

White grapes skin contact, an opportunity to manage.

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- ❑ General concepts of skin contact
- ❑ Technical gases for skin contact
- ❑ Machinery and managing of process variables
- ❑ A few applicable results

General concepts of skin contact

Once the berry's broken, several enzymatic activities commence. From this point the skin contact starts.

- In the winery for the hand picking grapes
- In the vineyard for the machine picking grapes with a certain quantity of must (liquid)



Factors to be considered

- ☐ Type of compound to extract
- ☐ Quantity of compound to extract
- ☐ Chemical reactivity of compounds
- ☐ How the process variables affect the compounds
- ☐ Technological phase (pre-fermentative, fermentative phases)

General concepts of skin contact

Goal

Increase the value of the grapes enological potential by transfer it to the wines.

It hasn't to be a fashionable technique but only a technological option to be exploited based on the grapes quality.

- ☐ Aromas and non smelling parent elements
- ☐ Polysaccharides
- ☐ Simple nitrogenous substances
- ☐ Proteins
- ☐ Poliphenols





General concepts of skin contact

Extractions of undesired compounds are possible

- ☐ Poliphenols
- ☐ Lees
- ☐ Unstable proteins
- ☐ Laccase, in case of grapes with botrytis
- ☐ Unpleasant aromatic substances
- ☐ Vegetal aromas Aromi (C_6 aldehyde and alcohols, pyrazines)
- ☐ Ground smell, mold and mushroom



General concepts of skin contact

- ❑ The extraction has to be managed in a reasoned way, considering some aspects of the quality, technique and enological goals.
- ❑ The goal is to extract the positive compounds and to limitate the extraction of those considered negative; that means a selective extraction.
- ❑ Considering the wine's life, the maceration is a very brief phase, anyway it strongly affects the quality, so it has to be correctly managed with specific equipments able to thoroughly control the maceration.



General concepts of skin contact

Main factors which determine the extraction.

- ☐ Grape ripeness (measurable)
- ☐ Cellular ripeness (measurable)
- ☐ Temperature (manageable)
- ☐ Additives e adjuvants (manageables)
- ☐ Mixing (manageables)
- ☐ Enzymatic activities (manageables)
- ☐ Time (result of the different factors)

These factors have to be managed with specific technologies able to exploit, when needed, technical gases.



General concepts of skin contact

- ❑ It has to be considered the temperature conditions which can ease or block the enzymatic activities
- ❑ In case of grapes with botrytis problems it's preferable to rapidly extract, avoiding a long contact with the skins
- ❑ To avoid too strong pressure on the skins during pressing phase, the cloudy pressed juice (NTU) is the key for managing the maceration.
- ❑ If the ripeness is not homogeneous, it's fundamental to conduct a quick extraction and in case to select the batches after press.
- ❑ The use of CO₂ during skin contact permits to reduce the use of SO₂, the latter would have a non selective extractive effect.

General concepts of skin contact



- ❑ The research activities on white grapes skin contact are numerous, that witness the importance of this technological process. In the last years the aspects covered have been about: the selective extraction of aromas and parent elements, the managing of the polyphenols extracted, the C 6 compounds, the managing of the oxidations, the Glutathione, etc.
- ❑ The argument “aromas” surely is the most interesting for the white wine quality, however we still don’t know precisely the aromatic potentials of different varieties. This lack can make difficult the managing of the maceration.

General concepts of skin contact

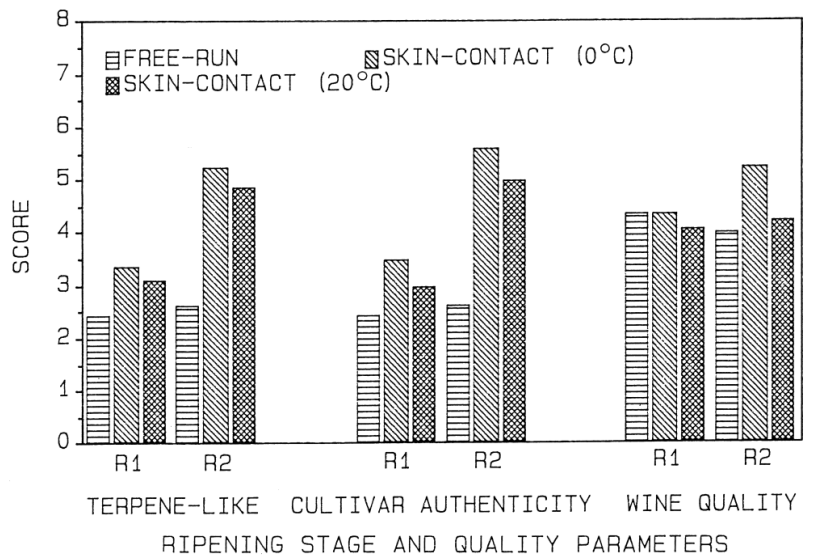
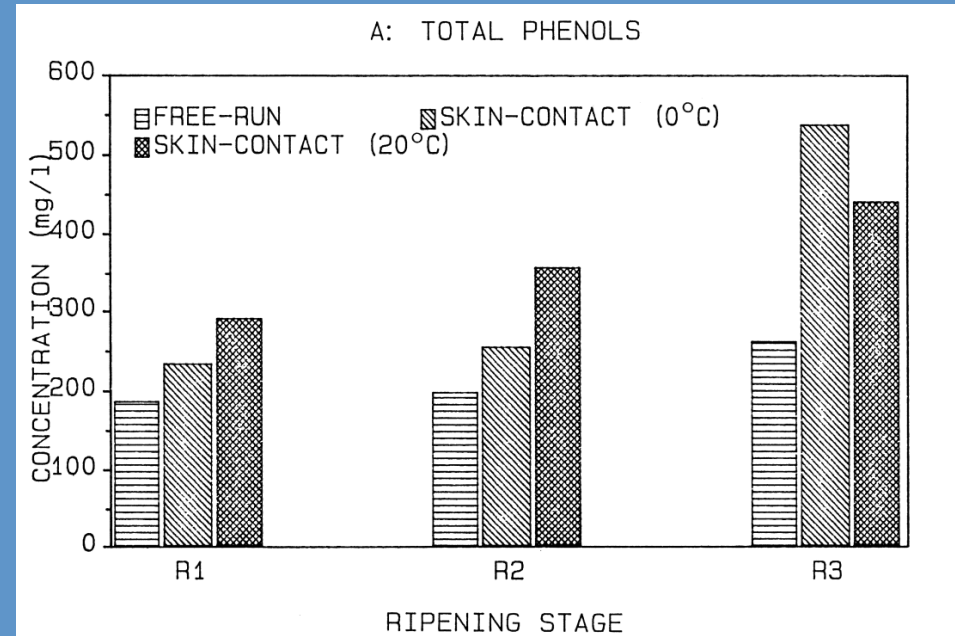


FIG. 6
Effect of skin-contact temperature (0°C and 20°C) on terpene-like character, cultivar authenticity and overall wine quality of 1987 Gewürztraminer wines at different ripening stages (R1 = 18,0°B and R2 = 21,5°B). Skin-contact time = 20 hours.



At low temperature the extraction of the primary aromas and parent elements are optimised, instead the extraction of unstable polyphenols are limited.

Sauvignon (*Marais e Rapp, 1998*)

The effect of skin-contact time (4 hours and 15 hours) and temperature (0°C and 20°C for 20 hours) on terpene, phenol and acetamide concentrations in Gewürztraminer juices and wines and on wine quality was investigated. An increase in skin-contact time and temperature generally resulted in increases in terpene, phenol and N-(3-methylbutyl)-acetamide concentrations. Wines produced from juice subjected to low temperature skin-contact were generally of a higher quality than wines produced from free-run juice or juice subjected to skin-contact at elevated temperatures.

