MASI
AGRICOLA

Amarone: The Biological Background

Seminario Masi - Vinitaly 1999

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Introduction

This year, the Masi Technical Group deals in greater depth with a theme that was touched on last year: the semi-drying and fermentation of grapes for the production of Amarone.

The ancient and sophisticatd production technique for Amarone reveals a series of absolutely singular biological phenomena, which find their true and optimum expression through the medium of the Corvina, Rondinella and Molinara grape varieties.

This year's Seminar will follow the production cycle of this wine and analyze its biological backgroud in the vineyard, during the drying phase, during vinification and during the ageing process, thus highlighting the individuality of Amarone and the reasons for its great contemporary success.

Biology manifests itself in the vineyard both through natural phenomena and through various interventions by the grower.
Then, the drying of the grapes involves the practical application of techniques which make use of a certain knowledge of biology, for the control of the phenomenon of botrytization.
The conditions during vinification highlight other important aspects of the biotechnology of Amarone, especially with reference to the need for greater control of the alcoholic fermentation. It is also of great importance, both from a technical and a quality point of view, to induce the malolactic fermentation at the right time.

Nowadays, the above biotechnological interventions take place with due respect for the potentialities of the grapes themselves, by using particular types of yeasts and bacteria which are specially selected for this purpose. The aim is to obtain, in a briefer time than in the past, an Amarone which displays greater character and definition, without any possible unpleasant faults in colour, aroma or flavour.

"Our goal with these new technological methods" says Lanfranco Paronetto, coordinator of the Masi Technical Group, "is to exercise a certain control over the numerous natural biological phenomena, using the best that Nature itself has to offer."

Sandro Boscaini adds: "Yet again, here in the field of technology, we find expressed the uniqueness of Amarone, which offers aspects which are simply not to be found in any other type of wine. Amarone, then, is a unique wine not only by virtue of its style, but also because of the grapes and the techniques which go into making it".

For over ten years now the Masi Technical Group has presented, during Vinitaly, the results of its research into the factors that determine quality in the wines of Verona. On each occasion its studies have delved deeper into particular aspects regarding climate, soils, grape varieties and the human factor both in the vineyard and in the winery.

BIOLOGY AND QUALITY IN THE VINEYARD

Dario Boscaini

I shall discuss here "viticultural ecology" meaning the study of the interaction between viticulture and the environment, defining this latter term as climate and soil conditions.

In modern viticulture, the objectives of production are many and various, and their realization is determined by different conditions of environment and terrain. In order to produce wine grapes, table grapes or grapes for drying, it is fundamental to select the most suitable natural ecosystem based on the interaction between climate, soil and the biological entity constituted by an individual grape variety and an individual rootstock.

The grape variety is without doubt the most important factor in the ecosystem for the realization of a particular winemaking objective.

At last year's Seminar, the results of drying and then vinifying some of the most noble and highly-prized grapes (Sangiovese, Barbera, Raboso, Cabernet) were presented. The goal of this research was to verify if these varieties were able to improve upon the traditional blend of Corvina, Rondinella and Molinara in the production of Amarone. Though the resulting wines were very interesting, they were not deemed satisfactory with regard to the aim in question. It was agreed that the best "recipe" for Amarone remained that using traditional grapes.

In view of the above, let us examine what the situation is today and what the prospects are for the future as regards production of the three grapes destined for semi-drying for the production of Amarone.

Their indispensable characteristics are those that all grapes must have which are destined for the production of fine wines, but with other specific qualities because they are not vinified in October but in January, after three long months of drying during which the biological processes are several and of fundamental importance.

THE GRAPE VARIETY AND THE ROOT STOCK

The clonal selections for Corvina, Rondinella and Molinara which took place twenty-five years ago made available clones which were undoubtedly superior to those found in the past, capable of yielding grapes of higher quality, which were less subject to disease and which showed good typicity.

These clones, however, were selected particularly for the production of Valpolicella, and little thought was given to the delicate drying phase. Even today we still lack specific clones, in particular of Corvina and Rondinella, which, as we know, are the most important varieties.

