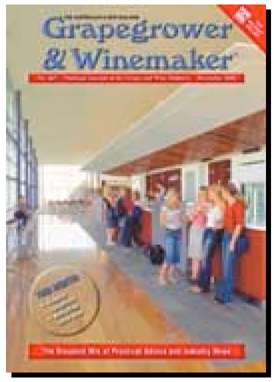
Presentation of a Racking Technique for Premium Mediterranean White and Rosé Juices



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Introduction:

This article briefly describes a unique racking technique developed for making premium white and rosé wines from the Mediterranean Languedoc and Rhône regions. This technique is a result of Research and Development work conducted on the white winemaking process at the Institut Cooperatif du Vin (ICV) between 1990 and 1995 (Delteil and Jarry, 1993; Delteil and Lozano, 1995; Delteil, 1998). Since then, it has been incorporated into the ICV enological Quality Consultation Plan, which follows the rules of Quality Assurance. It was tested in wineries (70 consulting enologists proposed it in 1500 wineries) throughout the Mediterranean Languedoc and Rhône regions in France for its feasibility and its effects. In this article, I will report on the objectives of this technique, the principal experimental steps taken for its development, and a practical description.

The preparation strategy of Mediterranean white and rosé juice:

The term "juice clarification" implies an immediate condition of the juice. Aside from the market for clear juice, racking is only an intermediary stage for the subsequent stages in winemaking. For this reason I prefer to use the expression "juice preparation". This refers to the immediate objectives for the juice, but primarily for the long-term objectives in the wine.
The three principal objectives of this **juice preparation** are:

1. To limit the aromatic and gustatory risks of fermentation to wine quality: disagreeable volatile sulfur components of rotten eggs, onion, garlic, rubber, tin can, etc. These components have a very negative impact on the mouthfeel: increases in rough, dry, and bitter sensations as measured by Quantitative Descriptive Sensory Analysis at the ICV (D. Delteil, 2001).
   To accomplish this objective, it is necessary to eliminate the suspended solids in the juice generating the haze (particles originating from the grapes). This is a very classical and well-known approach of juice clarification.

2. To limit the risks to wine quality from alcoholic fermentation: sluggish or stuck fermentation, production of volatile acidity by the strain of *Saccharomyces* used, etc.
   To accomplish this objective, one must manage the composition of nutrients and growth factors in the must that are indispensable for the yeast. This is not always as carefully considered, as it should be.

3. To develop the grapes' full potential as a function of market objectives.
   To accomplish this, one must manage the elements in the must that contribute to the wine's identity such as soil/climate and variety.

To eliminate the elements of haze in suspension:

It has been demonstrated that the particles in suspension in juice before fermentation have a very great influence on the production of volatile sulfur compounds, such as methionol (Lavigne *et al*, 1993), by the yeast during fermentation. Many of the sulfur compounds are stable in wine and have a negative impact on the wine's aromatic and gustatory profile.
Based on experience, to manage this risk in Languedoc and Rhône Mediterranean white and rosé juices, one must lower the turbidity in the must below 100 NTU. This figure takes into account the variability in Mediterranean grapes and juice extraction methods.
For these Mediterranean juices, clarification by static sedimentation/settling after the addition of selected enzyme preparations allows easy accomplishment of the first objective, in the absence of grey rot. If the enzymatic clarification is properly carried out, then the addition of other auxiliary products, such as bentonite, gelatin or silica gel are not necessary at this stage.

Figure #1 shows the ICV R&D test results on the level of must turbidity comparing two clarification methods. In this trial, despite a sulfite addition blocking the onset of fermentation, certain clarification and settling techniques, like that of bentonite, did not allow a sufficient drop below a turbidity threshold. The potential production of volatile sulfur compounds is 72 hours at 4°C in this example, even with adequate time/sufficient waiting and at the high cost of chilling.

