numbers of replies was much smaller than for the other questions (50% less), so the samples are less representative.

6.4.2 Stakeholder consultations on enrichment

In France, a majority of stakeholders considers that the enrichment is not an issue peculiar to organic wine, but rather a concern of "origin controlled appellation". They insist on the importance of using organic sugar or musts.

Like their German counterparts, Austrian stakeholders would prefer no more limitations in organic than in conventional winemaking.

In Switzerland the stakeholder meetings showed that a modest limitation of enrichment could be acceptable (as is already the case in BIO SUISSE Standards).

In Italy producers perceive enrichment as a risk for authenticity and suggest forbidding it or, in order to allow organic wine production in difficult EU areas, limiting it drastically (50%) and using it only in cases where it is clearly needed.

In Spain, most stakeholders agreed with progressive limits on enrichment, in agreement with the other European wine producing countries.

6.4.3 Other data on enrichment

Considerations on the production methods of the materials: the enrichment in organic wine, if allowed, must be done with organic ingredients, namely certified organic sugar (where allowed by national legislation) and organic concentrated and rectified musts. All those possibilities must be allowed to avoid producing unfair conditions among wine producers. In the case of rectified must, there is as yet no alternative to the use of ion-exchange resins.

Private standards: the enrichment is allowed by considered standards if done with organic ingredients.

Consumer acceptance: the consumer survey revealed no clear position on this issue, but some concern on “authenticity“.

6.4.4 Proposed scenario

On the basis of these results, the project consortium has formulated three scenarios:

- scenario 1: no enrichment allowed in organic winemaking;
- scenario 2: enrichment allowed as in conventional wine but with organic ingredients;
- scenario 3: enrichment allowed but to a lower percentage (30% or 50%) and with organic ingredients.

The percentages of enrichment per zone and per scenario are presented in the following table (18).

Table 18: Percentages of enrichment allowed by each proposed scenario

	Zone A	**Zone B**	**Zone C**
No reduction (scenario 2)	3%	2%	1.5%
Reduction of 30% (scenario 3.1)	2.1%	1.4%	1.05%
Reduction of 50% (scenario 3.2)	1.5%	1%	0.75%

Scenario 1: no enrichment

Pros: it can be a good marketing argument to differentiate organic from conventional wines, and can be considered as a mark of the stronger authenticity of organic wines.
Cons: this scenario is risky for some traditional and quality wines in difficult years; the prohibition of enrichment can also change the taste and the quality of some wines that the consumers are used to.

Scenario 2: as in conventional, but with organic ingredients

Pros: in difficult areas/years the organic producers, with this scenario, will not have more technical problems than conventional producers.
Cons: organic wine will not differ from conventional wine on this point. This scenario requires the acceptance of ion-exchange resins in organic.

Scenario 3: allowed but limited to 30%-50% of CMO

Pros: the limitation of enrichment can be claimed for marketing and a higher characterization and link to the place and year of production (authenticity).
Cons: too drastic limits might cause problems for some wines in difficult areas/years. This scenario requires the acceptance of ion-exchange resins in organic.

Note: *because the amount of enrichment currently allowed by CMO is reduced and related to geographic area, any restriction lower than 50% will be insignificant.*

6.4.5 Discussion of enrichment

While there is general agreement on the use of organic ingredients for enrichment, the principle and the level of limits remain controversial. Wine producers from Southern countries generally agree to limits on or prohibition of enrichment, even if it is not an issue for some in their organic regulation or standards. Producers from Northern countries, meanwhile, are opposed to any limits. In Switzerland a contrasting picture emerges from the second web survey, the discussion with stakeholders and standards requirements (where enrichment is limited).
In zones where the addition of sugar (from cane or beet) is forbidden (Italy, Spain, Greece, South of France), there is the question of organic rectified concentrated musts (RCM). To make RCM, it is necessary to use ion-exchange resins; yet this technique is considered incompatible with organic principles. A way must be found to avoid unfair competition between zones that may use both sugar and RCM and zones where only RCM are allowed.

ORWINE proposals on enrichment

Enrichment has to be accomplished with organic ingredients.

In general, concentration techniques (reversal osmosis, evaporation, cryo-concentration) received a negative evaluation.

The technique of ion-exchange resins should be allowed in the making of concentrated rectified musts in order to avoid unfair conditions among producers.

The principle and the level of limitation is largely supported but Southern European countries and mainly rejected by Northern European countries.

6.5 Practices and processing methods

In analysing the pros and the cons of negative and positive views of processing practises/methods, the ORWINE consortium has reached what it considers the best solution: establishing a list of prohibited practices for organic winemaking (negative list). Techniques and processes concern mainly mechanical and thermal processes, which are not incompatible with organic principles. They often permit reducing or avoiding the use of additives and processing aids. The negative list will also consider techniques used outside the EU. First, they could very soon be allowed in, through the agreement with OIV. Second, the idea is to prevent organic wines made with no limits to enter the EU from abroad, although what the EU prohibits now will not necessarily remain prohibited a few years in the future (see producers survey WP 2.4).

6.5.1 Practices allowed for conventional wine by Reg. (CE) 1493/1999

The ORWINE project didn't identify any reason to not fully permit these practises/methods under the EU Regulation for Organic Wine. However, to be sure, in the second web survey the participants were asked to select those they would not agree to allow in the EU Regulation for Organic Wine production, under the same conditions as for conventional wine (Table 19).