The plants should be of low vigour, with bunches that are loosely packed and fairly small, containing small berries with resistant skins, so that ripening takes place earlier.

Corvina, in addition, has to produce on the basal buds in order to avoid having to prune too long, which can lead, for a whole host of reasons, to lower quality.

Unfortunately, the work of clonal selection stopped after the first phase and I do not believe that it will recommence in the near future.

The same goes for rootstocks; which are of considerable importance because they modify the normal metabolic rhythm of the plant.
Initially, rootstocks had the the single, precise function of protecting the vineyards from the damage provoked by phylloxera, but today we demand much more of this important part of the plant: in particular,

- resistence to parasites (phylloxera, nematodes, ladybirds, rotting of the roots)
- resistance to the lack of certain minerals o resistance to humidity and drought

control of the natural vigour of the grape variety

I should like to dwell briefly on this last point because I believe it to be of fundamental importance for the objectives that we have set ourselves.

Control takes place by means of regulating the absorption of minerals and water by the root system, the determination of the length and intensity of vegetative growth during the course of the year and the bringing forward or delaying of the ripening of the grapes. It is well known that the best results are obtained with weak rootstocks which curb the vigour of the vines and therefore permit dense planting. Vigorous rootstocks, on the other hand, prolong the vegetative cycle, with less accumulation of sugars and of other desirable components in the grapes themselves, as well as favouring possible attack by Botrytis cinerea and other diseases because of the over-plentiful leaf canopy and shade which it provides.

For rootstocks too, there has been a lamentable delay in perfecting plants with the desired characteristics.

To this fact one must add that the information which reaches the vinegrower from researchers and public bodies is not always accurate and precise.

Some twenty to twenty-five years ago, SO4 was proposed as a rootstock particularly suitable for producing quality grapes. In point of fact it was revealed to be too vigorous, with all the ensuing drawbacks that I have just outlined. Unfortunately, many vineyards were planted with this rootstock, thus causing serious damage, in view of the fact that the average lifespan of a vine is thirty to forty years.

NUTRITION OF THE VINE
The DOC regulations forbid the use of practices which might overstress the vine. Undoubtedly, until a few years ago and still, unfortunately, in some cases today, the fertilizing that was or is carried out really does overstress the vine, merely increasing quantity to the detriment of quality.

On the other hand, however, we must remember that mineral nutrients are indispensable, and play a very important role in determining the quality of the grapes. Macro- and micro-elements are capable of modifying the vine's content of Carbohydrates, Proteins, Aminoacids, Aromas, Vitamins, Organic Acids, etc.

Fertilization, when carried out in order to satisfy the real needs of the vines, leads to a notable improvement in quality with limited or non-existant increases in quantity. Nowadays, the opinion is still fairly widespread that to produce quality grapes it is better to avoid fertilizing the vineyards altogether. This is because, in the recent past, large-scale and unbalanced fertilizing yielded grapes of poor or indeed dreadful quality.
The exaggerated use of nitrogen both as an organic fertililzer and as a mineral one, undoubtedly led to rather negative results.
These results were not solely due, however, to the application of considerable amounts of organic substances and fertilizers, but rather also to the simultaneous use of all those biological factors (vines and rootstocks) and agronomic factors (training systems, high numbers of buds, treatment of the soil and irrigation, including the use of fertilizers) to which recourse was made in order to obtain quantity rather than quality.

Today we have a whole range of means at our disposal in order not to commit errors as regards fertilizing: I am referring to soil analysis, leaf diagnosis and to nutritional charts.

GROWING GRASS IN THE VINEYARD

This consists in maintaining the whole of the surface of the ground, or at least a part of it, covered with natural or specially-sown vegetation.

The advantages of this practice are many and are very important.
Just to mention a few:

- "ecological" control of weeds
- reduction of erosion of soil on slopes
- increase in the strength of the soil
- increase in organic substances
- better structure and porosity
- the development of microbial flora and fauna, and of useful insect life
- positive action against certain pathologies (Botrytis, drying of the Rachis, Chlorosis)
- reduction in production, with an increase in grape sugars and polyphenols
- reduction of the vigour of the vines.