General concepts of skin contact



Ambient temperature skin contact on Sauvignon Blanc – Friuli, Italy

(Celotti et al., 1999)

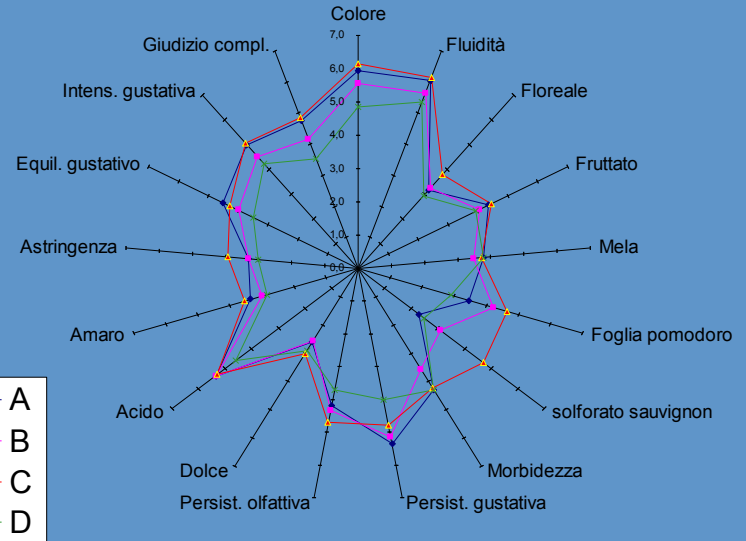
A- pigiato addizionato di enzimi (10 g/hL) e di SO₂ (50 mg/L);
 B- pigiato addizionato di SO₂ (100 mg/L);
 C- pigiato aggiunto di enzimi (10 g/hL) e di SO₂ (100 mg/L);
 D- pigiato iperossigenato e addizionato di SO₂ (50 mg/L).

10 giorni da fine fermentazione

	A	B	C	D
Tannini g/L	0,45	0,29	0,48	0,24
Polifenoli tot.mg/L	600	463	686	420
Catechine mg/L	137	102	149	93
DO 280	12,95	11,35	13,7	11,85
DO 320	5,2	5,9	5,85	4,6
DO 420	2,038	2,34	3,11	2,112
pH	3,7	3,6	3,6	3,8
Acetaldeide mg/L	61	51	67	52
MetOH mL/100 EtOH anid.	0,185	0,05	0,07	0,05

1 mese da fine fermentazione

	A	B	C	D
I HCl 24	15,5	2,4	18,2	12,5
I. EtOH	31,3	38,5	6,2	2,7
I. gelatina DO 280	59,7	82,3	67,5	81,3
POM test	32,6	28,9	29,0	21,8
Tannini g/L	1,02	1,54	1,27	1,27
Polifenoli tot.mg/L	534	416	597	386
Catechine mg/L	129	90	139	90
DO 280	12,9	11,3	14	9,2
DO 320	4,65	5	5,75	3,5
DO 420	0,125	0,103	0,144	0,15



SKIN CONTACT THESIS:

- A ENZ 10g/hl +50 mg/l SO₂
- B SO₂ 100 mg/l
- C ENZ 10g/hl +100 mg/l SO₂
- D HYPEROXIGENATION

The extractive effect on the aromatic parent elements is evident on skin contact conducted along with enzymes, although at ambient temperature a lot of polyphenols are extracted.

General concepts of skin contact



Gomez-Miguez, et al., 2007....an exhaustive control of the skin contact conditions (time and temperature) is really important to reduce browning in white wines due to this vinification technique.

Darias-Martin, et al., 2000.....Wines produced by maceration, compared with those produced by direct pressing, had improved sensory properties and increased contents of total phenols, total flavonoids and many individual phenols including resveratrol, piceid and catechin. Wines produced by maceration contained the highest levels of resveratrol and its glucosides, and piceid reported for a white wine; the level of total resveratrol and piceid being 5.18 mg/l.

Geffroy, et al., 2010.....Results showed that use of the maceration enzymes tended to increase juice yield, settling rate in the juice, and concn. of varietal thiol precursors. and improved mouthfeel of the wine, but had little effect on composition or aroma of the wines. Effects were generally greater for Rapidase Expression than for the general maceration enzyme.

Ferreira, et al., 1995.....After 2 h of maceration, levels of C6 compounds decreased, due to adsorption of these compounds onto macromolecules and the grape skin. Combination treatments of maceration and pressing increased the release of C18:2 and C18:3 fatty acids into the medium, and increased levels of C6 compounds. High levels of C18:2 fatty acids and hexan-1-ol were found in samples not subjected to settling. Enzymic settling produced wines with very low hexan-1-ol levels. Results showed that settling conditions can have direct effects on results of the maceration process.

Ruzic et al., 2011.....The maceration step allows the extraction of phenolic compounds from grape skins, seeds and stalks, resulting in phenol-rich white wine with strong antioxidant properties.

Cejudo-Bastante et al., 2011..... Combination of prefermentative treatments (skin maceration followed by must hyperoxygenation) produced an improvement of the global impression of the final wine based on better scores for tropical fruit, body and herbaceous notes.

Lecce et al., 2013..... The skin contact in low-oxygen atmosphere lead to an increase of the phenolic content and glutathione in must and white wine. At the end of fermentation, the macerated samples with pomace at 600 g L⁻¹ showed higher reduced glutathione and phenolic content,

There's also "scientific" publications with information absolutely non correct, sometimes with evident reference and opinions on commercial brands, with no scientific value !



Technical gases during skin contact

Some considerations

- ❑ The crushed grapes still contain, at the processing time, a quantity of dissolved oxygen depending on the operations that took place after the breaking of the berry (in the vineyard in case of mechanical picking) until the loading of the press or the maceration tank. Moreover in the grape there are substances that work as anti-oxidant, as the poliphenols and the glutathione.
- ❑ The technical gases, oxidant and non oxidant, can be utilised to manage the pre-fermentative phase of the skin contact depending on specific enological goals, for example the crushed grapes treated in “oxidation” or in “reduction”.
- ❑ When we work in oxidation or reduction conditions the enological goal doesn't necessarily correspond to the result of initial treatment.
- ❑ With oxidation the poliphenols are oxidated but we risk to damage the aromatic profile; With the reduction we protect the aromas but we're sure not to oxidate the poliphenols
- ❑ It's important then to manage in a reasoned and precise way the technical gases during skin contact (CO₂, N₂, O₂, aria)



Technical gases during skin contact

Technical gases for:

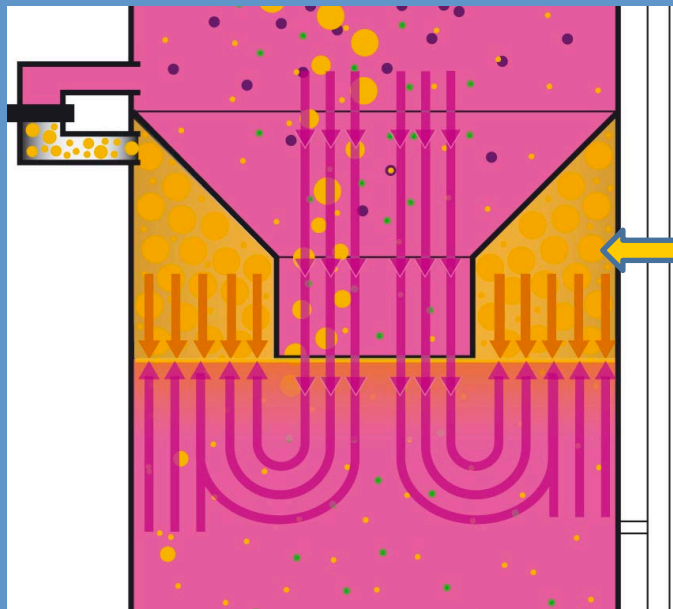
- ☐ Microorganisms
- ☐ Inertisation or oxigenation
- ☐ Enzymatic and chemical reactions

The conditions to optimize for a correct managing of the gas in the must-wine are:

- ☐ Pressure
- ☐ Time of contact
- ☐ Surface of contact
- ☐ Temperature

Technical gases during skin contact

Funnel system which permits a better managing of the technical gas.