Table 19: web survey results on techniques which could be prohibited for organic winemaking

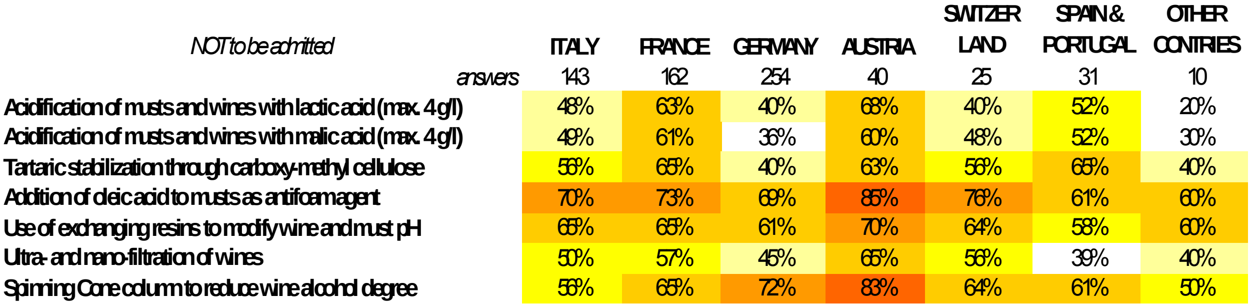
NOT to be admitted	ITALY	FRANCE	GERMANY	AUSTRIA	SWITZERLAND	SPAIN & PORTUGAL	OTHER CONTRIES
answers	*143*	*162*	*254*	*40*	*25*	*31*	*10*
Aeration	2%	1%	1%	0%	0%	6%	0%
Oxygen addition	14%	7%	4%	13%	4%	3%	10%
Use of inert gases (CO2, nitrogen, argon)	8%	3%	6%	8%	0%	6%	0%
Thermal treatments	20%	16%	5%	10%	12%	16%	20%
Centrifugation / Flotation	17%	27%	2%	15%	0%	23%	20%
Filtration	6%	5%	0%	0%	4%	3%	0%
Electrodialysis (wines)	47%	41%	35%	48%	40%	35%	30%
Reversal Osmosis (musts)	36%	43%	34%	55%	36%	29%	40%
Evaporation (musts)	33%	35%	22%	43%	16%	26%	30%

None of the practices listed in this group has been clearly indicated as forbidden. Some concern has been expressed in several countries against electrodialysis and reversal osmosis.

6.5.2 Practices/methods presently not allowed in conventional wine by Reg. (CE) 1493/1999

The following practices/methods listed below (Table 20) are presently not allowed in conventional wine by Reg. (CE) 1493/1999, but might be introduced soon in the positive list. The participants were asked to select those they would not agree to allow in the EU Regulation for Organic Wine production, under the same conditions as for conventional wine.

Table 20: web survey results on techniques which could be prohibited for organic winemaking



NOT to be admitted	ITALY	FRANCE	GERMANY	AUSTRIA	SWITZER LAND	SPAIN & PORTUGAL	OTHER CONTRIES
answers	143	162	254	40	25	31	10
Acidification of musts and wines with lactic acid (max. 4 g/l)	48%	63%	40%	68%	40%	52%	20%
Acidification of musts and wines with malic acid (max. 4 g/l)	49%	61%	36%	60%	48%	52%	30%
Tartaric stabilization through carboxy-methyl cellulose	56%	65%	40%	63%	56%	65%	40%
Addition of oleic acid to musts as antifoam agent	70%	73%	69%	85%	76%	61%	60%
Use of exchanging resins to modify wine and must pH	65%	65%	61%	70%	64%	58%	60%
Ultra- and nano-filtration of wines	50%	57%	45%	65%	56%	39%	40%
Spinning Cone column to reduce wine alcohol degree	56%	65%	72%	83%	64%	61%	50%

Some practices/methods are clearly indicated as to be forbidden: spinning cone, exchanging resins (to modify the wine and must directly) and the use of oleic acid.

Other practises/methods were considered unacceptable by most web survey participants in more than two countries: lactic acid, malic acid, carboxy-methyl cellulose, ultra and nano-filtration.

Case of cellulose gums (carboxymethyl cellulose)

The cellulose gums (carboxymethyl cellulose) are a very efficient agent for tartaric stabilization of white wines, particularly unstable wines. It has a lasting action which, unlike metatartaric acid, does not depend on the temperature. It remains efficient on unstable wines, unlike mannoproteins, which, moreover, are very expensive. Thermal (cool treatment is the traditional means for tartaric stabilization) or physical (electrodialysis) methods can be also used for tartaric stabilization of wines, but they consume considerable amounts of energy.

The cellulose gums are made with wood cellulose treated by acid and soda. Nevertheless, some tartaric acid residues in a wine do not constitute an unacceptable defect, affecting neither preservation nor flavour. It is thus not an essential product for organic winemaking, but it could be useful depending of the other allowed additives. A deeper evaluation of this product could be desirable, particularly of the origins and production process. This would be necessary to decide if it could be allowed or not for organic winemaking.

6.5.3 Focus on some practices tested during WP3

WP3 scientific work conducted by SRIG, ITV and UNIUD demonstrated that pH modification with bipolar process was possible; the pH needed could be obtained by this technique in place of tartaric acid addition. As already known, the active SO_2 was directly linked to pH. The current technique is not yet authorized in conventional wine regulation, and could probably be introduced two to three years from now at best.

Bipolar membrane electrodialysis efficiently converts aqueous salt solutions into acids and bases without chemical addition. It is an electrodialysis process, since ion-exchange membranes are used to separate ionic species in solution with the driving force of an electrical field, but it is different by the unique water-splitting capability of the bipolar membrane. In addition, the process offers special opportunities to directly acidify or basify process streams without adding chemicals. The wine can be acidified with the association of bipolar membrane and cationic exchange membrane. H+ coming from water splitting replace K+, going out through the cationic membrane.