This practice is rapidly becoming more widespread all over the Valpolicella Classico zone, and especially in the hillside areas which have always been best suited to producing grapes which will be destined for drying.

DEFENSE AGAINST DISEASES

To achieve the objectives that we have set for ourselves, it is fundamentally important to produce perfectly healthy grapes, with intact berries and thick skins which are capable of enduring the long drying period. All vinegrowers know that even a small rupture in just one berry can cause the development of moulds which may destroy the work of the entire year: thus the need for effective anti-parasitic treatments. On the other hand, there is now a generally widespread consciousness within the agricultural world of the need to reduce and improve the quality of treatments with chemical products.

Information on the subject is not always correct, with extreme points of view which vary between those who champion the total abolition of the use of pesticides and those who minimize the negative effects (especially on the environment and on the ecological equilibrium) caused by the excessive or unreasonable use of chemical plant protection products.

I do not believe that, as things stand, it is possible to do away completely with the use of pesticides and, therefore, in the companies within our group we are aiming to drastically reduce the use of chemical products. This organic protection system takes into consideration all the biological and technical factors which may have an influence on the level of infestation. All this has led to undoubted benefits from the point of view of reducing toxicity both as regards man and the environment, as well as to the protection and the reconstitution of useful organisms, and to the reduction of phenomena of resistance to pesticides.

In conclusion, I should like to say a few words about one of the most dangerous problems of a parasitical nature which also affects grapes that are vinified in October, but which is particularly harmful to those grapes which are destined for drying: grey rot.

This is caused by a fungus and, with vines, it can develop in different ways, giving rise to two distinct and opposite forms.
The former, so-called "noble rot", is the result of a larval development of the fungus within the berries both during the period of ripening as well as during the drying phase. Doctor Paronetto, in his paper, will explain to you the importance and the usefulness of noble rot.
The other form is that which provokes pathological manifestations, that involve the progressive decay of the grapes, which burst and become covered in a greyish mould.

A virulent attack of grey rot during the drying phase makes it impossible to produce an Amarone.

The conditions which favour the development of this disease are:
- very compact bunches
- thin-skinned grapes
- high relative humidity
- over-vigorous vines, giving rise to the production of abundant vegetation
- the presence of lesions caused by hail, by caterpillars, or by diseases, such as oidium,
- or heavy rains during the ripening period, etc.

"Indirect" treatment, which I have always preferred to "direct" action with pesticides, seeks to prevent creating conditions which are favourable for the development of grey rot. During this brief paper I have already had an opportunity to highlight the principles of this indirect treatment; I should also like to remind you about the use of treatments with copper-based products, in order to combat Peronospora: these permit a thickening of the skins and therefore make the development of Botrytis more difficult.

The biology of the Amarone production

Lanfranco Paronetto

During the Masi Seminar at Vinitaly last year (1998) we examined what the consequences on the quality and typicity of Amarone della Valpolicella might be of introducing some of the more widely grown grapes in Italy, and whether the appassimento (drying) of these grape varieties (amongst which were Sangiovese, Barbera, Raboso, and Cabernet) could lead to obtaining wines which might be able to improve or modernize the slightly blowsy style of certain Amarone's currently on the market. The result of the Seminar - even if not completely definitive - was to highlight the great interest in wines made from semi-dried grapes using the traditional method of the Valpoilcella area. It was concluded that these new grapes did not live up to the very high standard enjoyed by Amarone and that, besides, they substantially altered the style of Amarone.

The ancient and sophisticated technique used in Amarone production makes full use of a whole series of biological phenomena, which find in Corvina, Rondinella and Molinara the ideal catalyst for obtaining the results with which we are familiar.

If, indeed, we may consider vinification to be a "biotechnology", in the sense that a large number of biological phenomena (over which man, however, seeks to have a degree of control) are involved in transforming grapes into wine, then the production of Amarone must be considered a very special type of biotechnology: one which results from deliberate selection within the context of a tradition that goes back thousands of years, and which certainly offers manifold solutions and surprising results.