Gas accumulation zone
in pressure (better
solubility and lower
loss)

Henry's Law

$$p_i = H(T) x_i$$

p_i =partial pressure

x_i =molar fraction

$H(T)$ =constant (temperature)

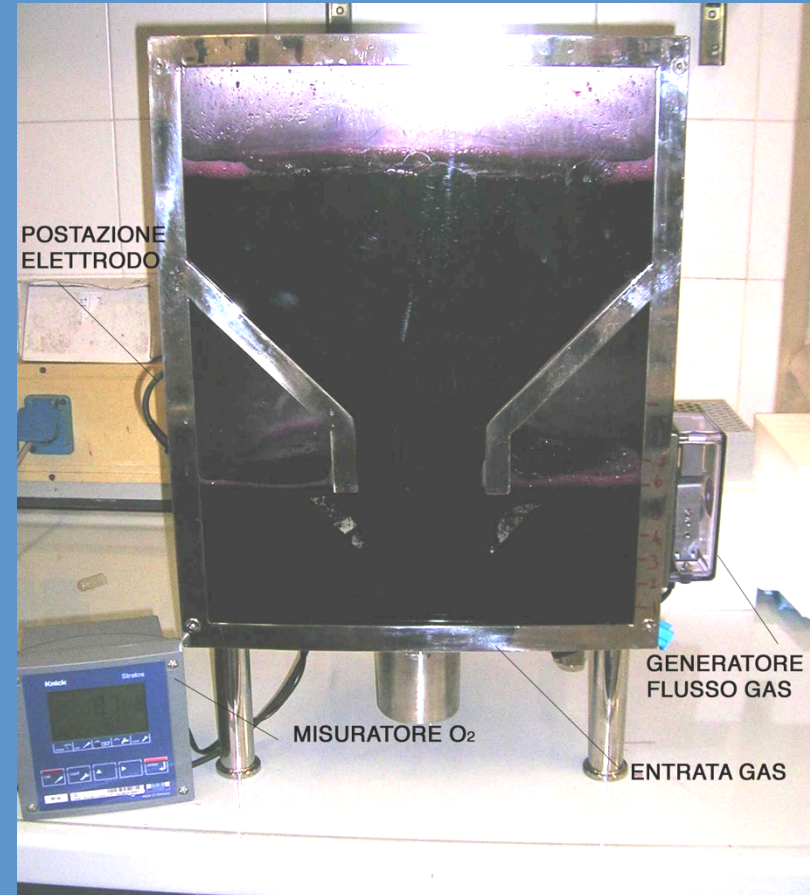
“A gas that applies a pressure on a liquid's surface, continues to dissolve it into the liquid until it reaches in this liquid the same pressure that it applies over it.”

Technical gases during skin contact



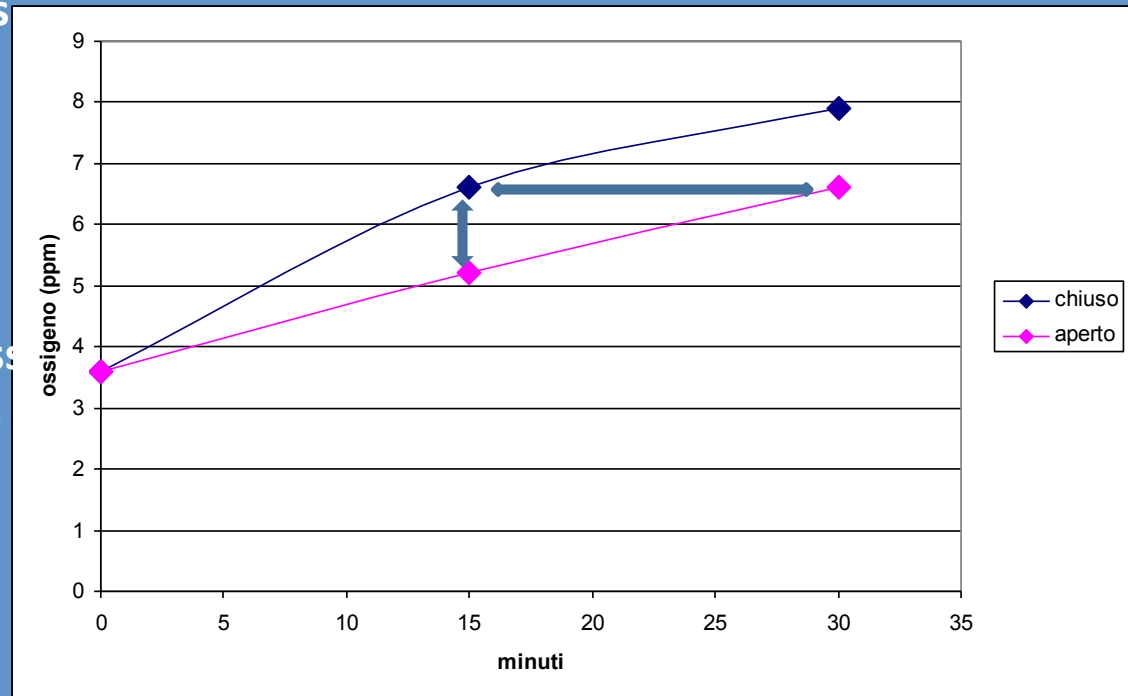
Experimentation's results for the optimization of the technical gas managing.

Analysis of the gas solubility's kinetics in different operative conditions.



Technical gases during skin contact

The area between the 2 curves identifies the closing bypass effect on the gas solubility. There are very important differences on necessary time to reach a certain gas concentration, with the bypass closed the gas dissolves with a more rapid kinetic.

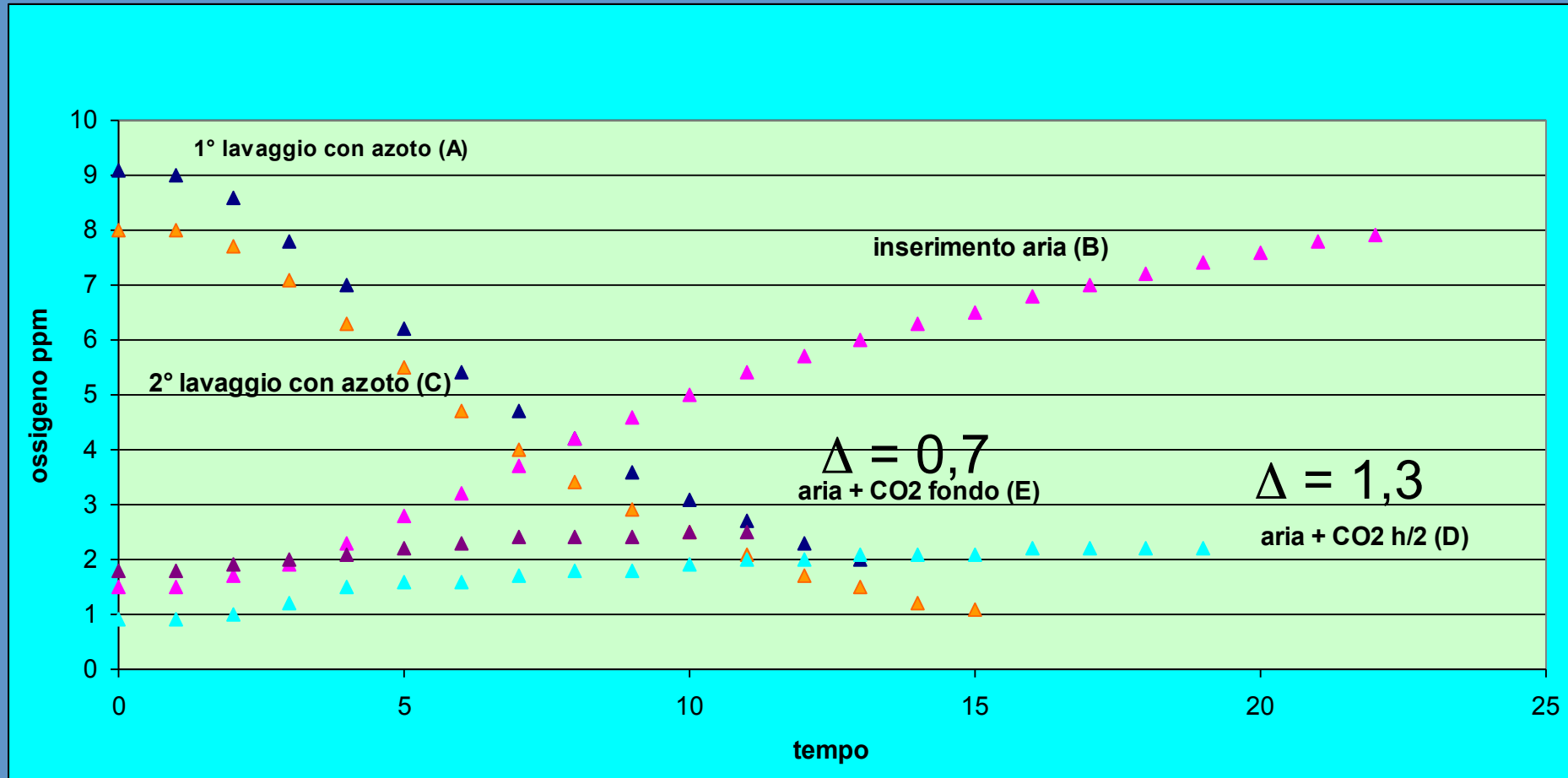


The time is important if we consider, for instance, the rapidity of enzymatic oxidations on musts (very rapid on Sauvignon Blanc)