Note: *A selected enzyme preparation for the elaboration of Languedoc and Rhône Mediterranean white and rosé wines is added to the grapes at reception. In this way the enzymes act during maceration and pressing, appreciably modifying the parameters of the exchanges between the grapes and the juice. In particular, it permits the liberation of a greater volume of juice. This juice is richer in important macromolecules and in aroma precursors from the grapes (Canal-Llauberes, 1993). The action of these enzymes is the ultimate pursuit of juice extraction. They carry out the hydrolysis of pectic complexes that are diffused, and permit the achievement of a static settling with the results that are described in this article.*

Figure #2 shows the clarification kinetics of pneumatic- pressed juice, after the addition of selected enzyme preparations to 200 hl volumes. In this application, the juice was kept an hour at 20°C until complete depectinisation, and then it was cooled to 10°C.
Within hours, a very large portion of the must (often more than 80% of the final clear juice) can be prepared for fermentation: racking and addition of selected, rehydrated yeast. It is important to prepare this large part of the juice for fermentation, because every delay is favorable for the multiplication of indigenous yeast that will compromise the inoculated yeast implantation. Additionally, as long as the grape quality and the objectives are working, another stage for the preparation can be added: the re-introduction of the depectinised fine lees, also termed “pectic flakes” because of their physical appearance.

To manage the composition of the nutritional elements in the juice which are important for yeast.

The settling described here does not modify the contents of the juice in hydrolysable nutrients for the yeast: assimilable nitrogen, vitamins, etc.
On the other hand, when the first objective of juice preparation is attained, meaning the turbidity is lower than 100 NTU, the juice is poor in certain insoluble hydrophobic growth factors in the juice, such as polyunsaturated fatty acids and sterols.

The depectinised juice solids (i.e. the pectic flakes) that have settled above the heavier solids are rich in certain colloids and in fatty acids and sterols. When one adds a portion of the depectinised juice fine lees solids or pectic flakes (1-3% maximum) back to the clear juice, the yeast population has access to essential growth factors at a critical moment in its quantitative and physiological evolution. As the composition of juice nutrients has changed, the results in the fermentation may change and therefore the composition of wine can be modified: e.g. less sulphur off-flavour compounds, less acetic acid.

Figure #3 shows the ICV R&D results of the addition of the depectinised fine lees solids on the quantity of acetic acid produced by the yeast during the fermentation, selected yeast ICV D47®.

In this example, it is the differences in the availability of nutritional growth factors such as unsaturated fatty acids and sterols that influence the metabolic activity of the yeast. In this trial, the change in turbidity (a difference of 28 NTU between the two juices) is not sufficient to explain the change in the metabolism of acetic acid by the yeast. It is known that the elements of solids that are nutritionally neutral may also influence the metabolism of acetic acid by Saccharomyces (Delphini and Costa, 1993). One begins to be able to note apparent differences with changes in turbidity above 200 NTU, at least in Languedoc and Rhône region white and rosé juices. With such a change in turbidity, one also augments the production of sulphur compounds, contrary to the first objective of the preparation of juice, as previously mentioned.

Below 100 NTU, the turbidity is no longer the principal indicator of the quality in the must preparation. For example, in this trial, one juice with 50 NTU is missing certain elements for the yeast, while another is balanced for the same elements with 78 NTU. When reduction of the principal risks is attained, a well managed juice preparation such as is described later, should permit the development of the qualitative potentials of the grapes, consistent with the profiles sought in the market.

To manage the elements in the must that contribute to the wine's identification with “terroir” and variety:

Figures #4 and #5 show the effect on the aromatic and gustatory profiles of a Chardonnay fermented with selected yeast ICV D47® with the addition of 1% depectinised fine lees solids (pectic flakes) to clear juice before fermentation.
The same trial as figure #3. The yeast used in this trial is also used in Australia for Chardonnay (B. Hickin, 2001), distributed by Lallemand.

After a settling with a selected enzyme preparation, the re-introduction of a 1% mixture of depectinised fine lees solids to a very clear juice permits a modification of the aromatic and gustatory profiles in the wine. The descriptors sweet and fruity dominate compared to the same must fermented uniquely as clear juice. The risks of aromatic defects are controlled, but above all the grape potential is developed. The current goals for Languedoc and Rhône Mediterranean white and rosé wines include sensations of sweet, fruity aromas, and a mouth-coating sensation/viscosity.

The changes in wine style are due globally to a combination of two phenomena:

1. The release into solution of hydrophobic elements bound to colloidal complex-forming solids, and the elements making up the solids (polysaccharides, aromatic compounds, etc.). These elements are released in the juice in fermentation and afterwards in the wine when the conditions of solubility change due to the production of alcohol and other components by the yeast.