Speaking of biotechnolgy, however, prompts us immediately to draw a precise distinction: in everyday use, the term "biotechnology" has become a synonym for genetic engineering or for the use of organisms which have been genetically manipulated. This is not what we mean here: in this context, enological biotechnology
means a winemaking process which takes into account biological phenomena and which uses selected "natural" biological products.
The use of products which have been manipulated genetically is not foreseen here at all.

Here, we shall attempt to highlight Amarone's great prospects for development, which are gradually becoming more and more evident as the chain of biological activities which are present in its production process is more fully understood and exploited.

BIOTECHNOLOGY - THE NEW QUALITY FRONTIER

No great effort is required to convince ourselves that wine production has always been the fruit of biotechnology. Wine has always, after all, resulted from vinification, a process in which the phenomenon of fermentation, that is to say the action of yeast and its consequences, is the most important moment.

However, we have moved on from the "rudimentary" biotechnology of our forefathers, in which there was no choice but to let Nature take its course (with, in practice, rather dubious results).
Enological technology - by chemical and later by chemico-physical means - is swiftly arriving (and to some extent has already arrived) at an increasingly greater control of biological phenomena, starting off with those within the grapes themselves, with the aim of producing wines of high quality and notable personality. This is the application of "modern biotechnology" (Fig. 1).

Though within a framework of considerable progress, one still finds a jumble of the three technological phases we have mentioned present in the various technical and regional contexts, and indeed, even within the context of the same winery. The biological approach is still struggling to gain widespread acceptance. The primary reason for this lies in the need for a real change in mentality amongst people in the winemaking sector: they should be working towards goals fixed in advance rather than merely adopting "curative" methods as in the past.

Every change requires a certain amount of time to be "digested", but changing market conditions and the evolution of the concept of quality amongst more knowledgeable consumers, are no doubt accelerating reflections on the subject.

In this regard, it seems important to me to highlight two characteristics of quality which seem to be evermore sought after and appreciated by the consumer: personalization of the product (diversification and style) and its authenticity (genuineness) (Fig. 2).

PERSONALIZATION

The importance of an obvious "personalization" of quality is highlighted today by the requirements of what is now a global market, which has access to a vast number of producers from a very large number of winemaking countries. Up until a short time ago (and indeed still today) people criticized the adoption of winemaking technology which, though capable of producing wines of respectable quality, tended to make the characteristics of these wines fairly uniform. The nuances and details which should sometimes be quite evident, deriving as they do from particular soil and climatic conditions and hence from the composition of the grapes themselves, were cancelled out, and quite often even the differences between grape varieties were covered up by a rather depressingly generic style. Summing up, everything that could have derived from the grapes, if it was there, was merely diluted by technology.

AUTHENTICITY AND WHOLESOMENESS

What we eat and drink may justly be deemed to be factors which can have a direct correlation with our well-being.
If the terms "natural" and "genuine" are not necessarily direct expressions of wholesomeness or quality, it is nevertheless true that, psychologically speaking, the term "Nature" always evokes a favorable situation and a positive relationship with our surroundings. The term "artificial", on the other hand, suggests a negative situation which

we associate with "pollution" and which is, therefore, subtly threatening and against which it is difficult to defend ourselves.
Therefore, it is not only from a technical point of view, but also from a psychological one, that it is important to underline respect for the grapes as the "natural" raw materials of wine.
From these raw materials, one can obtain notable levels of quality and enjoyment by means of equally natural phenomena which express the positive aspects of the wine and highlight characteristics which are recognizable yet diverse, exciting yet natural, genuine yet highly refined.

The potential for technological improvement cannot but take into account what I have said above, and it seems to us that the search for greater personalization and authenticity in wine can be made concrete by means of innovative technology, which is the expression of the careful and diligent transformation of appropriate raw materials (grapes).
The biotechnology we are talking about, then, is nothing more than a technology which makes the most of the potential of the grapes by means of the use and control of (natural) biological phenomena: vinification is an obvious example.
In this perspective, we may therefore look forward to both a "viticultural biotechnology", which seeks to produce grapes which are suitable for the objectives of the production process and of the market, and an "enological biotechnology" which is capable of extracting from the grape, and expressing, its true potential and charcteristics (Fig. 3).