Technical gases during skin contact

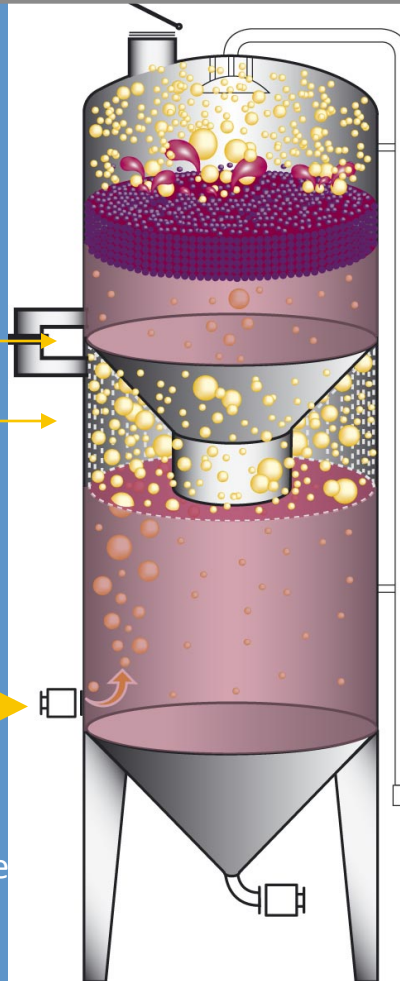
Limited solubility O_2 in presence of CO_2



CO_2 effect (simulation of the maceration / fermentation conditions)

Technical gases during skin contact

The gas excess goes out through the neck of the diaphragm mixing the product and assuring the homogeneity.

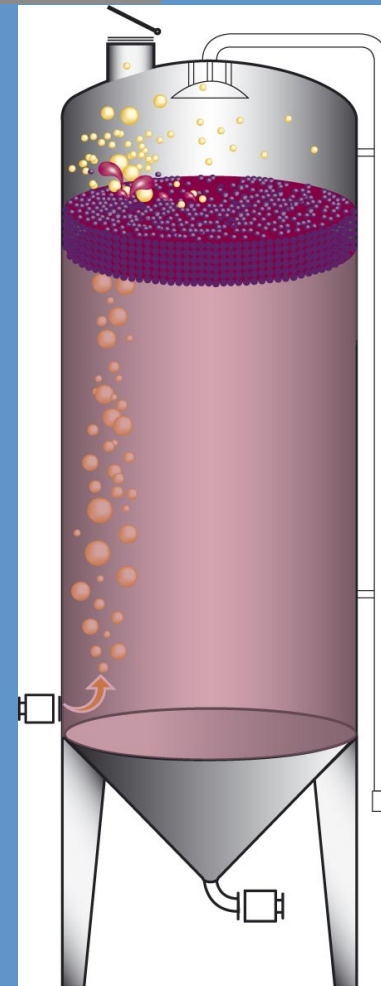


Ganimede®

The **surface of contact** between the liquid and **gas in pressure** (0,2-0,4 Bar) under the diaphragm, is equal to 80-85%

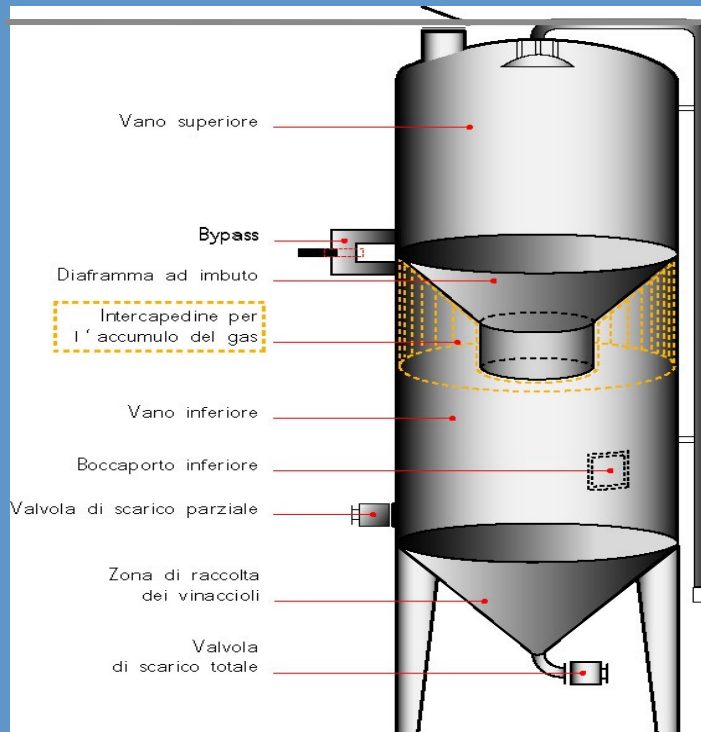
The gas introduced is accumulated under the diaphragm, under pressure and for an extended time.

The gas introduced in the traditional fermenters **goes up rapidly** towards the surface, forming a **small vertical column** which affects only for a **few seconds a marginal portion of product**. Moreover, the technical gas introduced has no way to stay for a long period, under pressure, in contact with the liquid, also because of the “**stripping**” effect: The huge quantity of micro bubbles of CO_2 , in fermentation, present everywhere in the mass, drag outside the external gas introduced, which becomes in this way ineffective.



Traditional

Equipments and managing of process variables



The equipment has to permit to manage all the different process parameters, in order to bring out of the wine all the enological potentials from the grapes. From grapes with great enological potentials, the different managing of the maceration will allow to produce wines with different characteristics

❑ Soft skin contact by adding technical gases (CO_2)

❑ The crushed grapes are not mistreat thanks to the soft dynamic skin contact.

❑ Absence of mechanical damages on the

❑ The possibility to inert with CO_2 , allows to limitate or eliminate in the first phases the use of SO_2 , exploiting the antioxidant effect of GSH present in the grapes.



Equipments and managing of process variables

GRAPES

CRUSHING

SKIN CONTACT

MUST

O_2

CLARIFICATION

FERMENTATION

Oxygenation

SO_2 in case only after having completed the enzymatic oxidation kinetics.

Goals

- Phenolic stabilisation of the wine
- Wines processed with low content in SO_2

Risk

- Oxidation of the varietal aromas



Protection from oxygen

GRAPES (CO₂, antioxidants)

CRUSHING(nitrogen, CO₂)

SKIN CONTACT

MUST (nitrogen, CO₂)

CLARIFICATION

FERMENTATION

The key for the success of this technique is the protection from the grapes to the bottle. We can count on internal and external protection systems.