2. The changes in the metabolic activity of the yeast.

Clarification by other techniques (cold settling alone without enzymes, fining, centrifugation, etc.) does not permit such development of the grapes' potential. Cold settling alone, without enzymes, doesn't usually allow a complete depectinisation, a flocculation, and a well-stratified sedimentation. The addition of fining agents doesn't allow recovery and re-use of certain unique elements from grapes. In fact, the solids of the fining agents contain different constituents to which certain negative elements are adsorbed. As for centrifuging, it eliminates a mixture of the particles and the solids. Also, it cleaves some particles giving a haze even more difficult to eliminate later on.

A settling technique that fulfills the objectives of preparing premium Languedoc and Rhone Mediterranean juice:

Diagram #1 illustrates this technique, with its four principal steps.

Step #1: Add selected enzyme preparation into the raw juice at the correct concentration. The enzyme action should assure a complete depectinisation within 1 hour at about 20° C. As indicated in the beginning of this article, the proper management of the enzyme addition to the grapes before pressing avoids an enzyme re-addition to the extracted juice.

Step #2: After the flocculation and sedimentation (from 6-48 hours between 5 and 15° C), the juice tank separates into different layers/strata. From top to bottom: clear juice; low turbidity from which all of the negative elements have been eliminated; then the white fine lees solids (the pectic flakes) of the depectinisation which are rich in colloids, fatty acids and sterols; finally at the bottom, the heavy lees.

Step #3: Pump the clear juice to the fermentation tank, taking care to not disturb the lees. The juice is very clear (turbidity of 30-100 NTU), and is rid of negative extraction elements from the raw juice. On the other hand, it has been clearly impoverished of colloids and fatty acids, elements that the yeast need, and that positively influence the wine's profile.

Step #4: Taking care not to put the suction hose in the heavy lees, rack the depectinised fine lees solids (pectic flakes) that are mixed with the clear juice. For 300 hl of clear juice, take 3-6 hl of this mixture, depending on the objectives of the wine style. The turbidity increases minimally: for example it increases from 50 NTU to 80 NTU, and the fine must composition is sufficiently re equilibrated.

Conclusion:

As indicated in the introduction, this clarification technique is well-known in the French Mediterranean arc and in certain countries where I am a consultant: Italy, Argentina, and Spain.

Like all techniques, its utilization should be reasoned and adapted to the average technology, staff and finances of the winery, and of course to the grapes to be treated.

Like all techniques, it is not universal.

It is proven particularly well-adapted to accompany the winemaking of white and rosé Languedoc and Rhône Mediterranean wines positioned in the premium and ultra premium levels of the market.

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Figure #1. Effect of different types of juice clarification on the level of turbidity *(ICV R&D 1992 in-house document)*

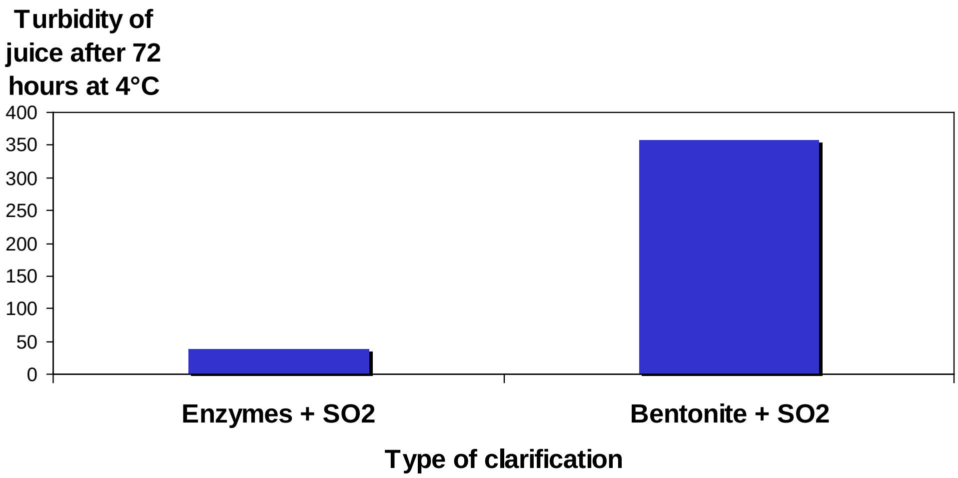

Figure #2. Effect of selected enzymes on the kinetics of clarification of pneumatic-pressed juice *(ICV 1994, in-house document)*

