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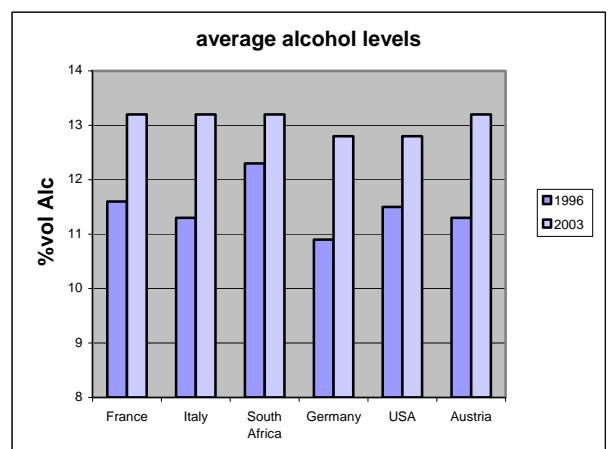
Impact of microbial aspects on the process chain during vinification

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Global warming has become an issue. In every area of our life we will be more and more confronted with the effects of the climatic change. We are experiencing extreme droughts followed by unexpected floods. The average temperature increased continuously over the past 20 years. Changing weather conditions with extreme temperatures and rain fall have a deep impact on the grape quality. The last vintage was in the mid of Europe one of the worst since records. Some areas reported botrytis infection levels up to 90%. This may remind us to the 2005 vintage in NZ. But the threat and the challenge for the viticulture is obvious. The viticulturists have to fight with more extreme weather situation but also with an increase of fungal infections. Apart from that, the fungi seem to become resistant to some spraying ingredients. The viticulture has to adapt to these conditions. But these changing conditions have a strong influence on the winemaking procedures and at the end on the quality of the wines.

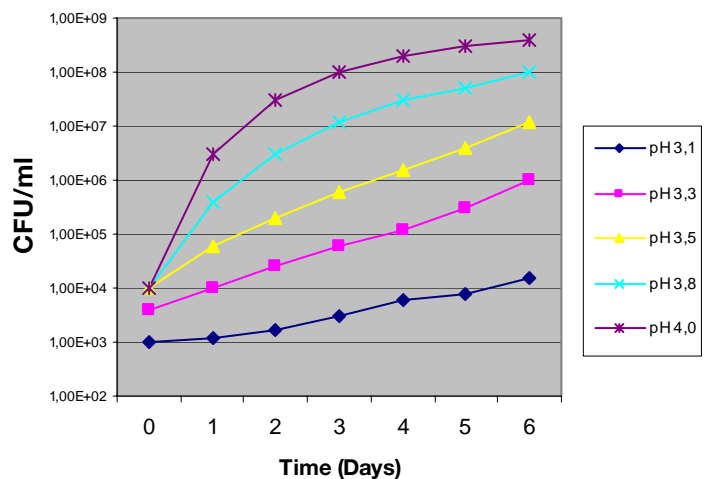
The winemakers have to be aware on the consequences for the oenology and the process chain. Increasing sugar levels lead to wine with excessive high alcohol levels. The current vine clones promote this effect. They were selected in times with less extreme weather conditions with the aim of a high sugar production. This physiological property is today counterproductive. We get high sugar levels where the physiological ripeness is still not at its maximum. This effect also results in wines with increasing alcohol figures. High alcohol wines are becoming difficult to sell in the global market. First because of the customers' preference and second because of lower limits for drivers. This results in a higher demand for low alcohol wines. The other great challenge are increasing pH values.



The next problem are the dropping values of yeast assimilable nitrogen (YAN) in grapes. Studies showed that the average levels of YAN became significantly lower in the past 20 years. (Sponholz1988 /Prior 1997). But it's also logical that the deficit of nitrogen is not a single deficit. The concentration of other micro and macro substrates dropped at the same time. This results in the tendency that the fermentation capability of the grape becomes weaker. The single eyed view only on YAN is not enough to explain fermentation problem and flavour deficiencies.

Increasing pH values have also a deep impact on the vinification chain. The winemakers are well aware that a high pH increase the risk of the growth of undesired micro-organisms. But it's often not in their mind that small differences in pH can cause already big differences in the growth rate of micro-organism. Apart from this aspect the pH has also a great influence on the metabolism of desired and undesired micro-organism. The metabolic functions of yeast or bacteria are also depended on the pH.

Graph 1 Average alcohol level in wine SLB



Different species and strains have different optimal pH requirements for the uptake of amino acids. This circumstance can result in inconsistent fermentation speed and aroma profile by yeast or bacteria. In worst case the combination of a low amino acid profile juice with high pH can become a selective media where more the undesired species find suitable condition for the survival. This aspect is very important for those winemaker that go for spontaneous fermentations. The "selective character" of amino acid profile and pH have to be considered if spontaneous fermentation is desired.