Goals

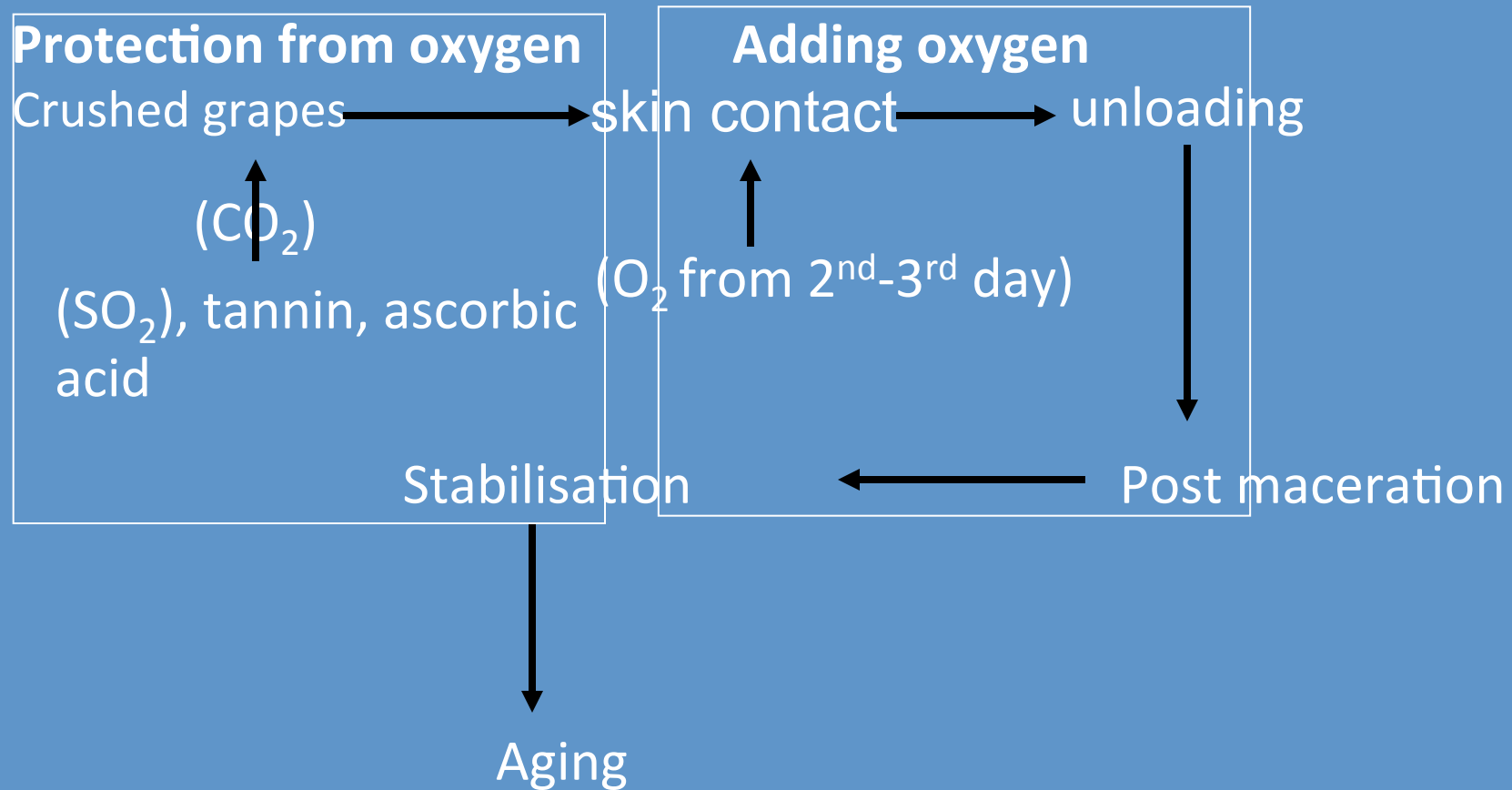
- To avoid the oxidation of aromatic molecules
- To preserve the varietal sensorial characters
- Less herbaceous aromas from lipossigenasica and idrolasica activity
- To process wines with low content of SO₂
- To preserve the glutathione (GSH) of the grapes