6.5.4 Discussion and proposal of negative list

The practises/methods or techniques have been also evaluated with a multi-criteria approach, not as deep as for additives and processing aids but still based on several principles and criteria taken from the Council Regulation (EC) 837/2007. The ORWINE consortium made an expert evaluation, using scientific results from WP3, results from the second web survey (see above table 20) and stakeholders' consultations, as well as a few elements from the comparison and analysis of private standards. The same colour code is used to express the degree of the estimated acceptability of each substance: dark green for "positive evaluation", green for "mainly positive evaluation", yellow for "mainly negative evaluation" and orange for "negative evaluation". Some comments on conditions of use have been added.

Techniques of enrichment have already been considered in the previous chapter, some techniques like cryo-concentration of wines and reversal osmosis of musts were rejected by a majority of producers. Evaporation and cryo-concentration of musts were also rejected. (See table 21, below).

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Table 21: summary of the techniques evaluation

🟩	🟢	⬜	⬛	🟧	🟨
positive	mainly positive	pros=cons	no evaluation	negative	mainly negative

	Expert' evaluation	Web survey	Stakeholder opinion	Comparaison of standards (WP2)	Laboratory experiments (WP3)	Conclusion	Comments
Practices allowed in conventional wine by Reg. (CE) 1493/1999							
Aeration	🟩	🟩	🟩	🟩	🟩	🟢	
Oxygen addition	🟩	🟩	🟩	🟩	⬛	🟢	
Use of inert gas	🟩	🟩	🟩	🟩	⬛	🟢	
Thermal treatments (including flash-pasteurization)	🟢	🟩	🟩	🟢	⬛	🟢	High energy demanding
Centrifugation	⬛	🟩	🟩	🟩	⬛	🟢	
Filtration (including cross-flow filtration)	⬛	🟩	🟢	🟢	🟢	🟢	
Electrodialysis (tartaric stabilization of wines)	⬛	🟢	🟢	⬛	🟢	🟢	High energy demanding
Reversal osmosis (musts)	🟩	🟧	🟨	🟢	⬛	🟨	
Cryo-concentration of musts and wines	🟩	🟧	🟨	🟢	⬛	🟨	
Evaporation (musts)	⬛	🟧	⬛	🟢	⬛	🟨	
Practices presently not allowed in conventional wine by Reg. (CE) 1493/1999.							
Acidification of musts with lactic acid (max. 4g/l)	⬛	🟨	🟥	⬛	⬛	🟨	
Acidification of musts with malic acid (max. 4g/l)	⬛	🟨	🟥	⬛	⬛	🟨	
Tartaric stabilization through carboxy-methyl-cellulose	⬛	🟨	🟥	⬛	⬛	🟨	More efficient than metatartaric acid and mannoproteins, and less energy demanding than cool treatment and electrodialysis
Addition of oleic acid to must as anti-foam agent	⬛	🟥	🟥	⬛	⬛	🟨	
Use of ions exchange resins to modify the must and wine pH	⬛	🟥	🟥	⬛	⬛	🟨	Shouldn't be allowed for modify wine and must pH, but should be allowed for RCM making
Ultra and nano filtration	🟨	🟨	🟥	⬛	⬛	🟨	
Use of spinning cone column to reduce the alcoholic degree of wines	🟨	🟥	🟥	⬛	⬛	🟨	

ORWINE proposals on techniques

List of enrichment techniques allowed by Reg. (CE) 479/2008 which have received negative evaluations:

- reversal Osmosis of musts
- evaporation of musts
- cryo-concentration of musts and wines

List of techniques not allowed by Reg. (CE) 479/2008 which have received general, negative evaluations:

- exchanging resins on musts and wines (expect for concentrated musts)
- wine separation techniques (spinning cone, reversal osmosis on wine, distillation, etc.)
- ultra and nano-filtration of wines

6.6 Special wines

Specialty wines represent a small part of the global production of organic wines, but they often can be very important and/or emblematic of a region (for example, Sauternes or Porto) or correspond to local consuming habits (for example, Retsina wines in Greece). How to deal with their production needs?

The reason to exclude "special wines" from the SO_2 reduction proposal while including them in the general regulation for organic wine, is that they are obtained in a very "tradition specific" way. Setting SO_2 limits at the EU level would hamper their specialty status. Besides, they are an important cultural and niche market product, but the total quantity of all "special wines" produced in the EU is very limited. Even if their SO_2 content is commonly very high, the amount consumed is very limited, and thus induces a limited impact on human health.

Special wine should be excluded from SO_2 limits (if limits) but included
in organic wine regulation

6.7 Labelling

6.7.1 General labelling of organic wine

From the discussion about the labelling of organic wines, four different options for labelling have been discussed and can be seen:

- a complete list of ingredients, additives and processing aids as well as relevant methods to appear on the label. Some consumers surveyed required this option, considering that they should be clearly informed by the label of the additives and processing aids used in winemaking. While the most transparent solution, this option would entail unfair competition between conventional and organic wine production if conventional wines were not also obliged to fulfil the same detailed labelling requirements. Furthermore, a complete list would overburden consumers and wine labels alike. A reduced list with the labelling of a selection of additives and processing techniques would inform consumers in a more transparent way, but the problem of unfair competition would persist if organic wine alone is subject to labelling obligations;

- labelling of substances not used in production or processing. It seems to be an adequate way to inform consumers and to communicate the benefits of organic farming at the same time (e.g., non-use of sulphites). This labelling concept therefore helps improve the marketing potential of organic wine. The difficulty is that it would lead to a very long list of substances, as in organic winemaking many substances and techniques are not used. The consumer survey suggests that only a few substances are critical and the rest hardly known; a selection of substances might have to be effected to make negative labelling feasible. Another difficulty lies in a certain discrimination directed against other organic wines. This might not be seen as a problem as long as this refers to the non-use of sulphites or the non-use of commercial yeast, and as long as the option is open to all wine producers;
- no detailed labelling of the applied substances and techniques, but the organic label to stand for unambiguous cellar regulations. This option does not imply an unfair competitive situation for organic wine, but consumers do have to take action if they want to find out about the differences between organic and conventional wine. This is sure to demand too much effort of some consumers. According to the survey, some consumers, aware of their limited understanding of winemaking, prefer to trust a common (EU) logo that would identify organic wines without reporting further details on the label.