THE BIOLOGICAL ASPECTS OF AMARONE

The biological characteristics of Amarone may, quite obviously, be attributed to its singular production process:

Selection of the best grapes during harvest
The various interactions between the microorganisms which may establish themselves within the grapes do not allow for a haphazard approach to the harvest. Therefore, only the finest and healthiest grapes, which offer an homogeneous degree of ripeness, are set aside for the production of Amarone. Before being laid out on racks or in wooden crates for drying, they undergo a further selection process to ensure that the inevitable rupture of some berries and the consequent release of sugary liquid do not permit the rapid spread of certain potentially dangerous fungal infections.

The drying process
The racks or wooden crates are placed in large, well-ventilated rooms where the grapes are left to dry for some 80-100 days. During drying, the grapes loose water and are prey, to a greater or lesser extent, to attack by Botrytis, a fungus (or type of rot) which, depending on the temperature and humidity, can either take on a noble, positive form, or the harmful, vulgar form known as grey rot.
The most delicate period for botrytis attack is the first 15 days of drying: during this period the grapes are completely vulnerable and entirely at the mercy of the prevailing weather conditions. Cold temperatures and relatively low humidity favour a positive development of the drying process with ideal conditions for a moderate attack of noble rot; warm temperature and periods of rain are, on the other hand, conducive to the development of grey rot.
It is not easy to control these conditions because if one carries out drying in "artificially" temperature-controlled rooms, one risks preventing botrytization altogether and, therefore,

those characteristics which are attributable to the transformations resulting from noble rot may not be evident in the wine. (Amati and colleagues, 1980).
Here we could go, at some length, into the various arguments sustained by some producers whom we could describe as traditionalists and others who might be defined as innovators.
The former underline the importance of botrytis and maintain that the subtle interplay caused by fluctuations in temperature and by natural ventilation of the grapes cannot be substituted by any type of artificial drying. The latter do not agree that botrytis can indeed have a positive effect and are in favour of "conditioned" drying in rooms with controlled-temperature and, above all, controlled relative humidity.
Even if it would be very interesting and indeed useful to delve deeper into this question from a scientific point of view, we can underline that all the potential solutions merely represent the result of the practical application of techniques derived from an awareness of biology. Adopting one solution rather than another has to be a choice left entirely to the individual producer, as he or she aims to interpret and presonalize his or her product in the manner he or she sees fit.
This is the starting point for the biotechnology of Amarone, the first of the many characteristics which make it unique.

The second biotechnological peculiarity of Amarone concerns the different behaviour of the three principal grape varieties present in Valpolicella (Corvina, Rondinella and Molinara) with regard to infection by Botrytis. Corvina is clearly prone to being affected by rot while Rondinella is notably more resistant; Molinara lies somewhere in between (Fig. 4, from Usseglio Tomasset et al. 1980).
The attack of Botrytis and the consequent effect on the glycerine content of the wine has to be borne in mind when considering the style of Amarone which one wishes to produce: a higher incidence of Botrytis (Corvina) and higher glycerine give wines which are extremely soft, rounded and fleshy, with aromas and flavours of overripe fruit; less Botrytis infection (Rondinella) produces wines which are more austere and tannic.

To summarize, one can say that, on the whole, the drying process brings about a concentration of the grape sugars whilst at the same time maintaining initial acidity levels and, especially, that it modifies certain components of the grapes by means of the metabolism caused by noble rot (glycerine) or by grey rot (acetic
acid). (Fig. 5, from Usseglio Tomasset el al. 1980)