Counterindication

- Risk of phenolic instability



Equipments and managing of process variables



Managing of the red crushed grapes

Protection in the initial phase and controlled oxygenation from 2nd-3rd day

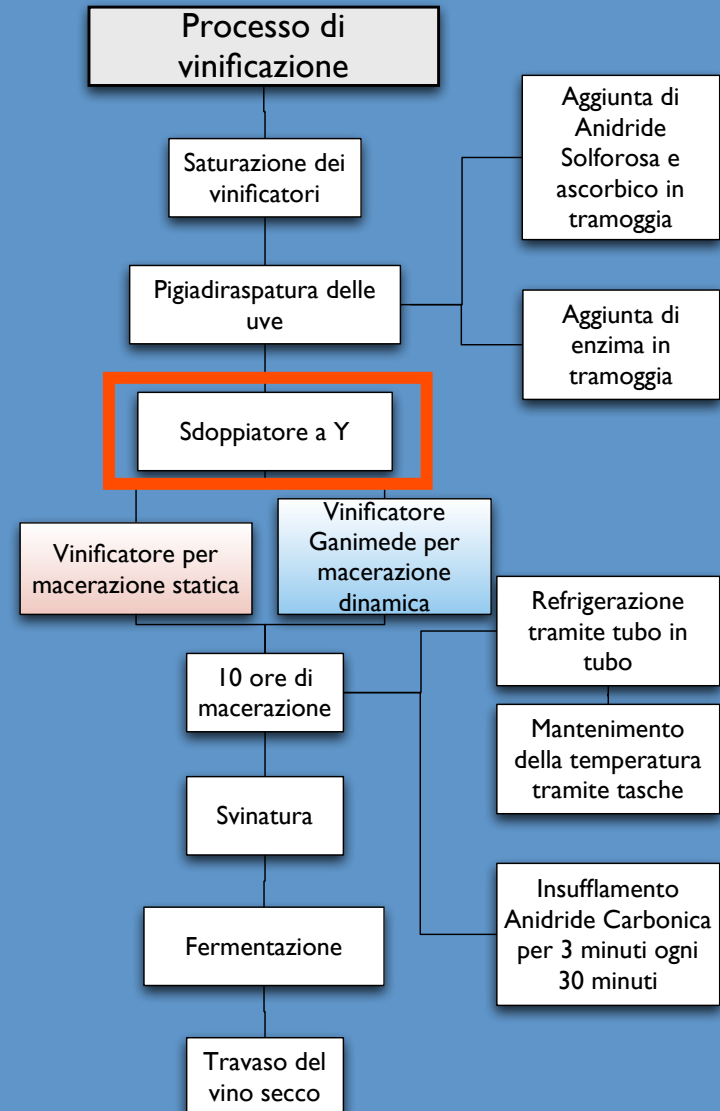
A few applicable results



Skin contact

static

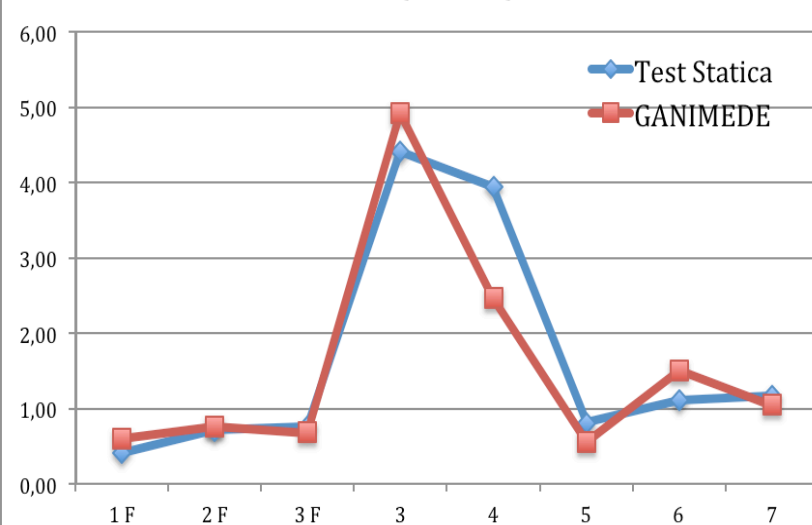
Dynamic, soft





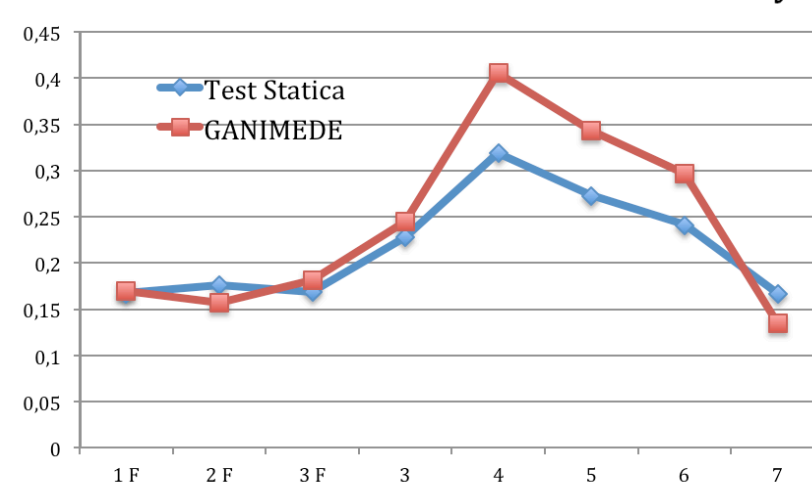
A few applicable results

Solidi Sospesi (g/100g mosto) Chardonnay

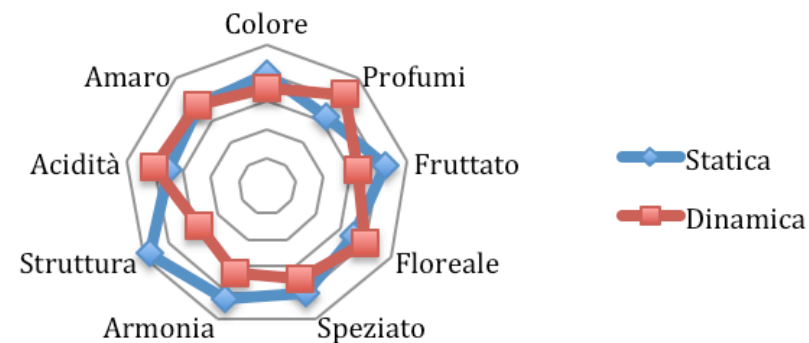


The dynamism of the skin contact process with technical gas, doesn't cause more lees if compared with static skin contact.