Following the logic of the current new EU Council regulation (EC) 834/2007 the last option might the most appropriate. Concretely, this would require a positive list of additives and processing aids as well as a negative list of some substances.

Since the survey has shown that a significant number (at least 10%) of producers favour a no-input approach, it is recommended that wine-producers also be allowed to use the indication “no sulphites used”, the indication “only spontaneous yeast” and/or the indication “no use of commercial yeasts”.

6.7.2 Certification and labelling of wine

All wines which fulfil the requirements of the new wine rules will be eligible for labels with the terms and EU logo in the same way as other processed products, as stated in Article 23 to 25 of the new Council Regulation (EC) 834/2007 and Annex 10 of the EU Commission Regulation (EC) 889/2008. That means that the term “organic wine” and the equivalent terms (Bio, Eco, Öko) will be officially used for labelling, advertising, marketing etc…

The question is what happens if a winery has wines that cannot fulfil the requirements of the new rules: e.g., when higher amounts of sulphites are used which lead to a sulphite content exceeding the EU regulation limit? It is recommended that in this case only this wine of the same variety and year not be labelled as “organic”, provided that all inspection requirements are fulfilled. The other wines can still be labelled as organic. The same principles as in food processing with a mixed operation would apply.

Furthermore, if under the existing procedures of the CMO or under the derogation system of the new Council Regulation (EC) 834/2007 for catastrophic or extreme weather an exceptional derogation is given for one year in a Member State or a region for the maximum amount of sulphites, then this wine still will still be eligible for the “organic” label. However, these cases would have to be very few and would have to follow a given procedure.

6.8 Links with non European organic regulations

USA

US rules, the National Organic Programme (NOP), require that wines to which sulphites have been added cannot be labelled as “organic wines”. This presents a real challenge for European organic wine producers. Some have already started to produces wine categories with no sulphites for the US market. It is unlikely that the US will change its requirements for sulphites even if they are actually causing difficulties to USA organic wines. But it would be desirable for the EU commission to establish the other requirements on additives and processing aids as equivalent to US rules.

Japan and other countries with their own organic regulations

It would be desirable for the EU, to negotiate the equivalence of its rules, as soon as they are introduced, with the requirements of the export countries. One difficulty might be that the *Codex Alimentarius* Guidelines for organically produced food — the official world-wide-reference for governmental bodies (along with IFOAM Basic Standards for the private sector) — has not yet considered wine processing, although adding wine-processing sulphites to the list has been discussed at several meetings. One reason was that Codex had not yet decided how to handle sulphites in wine.

6.9 Links between organic regulation and AOC certification

As wine is the most regulated food product in the EU it is advisable to organize the organic certification system taking into consideration at least the operational AOC certification. It means to verify if, and to what extent, certification procedures and documents of the two systems can be unify, leading to simplification and costs reduction.

During producers meeting some concern was expressed as well on the potential problems linked to the fulfilment of AOC sensorial parameters while decreasing or even avoiding SO_2 use. Few cases where analysed where organic low SO_2 wines had difficulties in meeting specific AOC sensorial characters even if judged positively in terms of global quality. Such issues must be considered and dealt at AOC committee level, which can set different parameters or simply widen their range for organic wines.

7 Other useful findings from ORWINE Project

7.1 Evaluation of yeast spraying as a tool for reducing fungus diseases on grapevines (OTA management)

The main objective of this task was the potential reduction of microbial diseases on damaged grape berries by spraying *S. cerevisiae* yeasts on the grapes and creating competition among microorganisms at their surfaces. Surface competitions were successfully performed to control post-harvest diseases (moulds) of fruits or vegetables by pre-harvest applications of yeasts. Natural saprophytic yeasts were generally used for this purpose. Such natural yeasts (mainly *Cryptococcus* and *Rhodotorula* spp.) are known to colonize plant surfaces or wounds for long periods under dry conditions, using available nutrients for rapid multiplication, and to be minimally affected by pesticides. Limits on the use of such yeasts stem from the difficulty, or even impossibility, of mass producing them at an industrial scale. However, to our knowledge, nobody has tried to test classical industrial *S. cerevisiae* strains, which are easily available in great amounts, for their ability to control fungus development. The choice of oenological *S. cerevisiae* strains was dictated by the original isolation of the available strains from grapes or wines. They therefore seemed better adapted to the peculiar substrate represented by damaged grape berries. We first assessed the quantification of the effect of *S. cerevisiae* on the development of undesirable bacteria or fungi at the surface of voluntarily damaged grape berries.

Results and Conclusion

We first assessed the quantification of the effect of *S. cerevisiae* on the development of undesirable bacteria or fungi at the surface of voluntarily damaged grape berries. The effectiveness of yeast spraying by different commercial *Saccharomyces cerevisiae* strains was first evaluated on two different model species of fungus diseases: *Botrytis cinerea* (invasive disease fungus) and *Aspergillus carbonarius* (undesirable fungus responsible for Ochratoxin A (OTA) production), as well as on an invasive bacterial model species (*Gluconobacter oxydans*).