The conclusion of all these aspects is, that winemakers need strong tools to control the processes during wine making. Strict analytical and microbial control and adapted vineyard management are a part of these tools.

Contribution of yeast supplementation to fermentation dynamics and to the wine flavour

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General

Stuck or sluggish fermentations are still a present problem in the wine industry. The second big problem in relation to the alcoholic fermentation is the formation of reduced off flavours. Both problems occur when the metabolism of the yeast is inhibited by either a lack of nutrition or by other external factors or inhibitors such as pesticides etc.

In case of a lack of nitrogen the addition of DAP or yeast extract is a commonly used method to avoid off flavour and ensure a complete fermentation. But in many fermentations the addition of DAP or yeast extracts is insufficient to ensure a reliable and clean fermentation. The reason for that is the deficit of important co-factors/ so called supplements such as vitamins, trace elements and specific amino acids that enable the yeast to utilize other nitrogen sources and conduct a secure and clean fermentation. The addition of some vitamins effect was suggested by previous studies. But in most cases

New formulation

The result of a 4 year research program is the FermControl™. This new balanced formulation fills the gaps of supplements in the juice. To show the efficacy of the supplementation a trial was conducted in 5000 litre stainless steel tanks. For this study a Muller Thurgau juice was selected from a vineyard that was known to give low values of yeast assimilable nitrogen (YAN). The data of the juice were: 13 vol%, pH 3,4, TA 7,8g/l, YAN 220 g/l. SF was compared with other fermentation aids on the base of DAP, yeast extract or yeast hulls.

Results

The study showed that the addition of FermControl™ to the poor juice resulted in a faster and more reliable fermentation than the control and the trials with the addition of 100g/hl DAP or the fermentation aids on yeast base. Fig. 1: The fastest fermentation was achieved by addition of FermControl™ with and without DAP. This shows that the slow fermentation in this poor juice was not caused by a lack of nitrogen but by a lack of supplements that enable the yeast to utilize the natural nitrogen sources more efficiently and completely.

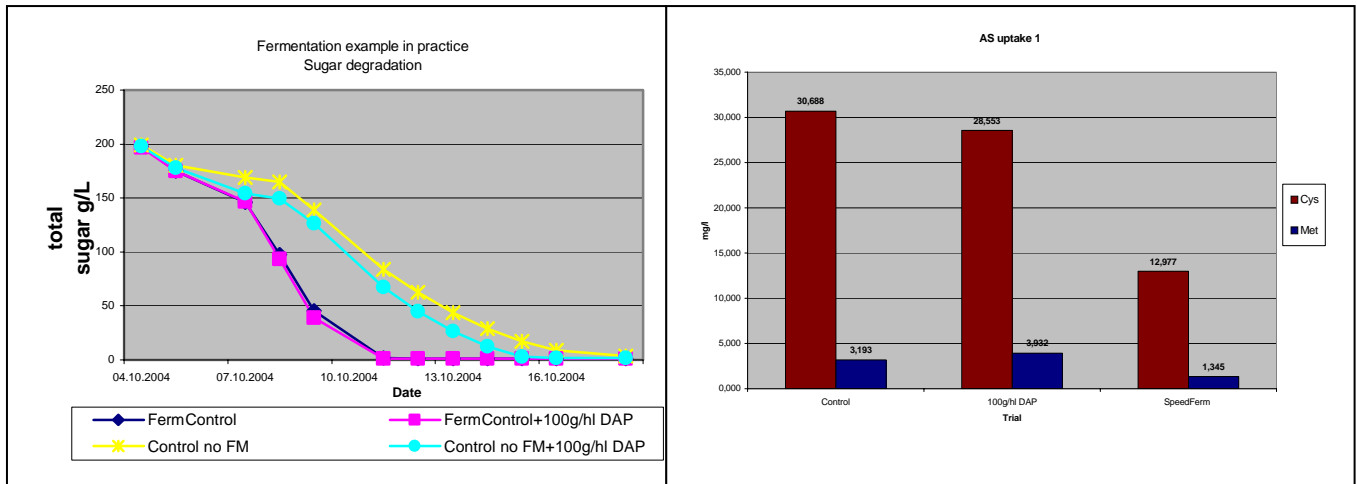


Fig 1

Fig.2

Another result of the study was that the addition of supplements leads to an improved uptake of amino acids. Especially the uptake of the two amino acids methionine and cysteine, that are mainly involved in the formation of undesired sulphur off flavours, was significantly improved. Fig.2: It became visible that the supplementation leads to a more complete utilization of these specific amino acids, which results in no production of H₂S or other undesired S off flavours.

Conclusions

It became clear that the presence of sufficient supplements has a higher importance than pure nitrogen. The supplemented fermentations with FermControl were more reliable and the flavour was free from S off flavours. Besides that it was observed that the SO₂ levels produced by the yeast were reduced up to 25 % in comparison to the non supplemented trials. Furthermore the sensorial evaluation showed a clear preference for the supplements wines. FermControl is a special preparation on of a highly purified special yeast extract. It doesn't give any yeast flavour to the wines. It's natural and GMO free.