Abs 420 nm Chardonnay



Dopo 16 giorni



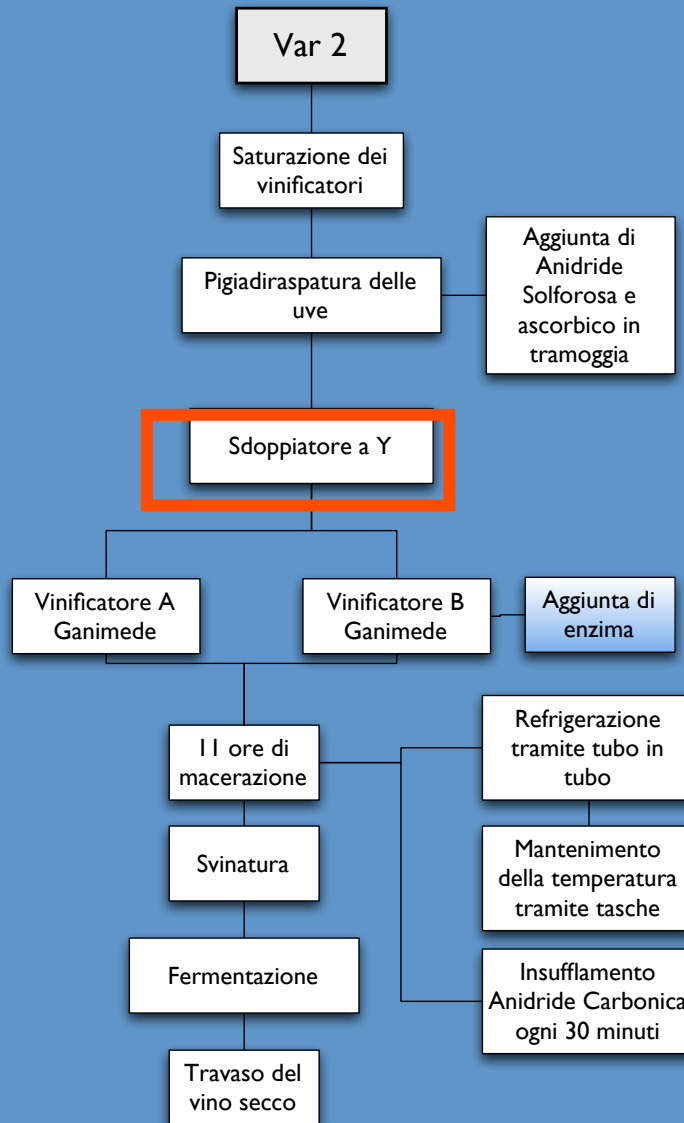
A few applicable results



Dynamic skin contact

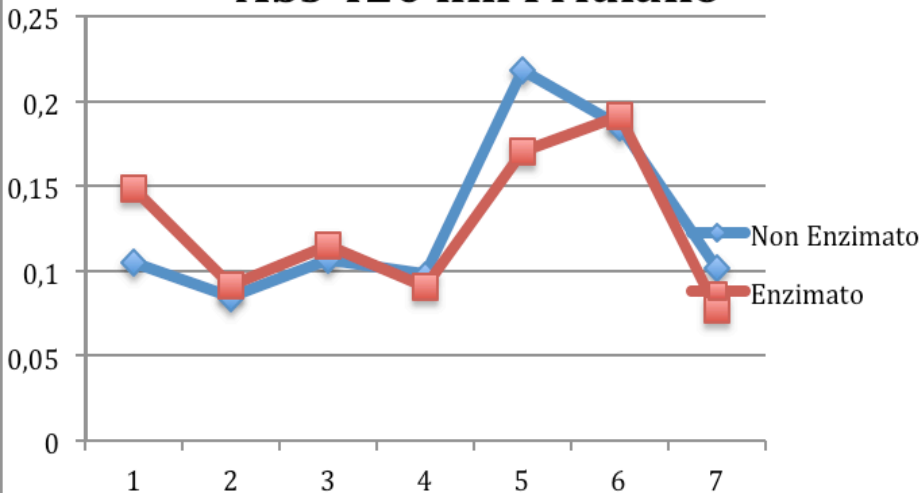
↪ with enzyme

↪ with no enzyme



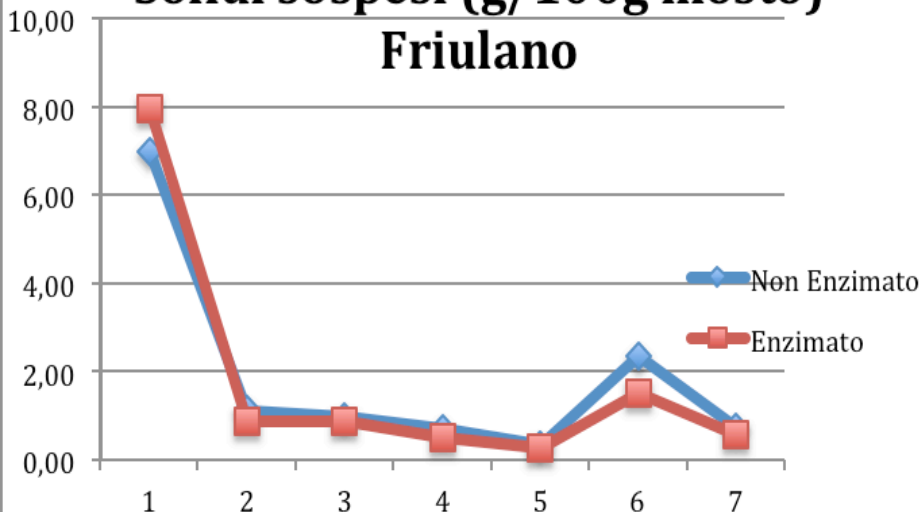
A few applicable results

Abs 420 nm Friulano

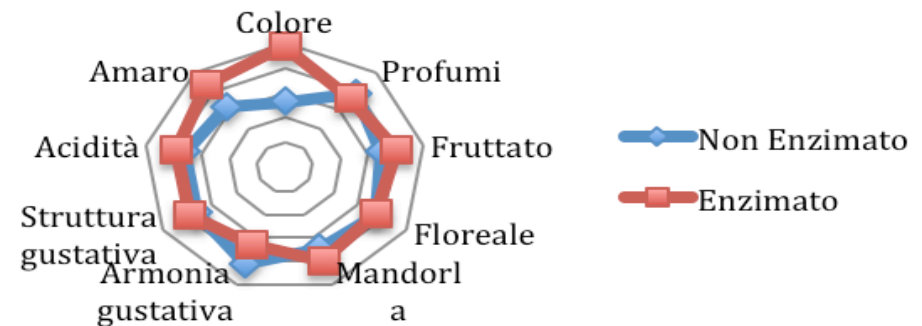


The soft dynamic skin contact allows to limitate or decrease the use of enzymes

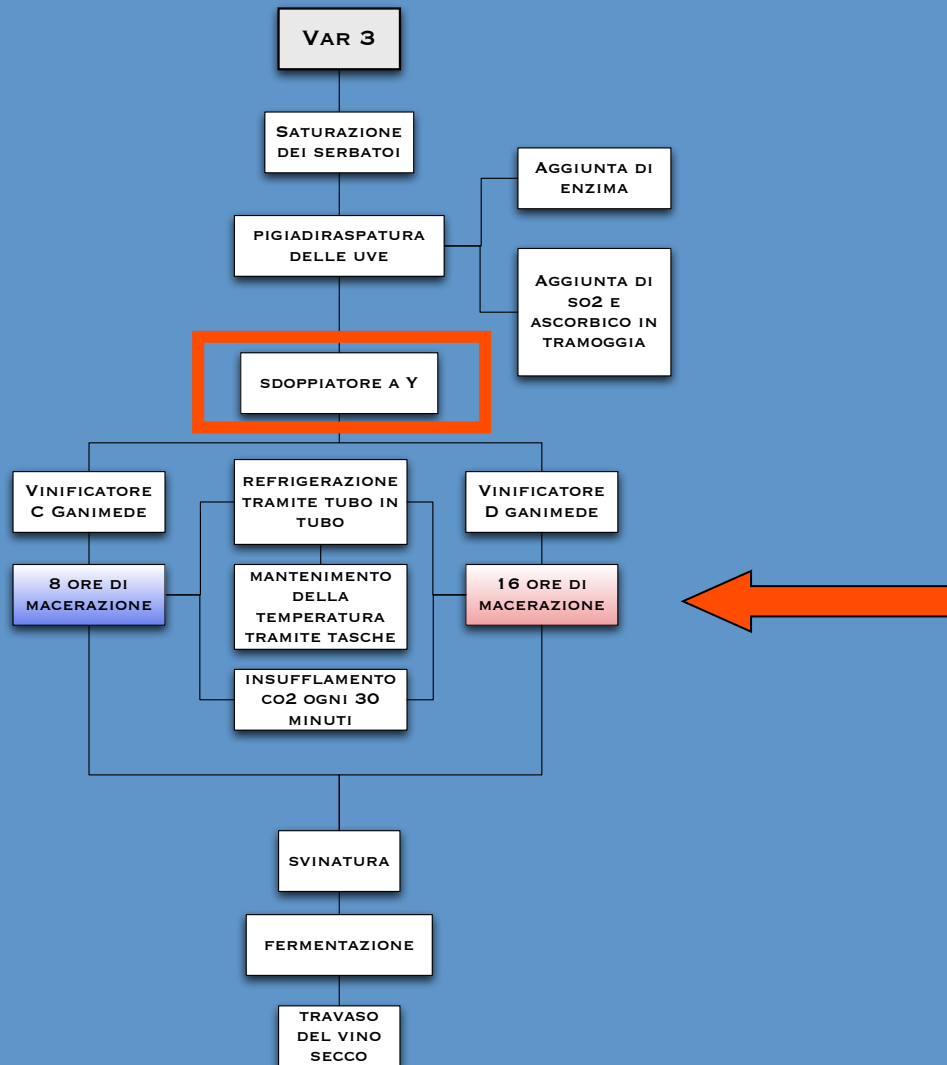
Solidi sospesi (g/100g mosto) Friulano



Dopo 26 giorni



A few applicable results



Dynamic skin contact

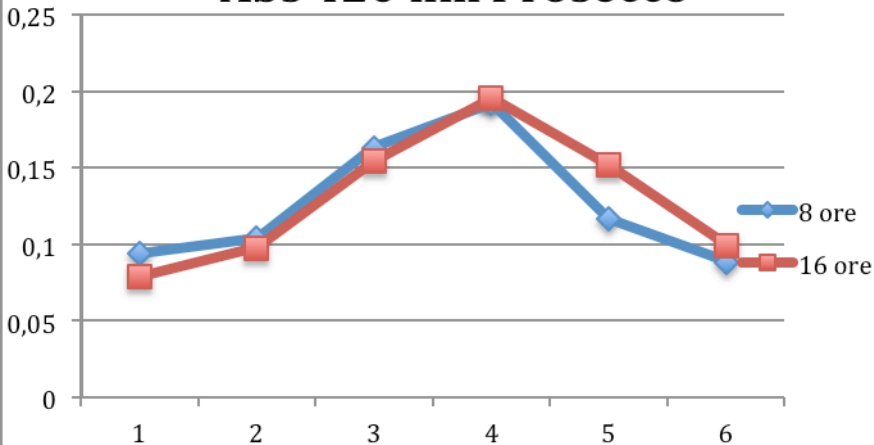
short

long



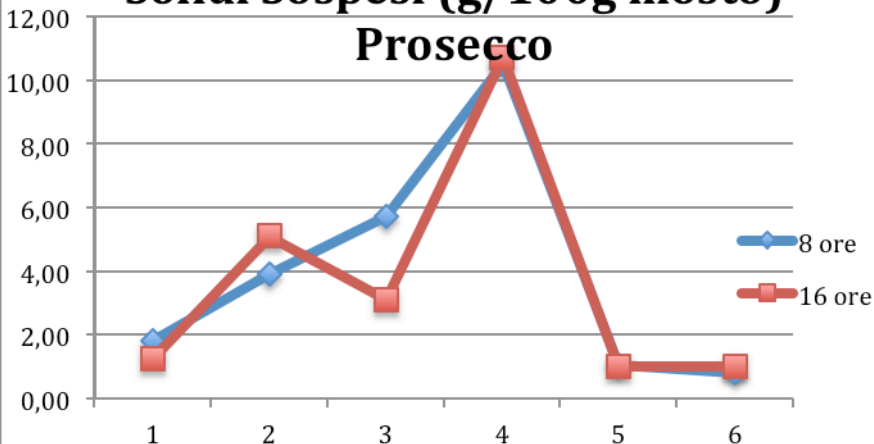
A few applicable results

Abs 420 nm Prosecco

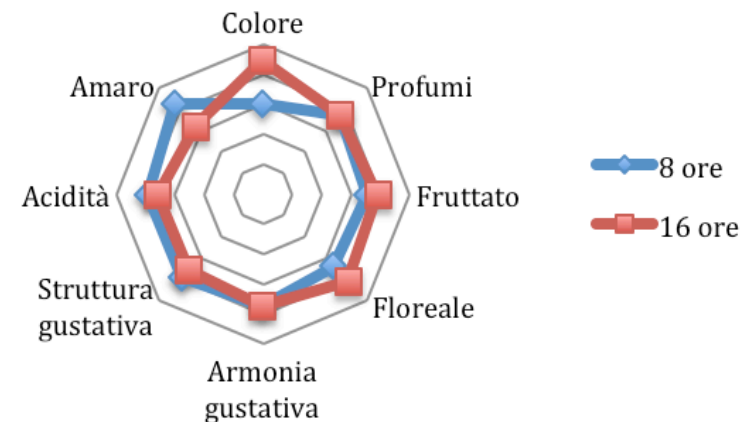


The soft dynamic skin contact allows to successfully manage even short time of maceration.