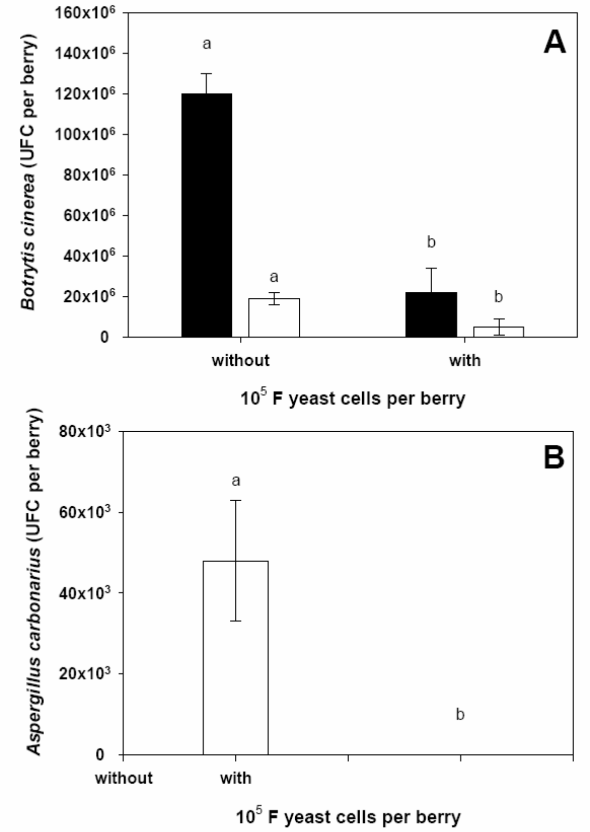

Figure 14: Effect of the inoculation of 10^5 S. cerevisiae F cells on the surface of wounded grape berries. (Source: INRA)

The berries were previously and extemporaneously inoculated in the wound with (A) 10^6 *B. cinerea* M04/51 (black boxes) and M04/63 (white boxes) spores or (B) 10^4 *A. carbonarius* spores. Fungi numbering was realized after 48h of incubation at 28°C (mean and standard deviation of two replicates of three grape berries for each situation). The same letters indicate homogeneous groups at the 95% confidence level, as tested by Tukey statistical test.

First, a general inhibition effect was observed *in vitro* by a set of 17 industrial *S. cerevisiae* strains against *B. cinerea* and *A. carbonarius* mycelium growth, but not against bacterial growth (*Gluconobacter oxydans*). However, only few of them are really very efficient. We therefore conserved the most promising *S. cerevisiae* strain, named F.

In a second set of experiments, we demonstrated that extemporaneous spreading of *S. cerevisiae* F strain at the surface of previously artificially damaged grape berries contaminated with different microbial species was very efficient for reducing fungus mycelium growth after 48h of incubation (Figure 14). This was not the case for bacterial *G. oxydans* contamination, where no effect was observed. From this first part of the work, it could be roughly concluded the that mass impact of *S. cerevisiae* F spraying could lower grape infection by fungi.

In a third set of experiments, we demonstrated that yeast spraying should be done about 2-5 days after initial infection by the fungi in order to get an optimal antagonistic effect. After this period, the potential of fungi to initiate disease remains, indicating that a competition for nutrients has taken place between protagonists. The effect of yeast spraying on *A. carbonarius* development on the grape berries was particularly significant. From all these experiments we therefore think that such yeast spraying before grape harvest could represent for the viticulturist a biological alternative for limiting the occurrence of *A. carbonarius* in the vineyard. (Figure 15.)

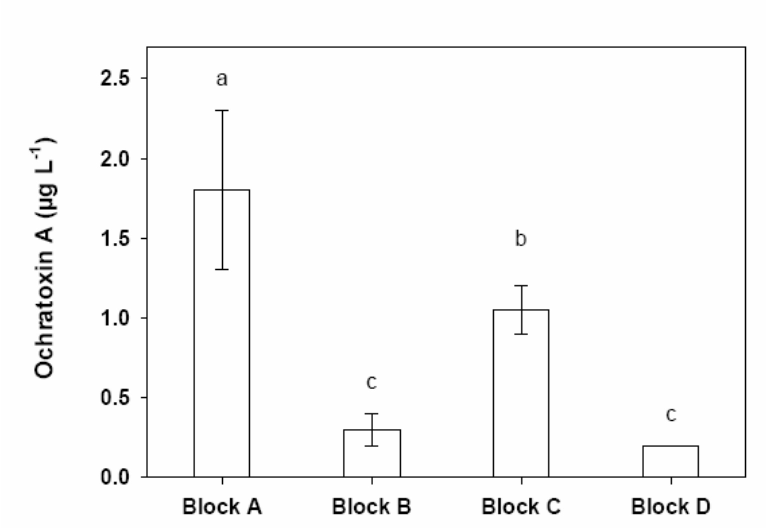

Figure 15. Ochratoxin A levels (µg L^{-1}) in the finished wines after yeast spraying on wounded berries (mean and standard errors of duplicates of 2007 vintage). (Source: INRA)

Each block contains 2 rows of 38 vine stocks of Mourvèdre variety. Two blocks (A and C) were contaminated by *A. carbonarius* spores (10^{3} spores per bunch) one month before harvest. Two blocks (B and C) were sprayed with commercial *S. cerevisiae* “F” cells (10^{7} cells per bunch) one week before harvest. The 304 vine stocks of the 4 separate blocks were hand-picked. Separate fermentations (2 x 1 HL) were performed on the grapes harvested in each block: identical starter yeast inoculation, identical alcoholic fermentation conditions, and wine ageing. The same letters indicate homogeneous groups at the 95% confidence level, as tested by Tukey statistical test.