Vinification

The conditions under which vinification take place highlight clearly other important aspects of the biotechnology of Amarone. Pressing of the grapes does not occur until January, in what is, generally speaking, the coldest period of the year: it is not unusual for the temperature of the must to be around 5 C. or even lower, temperatures which are, clearly, normally totally unsuitable for fermentation.
At such temperatures, and when the must demonstrates such a high concentration of sugar, the conditions under which fermentation takes place are totally different from those during vinification in the autumn.
During the vinification of the normal wines in October, the indigenous yeasts are very active and have to be checked by appropriate additions of sulphur dioxide. Fermentation generally starts off with Apiculate yeasts of the Hanseniaspora genus, which are very virulent and which are generally not particularly desirable because of their tendency to produce large quantities of volatile acids. Fortunately, they are sensitive to the alcohol which they themselves produce (max. 4%) and soon give way to the more robust, more

efficient and more useful Saccharomyces cerevisiae which in turn, (in the case of very rich musts), hands over the job of transforming the last few grams of sugar to its sibling, Saccharomyces bayanus (Fig. 6).
In point of fact, the situation is even more complex because there actually exist different strains of each species, that is to say, different varieties of the same yeast type. Each one of these strains can contribute to the qualities (or indeed defects) of the final wine, thanks to their individual metabolic capabilities or their sensitiveness to nutritional shortages or other conditions of the medium in which they find themselves.
For this reason, the biotechnolgy of normal vinification calls, nowadays, for the use of specific strains of selected yeasts (Fig. 7).

In the case of the vinification of Amarone, on the other hand, the blastomicetic flora (yeasts) is present in only very small quantities and is different in type to that present in normal musts.
We also draw your attention to the presence of a very particular yeast, Saccharomyces uvarum, which is especially resistant to low temperatures and is, indeed, capable of starting off the fermentation - even if rather slowly - and of transforming a fair proportion of the sugars contained in the must. At a certain point, however, the uvarum yeast is no longer able to carry on and gives way to Saccharomyces bayanus which now finds conditions which are more germane to its development.
In this case, too, however, one finds quite naturally various strains which, in consequence of their individual characteristics and the conditions in which they find themselves, can yield different, and not always favourable results, such as dangerously long fermentation, not very clean - or even unpleasant – compound aromas, absorption of colour, etc. The biotechnology of modern Amarone, therefore, foresees the use of particular yeast strains.
These are strains selected from the same species, "uvarum" and "bayanus", as those which are found in musts which ferment spontaneously. There is a two-fold reason for their use:

- First, in order to carry out a regular fermentation without any hitches or problems. Only in this way can the various technical phases proceed in a rational manner and be controlled by winemakers.
- Second, in order to exploit the specific qualities of the various available strains, which are able to express chracteristics which are only slightly different from each other but are nevertheless perceptible. In this way one can highlight particular nuances so as to establish a more personal and individual style.

Thus, the biotechnolgy of Amarone is enriched by various instruments which are capable of giving a distinct personality to the different Amarones. It thereby offers the skilled winemaker the opportunity to control certain important phenomena during vinification in order to give a specific result, using products supplied and selected by Nature itself.

The malolactic fermentation

Malolactic fermentaion in the production of Amarone is a process which is still not very carefully controlled. There are a number of reasons for this, ranging from a general ignorance about this important phenomenon on the part of winemakers, to the actual difficulty involved in controlling this fermentation owing to the difficulty conditions which the medium (Amarone) imposes on the bacteria.
Biotechnology does not, however, consider the malolactic fermentation as an accidental occurrence – a phenomenon which must be accepted or prevented – but rather as another opportunity to be seized in order to “perfect” the characteristics of the final

product. The conversion of malic acid into lactic acid and the consequent reduction in the wine's acidity are in fact on the most obvious aspects of the malolactic fermentation. In point of fact, this biological process, too, causes notable changes in a number of the wine's components and therefore plays an important role in determining the wine's final overall quality. Amarone's quality of being sustained by broad, complex aromas and flavours calls for a malolactic fermentation. Sometimes, in fact, the conditions during appassimento are such that the combustion (i.e. diminution) of the acids in the wine is not favoured and its eventual acidity may then be a bit high, and this renders the final product a little out of balance. Besides, the fullness and richness of the taste sensations one finds in an Amarone are added to greatly by the malolactic fermenation.

However, if allowed to develop according to its own whims, the malolactic fermentation, even if it is set off in the correct manner and at the right time, does carry with it (like all spontaneous biological phenomena), the risk of unsatisfactory fermentations or of various other problems. In this case too, therefore, appropriate biotechnolgy calls for the use of selected bacteria, with very precise conditions for their use as well.
The malolactic fermentation thus becomes yet another opportunity for intervening in a planned and specific manner on the quality and personality of a particular Amarone.