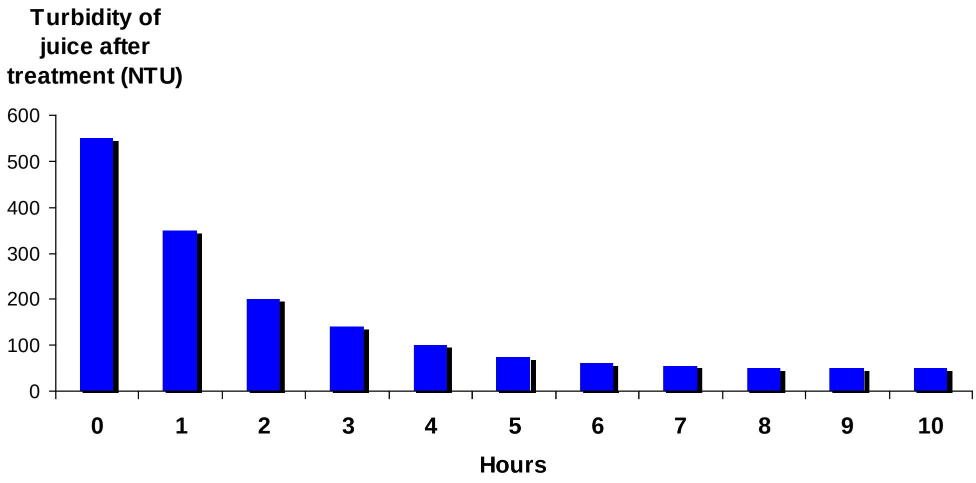

Figure #3. Effect of the addition of depectinised fine lees (pectic flakes) on the quantity of acetic acid produced by the ICV D47® yeast strain during the fermentation of Chardonnay juice.*(ICV R&D 1992, in-house document)*

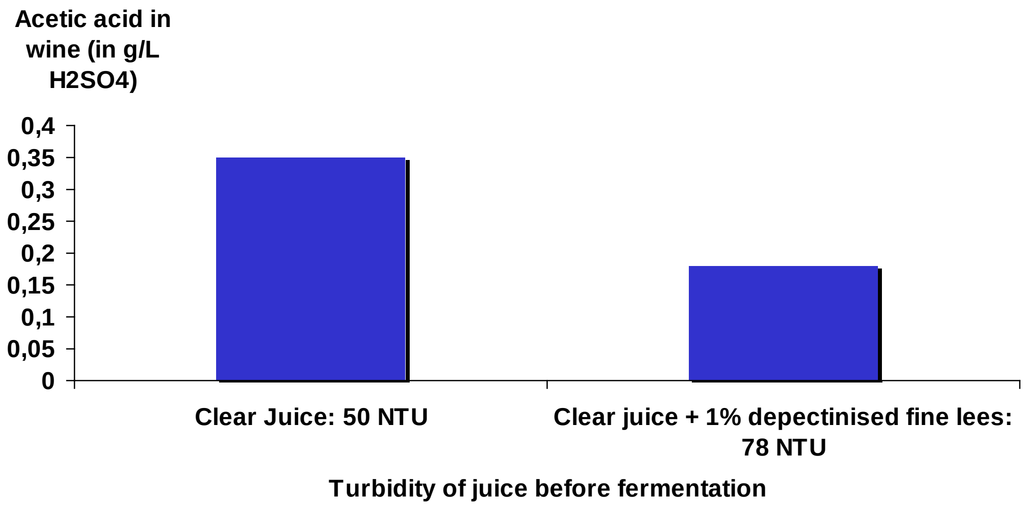

Figure #4. Chardonnay aromatic profiles fermented with ICV D47® yeast: Effect of the addition of 1% depectinised fine lees (pectic flakes) on clear juice before fermentation. *(ICV R&D 1992, in house document)*