In subsequent field scale experiments performed during 2007 and 2008 vintages, we show that yeast spraying with the selected industrial *S. cerevisiae* F strain on an artificially *A. carbonarius* infected vineyard was able to reduce the *A. carbonarius* proliferation inside the grape berries, even if the external black mycelia form of *A. carbonarius* was not observed at the grape berry surfaces. From the obtained results, it should be hypothesized that yeast spraying at the surface of intact grape berries partially reduces *A. carbonarius* penetration into undamaged grapes. Moreover, the reduction of *A. carbonarius* proliferation was accompanied by a significant reduction of the final level of Ochratoxin A in the corresponding wines. The chemical and sensory properties of the final wines were also not detrimentally affected by yeast spraying.

More experiments might be needed for different grape varieties and different climatic areas. If the positive results are confirmed it would be desirable to find partners from the Bio-control industry interested in the registration of such a product both for general use in viticulture and specifically for organic viticulture based on the procedures and criteria laid down in the new Council Regulation (EC) 834/2007.

7.2 Code of good practices

The ORWINE code of good organic viticulture and winemaking is a complementary tool to the new regulation for organic wine implementing rules under the (EC) Regulation 834/2007. It gives wine producers clear guidance on how to produce wine of high quality and reduce the use of additives. The aim of this code is to contribute to the further development of practices for organic viticulture and winemaking in terms of increased safety, quality, transparency and success. The code summarises different traditional and innovative viticultural and oenological practices suitable, approved and acceptable for organic production.

It indicates for the different steps in production and processing, which strategic options (e.g., no input, low-input, high-input) are possible to take within the given legal framework of the EU Regulation for organic production respecting the basic principle of organic agriculture. The code of practise might be even further developed as a common Code of Conduct, if supported and taken as a reference for a more process-oriented certification system in the future.

7.3 Environmental Impact of Organic Viticulture Indicator (EIOVI)

In the WP2, an Environmental Impact of Organic Viticulture Indicator (EIOVI) has been developed that can be reliably used in the management of organic vineyards. EIOVI can be used as a decision support system for farmers and other property managers by evaluating the potential ecological impact of their choices, thus optimizing management options. The tool allows the simulation of vineyard management on the basis of six agricultural and ecological modules. EIOVI is an expert system based on fuzzy logic algorithms, which calculates the relationship between the single modules on the basis of a set of 64 decision rules. The assessment tool is organized in 6 modules: i) pest and disease management ii) soil management and machinery use iii) fertilizer use management iv) irrigation management v) soil organic carbon and vi) biodiversity of flora and fauna. The modules are activated one by one. Specific functions are then selected and apply the indicator for assessing the relevant environmental protection end-point.

The integrated impact assessment tool, developed in Task 2.3, has been tested for practicability in 20 simulations on six selected pilot-wineries. To evaluate the practicability of EIOVI, the managers of the vineyards on which the tool was tested have filled in a questionnaire, asking them to comment on the practicability of EIOVI and suggest improvements.

This first testing showed that the modular organization of EIOVI already reflects well the complexity of agriculture and that it is mainly the structure of the input and output faces that needs improvement before EIOVI can be used as a standard tool by practitioners. When these first improvements are realized, it will be possible to include further information, like the annual treatment planning or the deepening of the “fertilisation management indicator” by including climate-relevant aspects of the cover-crop (e.g., its function as carbon sink or nitrate binder). This tool can even be forwarded to other agricultural production branches for adaptation to their needs by including perennial cultures and vegetable growth (also crop rotation) or livestock husbandry. For further information see the project deliverables 4.4 and 4.5 and "A management tool to indicate the environmental impact of organic viticulture", published by Fragoulis G., Trevisan M., Di Guardo A., Sorce A., Van der Meer M., Weibel F., Capri E. (2009) in the *Journal of Environmental Quality (*Vol. 38, Number 2).

7.4 Resistant grape varieties

Resistant varieties offer an easy way out of the fungi-trap: fungi which were imported from the New World in the second half of the 19th century: They are less or not sensitive to the main fungal diseases which menace the European viticulture: downy and powdery mildew. Recent varieties mainly developed in Germany and in Switzerland, also offer a high organoleptic quality and permit the implementation of quality wine.

Therefore, their culture should be authorised in all European wine-growing countries. Further information and a list of modern resistant varieties describing their disease-tolerance can be found in the Code of Best Practices. Further information on this topic is available in the project deliverable 3.6: *“Improved management practices in winemaking and experimental testing”.*

7.5 HACCP approach

The European Programme “ORWINE”, while dealing mainly with the question of winemaking in organic viticulture, has an agronomic facet as well. Its objective is to check that, in order to achieve a product of a defined quality, the technical regulations to be recommended or imposed for the grape processing in an “organic” wine cellar are compatible with the “probable” state of the grapes (the raw material), as the organic production conditions in the field generally allow. In case of incompatibility, it would be desirable to identify agronomic practices to ensure the compatibility at minimal cost in most cases (or, if this is not possible, to amend the wine production rules).

It is commendable to consider the links between grape production in the vineyard and grape processing in the wine cellar, and it is worthwhile to elucidate them; this demands a multidisciplinary approach between agronomists and oenologists. Organic grape-wine production makes this type of investigation particularly needed, because the organic production approach limits the possibilities of corrective interventions in the cellar or in the field; it is imperative to think together and with the same attitude about both the “crop management sequence” in the vineyard and the “winemaking chain” in the cellar.