BIOTECHNOLOGY - NEW POSSIBILITIES FOR AMARONE

The twin aims of improving quality and giving greater personality to an Amarone are highlighted, from the biotechnological point of view, as a series of winemaking options which, on the one hand show greater respect for the grapes themselves and on the other, are also capable of offering elegant, natural and diversified results.

The three characteristics phases of the production of Amarone:
- the drying of the grapes
- fermentation during the winter months
- malolactic fermentation

all give, thanks to biotechnology, better results, with greater control, definition and differentiation, personality and typicity.

Certainly, biotechnology cannot answer all our problems nor make them simple to resolve, but, by synthesizing Nature and quality, it is capable of offering important results: even in the case of Amarone!

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Masi Technical Group

Viticulture:	Dario Boscaini, Marco Olivetti
Enology:	Sergio Boscaini, Lanfranco Paronetto, Roberto Boscaini, Barbara Masello, Silvio Penna
Geo-Climate:	Lino Sartor
History:	Giovanni Vicentini
Coordinator:	Sandro Boscaini
Secretary:	Tiziana Ravanelli, Alessandra Vallenari
Translators:	Patricia Guy, Dina Emde

CAPTIONS

PAGE 1

Evolution of the production technology

Letting Nature take its course – wine with many problems
1. Chemical intervention – drinkable wine
2. Chemico-physical intervention – wine of good quality and stable (anonymus)
   The wine is stable and of good quality (anonymous)
3. Controlled biological intervention
   The wine is of high quality, with personality and typicity
   Modern Biotechnology

Evolution of the concept of quality

Wine must offer the drinker sensations of satisfaction and well-being

Satisfaction Authority - Complexity - Recognizability

The need to define typicity
The need to highlight characteristics

Well-being Cleanliness - Wholesomeness - Authenticity

Attention to health
Attention to what is "natural" and "genuine"
Attention to ecology and to culture

Fig. 3

The new biotechnology

Wine must be the result of the skilful transformation of an appropriate raw material, using technology that is suitable for the purpose
The meeting of "viticultural biotechnology" and "enological biotechnology"

THE RAW MATERIAL
Viticultural Biotechnology

- a raw material which is more suitable for showing off its own typicity and original characteristics
- a more "concentrated" raw material from which one can extract a more substantial and evident quality...one that is more recognizable
- appropriate viticulture

VINIFICATION
Enological Biotechnology

- A technology capable of making the most of the potential of the grapes through the utilization of ("natural") biological phenomena

- A technology which corresponds to the consumer's expectations

- A technology which allows for the choice of a style and quality with greater personality

Fig. 4

Variations in Weight and State of Health of Valpolicella Grapes During the Drying Process Depending on the Meteorological Parameters of the Year (1977 Vintage - Usseglio Tomasset et al. 1980.)

Percentage of Weight Lost During the Drying Process - giorni=days

Evolution of Temperature and Relative Humidity During the Drying Process
UR%=% relative humidity

Evolution of Mould (Botrytis cinerea) During the Drying Process
% of botrytized berries
days

Fig. 5

The Evolution of Some Fundamental Parameters Regarding the Composition of the Must During the Drying Process
(1977 Vintage - Usseglio Tomasset et al. 1980. Must obtained from 60% Corvina, 30% Rondinella, 10% Molinara)

Evolution of Sugars and of Total Acidity
Z=S A.T.=T.A.
sugars total ac. days

Evolution of Tartaric and Malic Acid During the Drying Process
tartaric ac. malic ac. days

Evolution of Glycerine and Gluconic Acid During the Drying Process
glycerine glucomic ac. days