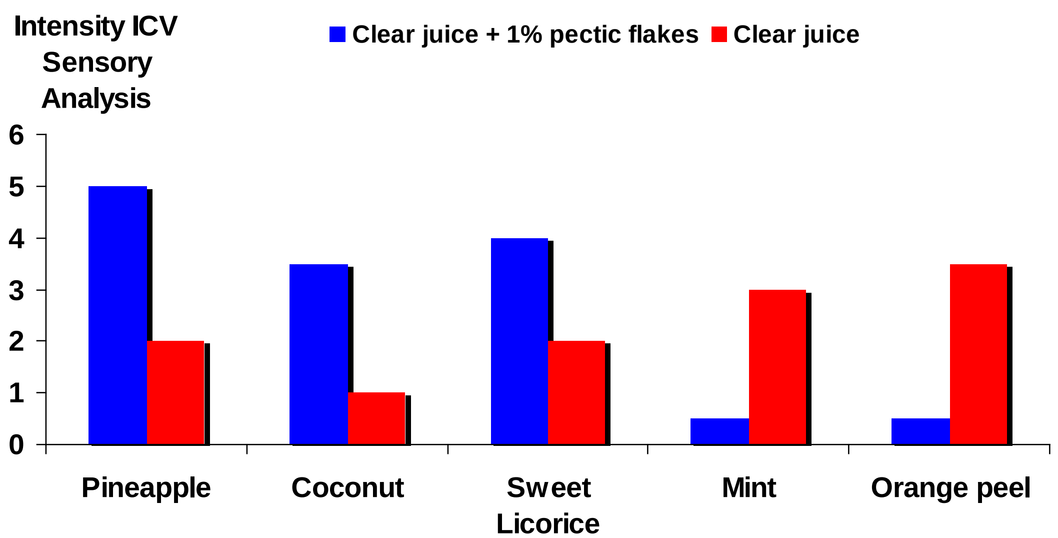

Figure #5. Chardonnay mouthfeel profiles fermented with ICV D47® yeast: Effect of the addition of 1% depectinised fine lees (pectic flakes) on clear juice before fermentation. *(ICV R&D 1992, in-house document)*

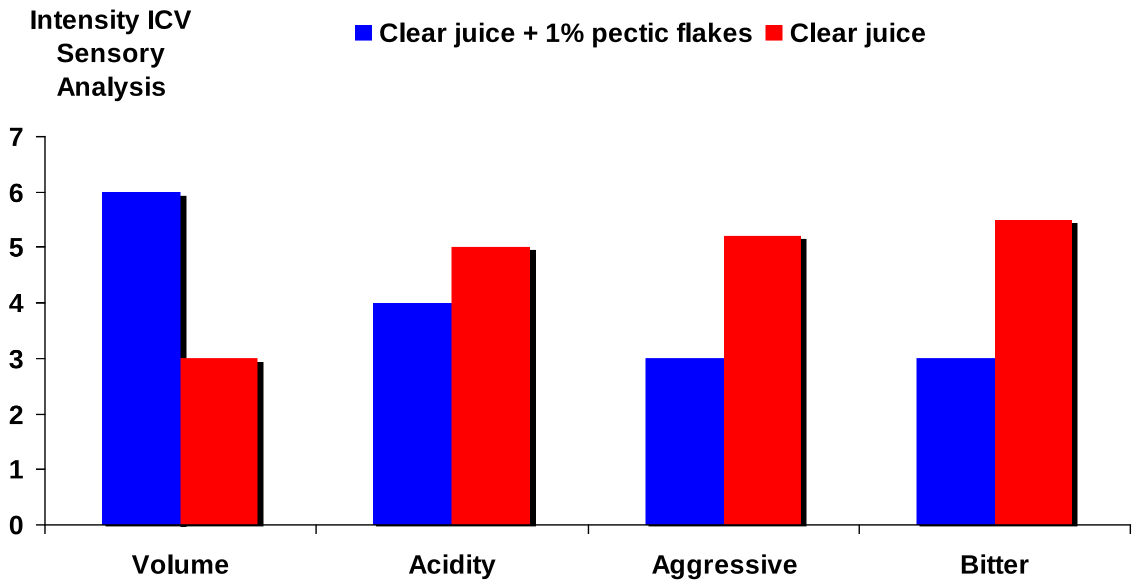

Diagram I. Preparation of juice containing depectinised fine lees (pectic flakes)