The purpose was to try to apply an HACCP type methodology, normally used for the grape processing in the cellar, to the grape production in the field. However, the objective is not to elaborate an HACCP methodology to guarantee the “quality” of organic-grape production in actual vineyards, but rather to take advantage of the methodology's principles to offer to experts from different grape producing areas an analytical framework, which will in turn shed light on the issue of the grape quality and its potential control in the case of organic production. The objective is to have an expert assessment of the critical points in the elaboration of the grape harvest in the field, in view of the final quality of the raw material (grapes to be transformed into wine). See deliverable 2.6: *“Development of integrated assessment tools for organic viticulture: Adaptation and application of the HACCP*[4] *methodology to agronomy: how to assure compatibility between grape harvest quality and wine processing rules”.*

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[4] Hazard Analysis Critical Control point

8 Conclusion

General preventive principle. Like organic-grape production, the organic winemaking must favour preventive measures in order to produce high-quality wines with the fewest additives possible (depending of the type of wine, the climatic year condition) and reduce the environmental impact.

Sulphites. The experiments performed in laboratory and on the farms demonstrate that it is possible to reduce SO_2 levels to a certain extent without compromising wine quality. However, depending of the conditions of grape production and harvest (weather, region, sanitary state of the grapes, etc.), a combination of different methods, including agronomic preventive measures in the vineyard, will allow SO_2 reduction or the use of other additives.

Additives and processing aids. The production and processing of good-quality wine is possible with a limited set of additives and processing aids, preferably of natural origins, and without the use of artificially, chemically synthesized products. This contributes to the good image and authenticity of organic wine. The oenological substances which will be allowed for organic winemaking (positive list) should fulfil the principles and criteria of the new Council Regulation (EC) 834/2004 for organic production and leave enough room for different winemaking strategies: with no external input, little input or higher input with the frame of organic production.

Enrichment. Depending of the geographic situation and the type of wine produced, enrichment is considered either essential (no stricter limitations than CMO limits) or useless (could be forbidden). In any case, it must be made with organic ingredients.

Most of the physical and thermal enrichment techniques are rejected by a majority of producers.

Processing techniques. The evaluation has shown that there are different perceptions. Some techniques allow for the reduction of the use of some additives, particularly sulphites, but not their replacement. The impact (on environment, on wine integrity) of certain techniques is still not sufficiently known and evaluated, and further research is needed to determine their compatibility with organic production principles.

Producer training. Many producers are already committed to sulphite and additive reductions, but in case of an organic winemaking regulation imposing stricter limits (than CMO limits), such reductions would have to be progressive, and it might be necessary to provide producers with technical support to avoid a decrease in wine quality and the eventual lost of certification. The web survey results shows that a strong majority of interviewees in every country would consider training and updating at least useful if a new stricter EU regulation were implemented. 20% to 35% considered such training opportunities essential.

Nowadays, organic wine production is increasing everywhere in European producing countries. Future regulation of organic winemaking is expected by the majority of the stakeholders involved in the development of organic wine production (producers, traders, consumers, etc.). This regulatory framework must support the development of the organic wine sector. That means helping producers to improve their practices and their wine quality, facilitating business exchanges and providing marketing arguments, and increasing consumer awareness of organic wines and their trust in the organic wine label.

9 Further research needs

- As the ORWINE project was limited in time, not all research questions could be taken up. The list below indicates some key areas where future research is necessary:
- Additional experiments are needed to evaluate the long-aging and stability of wines prepared with specific oenological tools to lower SO_2 addition.
- Eventual SO_2 limits for organic wine should take into account the normal operating conditions of different winemaking areas, as well as climate, seasonal events, “winemaking habits”, etc.
- Assessment of the impact of new technologies on both the quality and the authenticity of organic wines, as well as their environmental impact (e.g., energy use, bio-diversity), including the applicability for different types of vineries.
- Agronomic aspects and practices in the vineyard have been considered through the prisms of the HACCP method, as applied to vineyards, and the Code of Good Practices. However, further research is needed to determine the links between techniques used in the vineyard and grape quality (for example, how to avoid the nitrogen deficiency in the musts) in order to still improve the grapes quality and so reduce the need of oenological additives;
- Some organic producers are making high-quality wines with very few additives and processing aids (some even without any additives). It would be interesting to study this approach, in order to develop practical and technical tools to help other producers further reduce additives and processing aids;
- During the ORWINE project, the work on the evaluation of additives and processing aids highlighted the necessity to increase knowledge of the origin and mode of production of the discussed additives, and then to develop a scientific protocol to evaluate the compatibility of an additive for organic produce.

- The Ecological Impact Assessment Tool (EIOVI) proved to be a promising computer program that can be applied to practical vineries with a very positive educational effect. However, it is still not user-friendly enough to be used by advisors or even by the farmers themselves. Also the program is still missing a partition that can calculate the carbon footprint of the enterprise – a parameter of very high ecological and political relevance nowadays.
- Investigation of the authenticity of wines: The ORWINE studies have shown that wines from farm protocols and SO_2-lowered wines could mostly be differentiated concerning flavour and taste. The overall appreciation of the wines was, however, equal. Now the important and still unsolved question is which vinification additive or technology really produces the wine with highest authenticity (e.g., which gets closest to an entirely untreated wine). As “authenticity” is a frequently used term in (organic) winemaking and especially wine selling, the topic really deserves some more scientific attention.