New application for the MLF-flavour evolution by new MLF starter cultures

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General

The malolactic fermentation (MLF) is a commonly used method to convert the aggressive malic acid to lactic acid. This conversion results in a reduction of the titratable total acidity which is desired mainly in red wine but also in numerous white wines. This process will be done either by the indigenous flora of LAB or by selected strains of LAB e.g. *Oenococcus oeni*. During the MLF *Oenococcus oeni* doesn't convert only malic acid into lactic acid, a numerous amount of aroma active by-products will also be produced. The best known is diacetyl which gives a buttery note to the wines. In some wines, preferably red wines, this "buttery" note is accepted or even desired. Diacetyl will be produced during the MLF by the conversion of the natural citric acid in wine by *Oenococcus oeni* (Jan Clair Nielsen 1999). Besides diacetyl a high number of other aroma active by-products will be produced. The tasters in sensorial description call this flavour impact a "lactic note". In fruity white wines, such as Riesling or Sauvignon Blanc, this is not desired. A demand from the wine makers side is to avoid the lactic notes without losing the other benefits of the MLF.

Aroma profile of MLF

To avoid these lactic notes many studies or field trials have been conducted. The producer of MLF starter cultures tried to solve this demand by new selections of MLF starter strains. Fig.1 shows the profile of aroma compounds in wine produced with different MLF starter strains in comparison to a wine without MLF and a spontaneous MLF. It becomes obvious that the profiles of these aroma compounds are different for each culture.

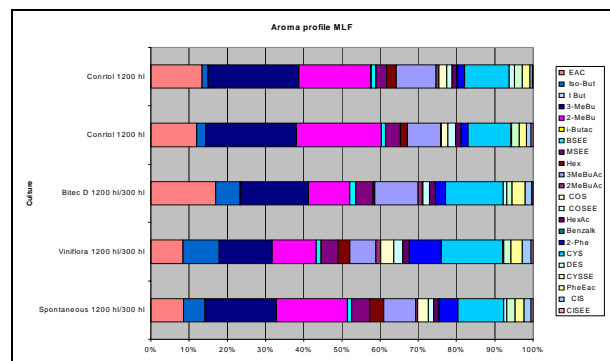


Fig.1

Timing of inoculation

Another way to reduce the intensity of these lactic notes is the degradation of diacetyl by active LAB or yeast. This method was described in 1999 in a field study conducted by Chr.Hansen and BWK in Germany. The corresponding publication "Timing of inoculation of MLF starter cultures" showed that the simultaneous inoculation of yeast and bacteria gave wines with less lactic notes than the post fermentative inoculation. The explanation was that the degradation of the diacetyl depends on a low redox-potential, which is mainly present during the alcoholic fermentation.

New MLF starter cultures

A new method to reduce the flavour impact from lactic notes is the application of a new MLF starter strain. This strain is "citric acid negative". Vinibacti™111 doesn't have the ability to degrade citric acid during the MLF. The result is that diacetyl and all other intermediate by-products coming from the citric acid metabolism are not produced by the strain. Fig. 2 shows the malic acid degradation curves with different MLF starter cultures in comparison to a control and Vinibacti™111. All starter strains conduct the MLF within 2 weeks. Fig. 3 shows the corresponding curves of the citric acid degradation at the same time. Except for Vinibacti™111 all MLF strains degrade the citric acid. The small drop of citric acid in the control was caused by the indigenous background contaminants. The control was sulphured right after completion of the alcoholic fermentation.

Conclusions

There are many ways to influence the aroma profile of wine with MLF. Timing of inoculation and ageing on the lees are possible methods to reduce the lactic notes. But these applications depend very much on external factors such as the redox-potential. The most promising method to avoid the impact of lactic notes coming from the citric acid metabolism of *Oenococcus oeni* is the inoculation of a citric acid negative MLF starter strain, Vinibacti™111. It's metabolism doesn't produce diacetyl and intermediate by-products coming from citric acid.

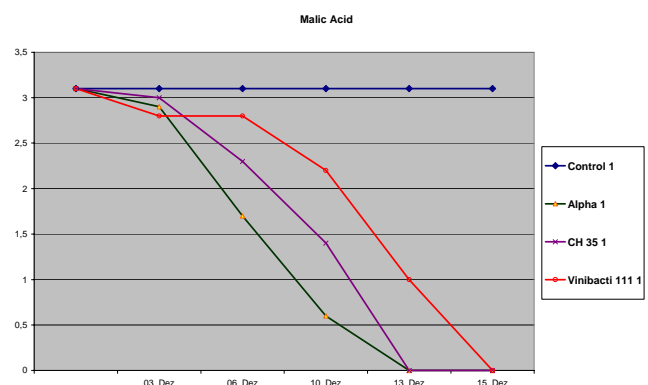


Fig.3