FIG. 6

The indigenous microflora of the must

OXYDATIVE YEASTS

Pichia membranafaciens	Survive in up to 14% alcohol
Pichia anomala	Produce acetaldehydes and ethyl acetate
APICULATE YEASTS	
Hanseniaspora uvarum	Survive in up to 4% alcohol
(Kloekera apiculata)	Produce volatile acidity
CONTAMINATING YEASTS	
Dekkera intermedia	Survive in up to 15-16% alcohol
Saccharomycodes ludwigii	Produce acetaldehydes, ethyl-phenols,
Zigosaccharomyces	baillii ethyl-guaiacols and fatty acids
FERMENTATIVE YEASTS	
Saccharomyces cerevisiae	Survive in up to 13-18% alcohol
Saccharomyces bayanus	Produce glycerine,higher alcohols and esters

Fig. 7

Selected yeast proposed in the practical application

GENERIC STRAINS

- Have good resistance to alcohol
- Have good resistance to sulphur dioxide
- Form little volatile acidity

SPECIFIC STRAINS

- Have good resistance to cold
- Have good resistance to heat
- Have little effect on the colour
- Produce sulphur dioxide
- Break down malic acid

AROMATIC STRAINS

- They are able to produce a large quantity of higher alcohols and esters

VARIETAL STRAINS

- They highlight typical varietal character, freeing molecules typical of the grape variety, starting off with odourless precursors molecules

SCHEDE DEI VINI IN ASSAGGIO

		1. *RECIOTO CLASSICO '99*	*2.* *RECIOTO ROSATO '99*	*3.* *RECIOTO BARRIQUES '98*	*4.* *RECIOTO MEZZANELLA AMANDORLATO '95*	*5.* *RECIOTO CLASSICO CASAL DEI RONCHI '93*
RACCOLTA HARVEST		7 Ottobre 1999 October 7th, 1999	28 Settembre 1999 September 28th, 1999	15 ottobre 1998 October 15th, 1998	7 ottobre 1995 October 7th, 1995	10 Ottobre 1993 October 10th, 1993
APPASSIMENTO DRYING	***Giorni / Days (fino a 16 Febbraio)***	118	112	124	115	115
	Supporto uva System	Canne di bambou				
	Tecnologie Technologies	Ventilazione naturale o meccanica in atmosfera controllata nell'impianto appassimento di Gargagnago. Natural or mechanical ventilation in controlled atmosphere in the drying center in Gargagnago.				
	% Botritis stimata Estimated % botrytis	25/ 30	25/ 30	20/ 25	20/ 25	30/35
	% Perdita peso % Weight loss	42	35	34	31	37
	Zuccheri alla pigiatura (gr/ %ml) Sugar level at pressing	31,64	31,09	30,12	26,95	30,92
	Acidità (gr/lt) Acidity	8,7	8,9	8,7	8,7	8,8
FERMENTAZIONE FERMENTATION	***Giorni Days***	45	50	40	48	50
	Tipo Type	In rosso con raspi Maceration with stems	Rosato	In rosso con raspi Maceration with stems		
	Agente Yeast	Ceppo di Saccaromices bayanus - Lievito selezionato Saccaromices bayanus strain-selected yeast				
	Svinatura / Racking off	* Con aggiunta… * With addition..	Fiore Pressed juice	* Con aggiunta della propria pressatura soffice * With addition of own soft pressed wine		
DATI TECNICI al 23 marzo 2000 **TECHNICAL DATA on March 23rd, 2000**	***Alcool (%Vol.) / Alcohol (%Vol.)***	12,64	12,40	14,10	15,00	14,31
	Zuccheri (gr./%ml) Sugars (gr/%ml)	10,60	10,41	6,68	1,95	7,02
	Acidità Tot. (gr./lt) Total acidity(gr./lt)	6,9	6,8	7,5	6,20	6,65
	Estratto (gr./lt) Extract (gr./lt)	36,2	30,1	35,8	36,35	31,40
	Glicerina (gr./lt) Glycerin (gr./lt)	12,2	11,4	11,8	12,1	11,80
MATURAZIONE MATURATION		Acciaio Stainless-steel	Acciaio Stainless-steel	Allier nuovo 12 mesi / New Allier for 12 months	Allier 1-3 anni + bottiglia Allier for 1-3 years + bottle	Botte tradizionale 24 mesi + bottiglia Traditional barrel 24 months + bottle

NOTE D'ASSAGGIO – TASTING NOTES

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