10 Annex

Annex 1: Summary of expert evaluations of additives, processing aids and practices

	Q1		Q2		Q3		Q4		Q5		Q6		Q7	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Wine preservation														
SO_2 gas	**16**	1	**6**	2	**10**	1	**7**	5	**9**	1	**10**	0	**17**	1
Potassium Bisulfite	**16**	11	**14**	7	**18**	8	11	12	**16**	8	**17**	7	**19**	7
Potassium Metabisulfite	**23**	4	**15**	6	**24**	4	**14**	11	**19**	5	**24**	2	**23**	5
Ammonium Bisulfite	5	20	7	11	13	13	8	15	11	13	10	13	**12**	11
Lysosyme	4	24	4	17	10	17	9	15	13	14	7	19	8	19
Sorbic acid	2	26	1	23	6	23	8	16	12	15	4	21	3	23
PVPP	2	22	5	15	8	16	8	11	8	15	2	22	5	19
Yeasts nutrition														
Ammonium sulphate	**14**	13	7	12	**15**	11	9	15	10	15	10	16	**16**	8
Diammonium Hydrogen Phosphate	**16**	11	8	12	**18**	7	12	12	10	14	11	14	**17**	7
Ammonium Bisulfite	6	20	4	16	11	14	6	17	6	18	6	19	9	14
Thiamin	**14**	12	8	11	**18**	7	12	12	11	14	12	12	**16**	8
Yeast ghosts	**15**	11	**11**	7	**21**	6	**15**	11	**17**	9	**13**	12	**22**	5
Wine making														
Wood chips	0	28	4	18	8	18	13	13	7	17	2	24	13	12
Clarification														
Proteins of plants origins	10	17	8	14	**15**	10	10	16	**10**	13	11	13	**19**	5
Betaglucanases enzyms	10	17	**10**	11	**16**	10	10	15	**13**	12	8	17	**12**	12
Potassium caseinate	**15**	12	9	14	**20**	5	12	12	**12**	11	10	15	**17**	6
PVPP	6	21	8	15	**13**	12	8	15	**11**	10	3	19	7	18
De-acidification														
Potassium bicarbonate	13	14	**13**	12	**14**	10	**13**	10	**14**	9	13	14	**18**	7
Stabilization														
Yeast mannoproteins	4	24	4	21	**17**	12	12	11	**15**	8	8	19	**16**	11
Metatartaric acid	5	21	7	16	8	18	10	13	**14**	9	5	20	12	13
Filtration														
Cellulose	**15**	12	**12**	11	**23**	5	**16**	9	**16**	8	**18**	9	**25**	1
Bottling														
Copper Sulphate	11	17	12	13	13	13	**14**	11	**15**	9	12	14	**19**	6
DMDC	0	27	4	20	3	23	7	12	4	16	1	25	1	25

Do you agree with the following affirmation ?

Q1: The substance is essential for the processing and/or preservation

Q2: Known technological alternatives may cause new and worse problems than those caused by the substance (Precautionary principle)

Q3: The substance contributes to a production of high quality products

Q4: The substance does not mislead consumers trying to cover up the true nature of the produce

Q5: The substance does not reconstitute properties that have been lost during processing and storage of organic food or correct the results of negligence

Q6: The substance is necessary to ensure production of well established food products in organic form

Q7: The substance is compatible with principles of organic agriculture and can be listed in the new implementing rules for organic wine (enventually with restriction).

Annex 2: List of the fact sheets

Substances	Facts-sheets	Expertise	Presently allowed in organic production
Ammonium bisulfite	X	X	
Ammonium sulphate	X	X	
Bentonite	X		X
Betaglucananses enzyms	X	X	
Cellulose	X	X	X
Copper sulphate	X	X	
Diammonium Hydrogen Phosphate	X	X	
DMDC	X	X	
Gelatine	X		X
Lysozyme	X	X	
Metatartaric Acid	X	X	
Potassium bicarbonate	X	X	
Potassium bisulfite	X	X	
Potassium caseinate	X	X	
Potassium metabisulfite	X	X	X
Proteins plants origins	X	X	
PVPP	X	X	
SO2 Gas	X	X	X
Sorbic acid	X	X	
Thiamine	X	X	
Wood chips	X	X	
Yeasts ghosts	X	X	X
Yeasts mannoproteins	X	X	X

X : fact sheet or expertise available

Annex 3: List of deliverable references quoted in this report

WP2: STATUS-QUO ANALYSIS OF WINE-PRODUCER PRACTISES, MARKET NEEDS AND CONSUMER PERCEPTIONS

D 2.2 Analysis of regulatory framework and standards applied to organic winemaking in Europe

D 2.4 Analysis of markets needs

D 2.5 Applied technology, markets and production attitudes of organic-wine producers;

D 2.6 Development of integrated assessment tools for organic viticulture: Adaptation and application of the HACCP[5] methodology to agronomy

D.2.7 Consumer expectations of organic wine – a qualitative consumer study

WP 3: IMPROVED MANAGEMENT PRACTICES IN WINEMAKING AND EXPERIMENTAL TESTING

D 3.4 Report of monitoring activity on health-related wine compounds

D 3.6 Improvement of organic winemaking practices management: scientific experiments and results

WP 4: ON-FARM APPLICATION AND TESTING OF INNOVATIVE METHODS

D 4.4 Report on the application of the impact analysis tool and system analysis for organic viticulture and fine-tuned application of the tool.

D 4.5 Final consolidated internal report, including winemakers' acceptability evaluation.

WP 5: REGULATORY PROPOSAL, STAKEHOLDER INVOLVEMENT, RESULT DISSEMINATION

Results of the web survey consultation on the regulation of organic-wine production in the EU

Final report on stakeholder involvement

D 5.4 Proposal and Recommendations for the improvement of EU Regulation 2092/91(first draft)

D 5.7 Proposal and recommendation: "Code of good organic viticulture and winemaking practices"

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[5] Hazard Analysis Critical Control point