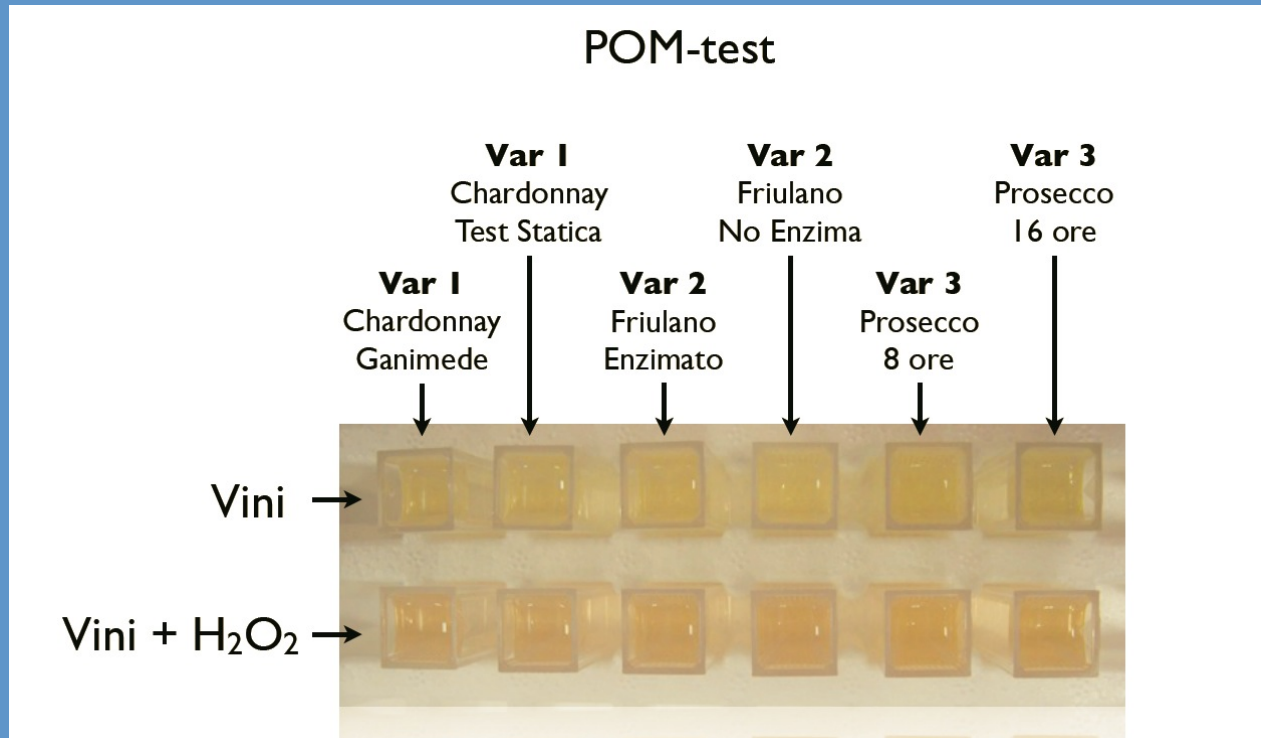
Solidi Sospesi (g/100g mosto) Prosecco



Dopo 8 giorni



A few applicable results



The oxidative stabilisation of wines produced, has been similar among all the trials, proving that there are no undesirable and unmanageable extractions of poliphenols.



A few applicable results

- ☐ The soft dynamic skin contact hasn't provoked more lees.
- ☐ The extraction of unstable polyphenols has been similar to that of static skin contact.
- ☐ It's been verified the possibility to manage the time of maceration based on grape's quality and winemaking's goal
- ☐ The soft dynamic mixing action can substitute the enzymes
- ☐ The inertisation, thanks to the CO_2 allows to reduce the adding of SO_2 , reducing in this way the non selective extractive effect, obtaining wines with low content of SO_2
- ☐ The general macrocompositive situation didn't appear modified



A few applicable results

Vintage 2012

Several situations of grapes with low juice yield because of the climatic conditions.

Prove su grandi volumi con enzimaggio nel maceratore Ganimede
Cantina Rauscedo

Controlli

2 campioni durante la macerazione

torbidità, acidità
pH, polifenoli, catechine

% succo, torbidità, acidità
pH, polifenoli, catechine

% fiore, test pectine,
torbidità, pH

analisi sensoriale,
catechine, POM test,
polifenoli totali

analisi sensoriale

pigiatura - diraspatura

valvola ad Y

2 maceratori Ganimede

macerazione dinamica soffice

"svinatura"

chiarifica

fermentazione alcolica

1° travaso

vino stabilizzato

Aggiunte o trattamenti

saturazione serbatoi con CO₂

enzimaggio (3mL/hL) in uno
dei maceratori ogni 100hL

raffreddamento,
insufflazione CO₂

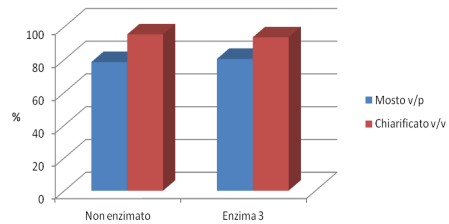
enzima aziendale nel mosto
non enzimato in macerazione

enzima 1mL/hL
(attività β -glicosidasica)

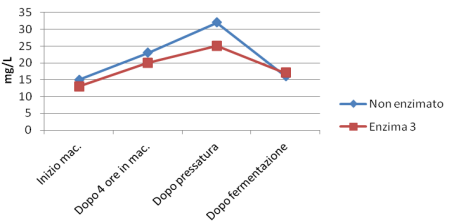
A few applicable results



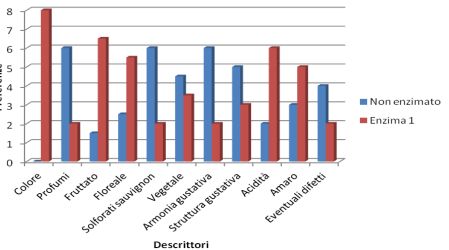
Rese Prosecco B azienda C



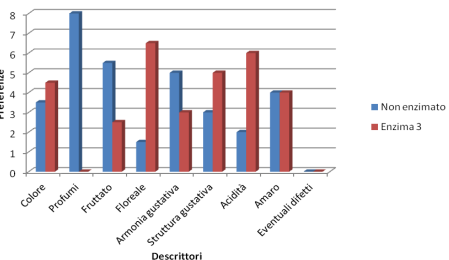
Catechine Prosecco B azienda C



Prima analisi sensoriale Sauvignon



Prima analisi sensoriale Prosecco B



- The enzymed samples have done comparable yields, proving that the dynamics of the maceration allows to substitute the enzymes, even on grapes difficult to make must from.
- The extraction of the poliphenols is controlled.
- The phenolic compounds, possibly extracted with the maceration, can be managed through the clarification, in fact the wines produced have acceptable levels of oxidation.
- The soft dynamic skin contact has produced more elegant wines which have been preferred especially for their aromas



A few applicable results

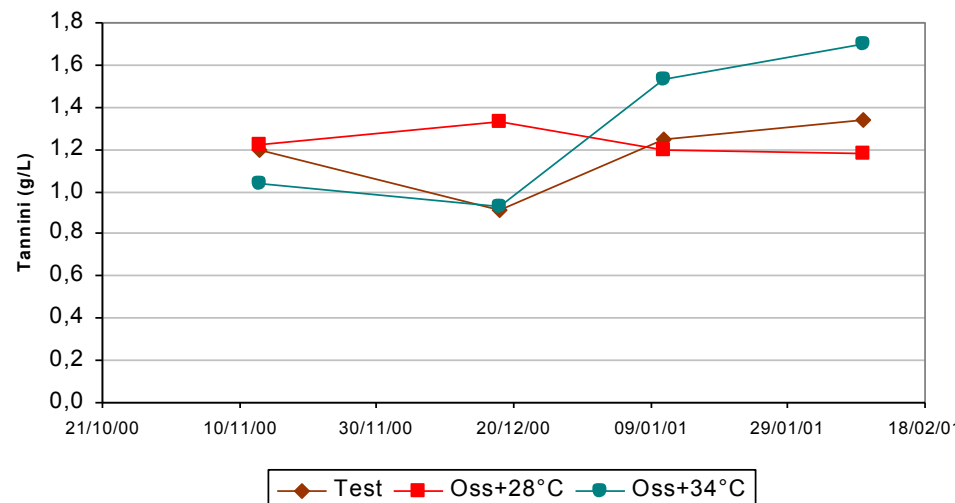
A brief reference to red wines

Interaction among factors, as long as manageable with adequate technologies.

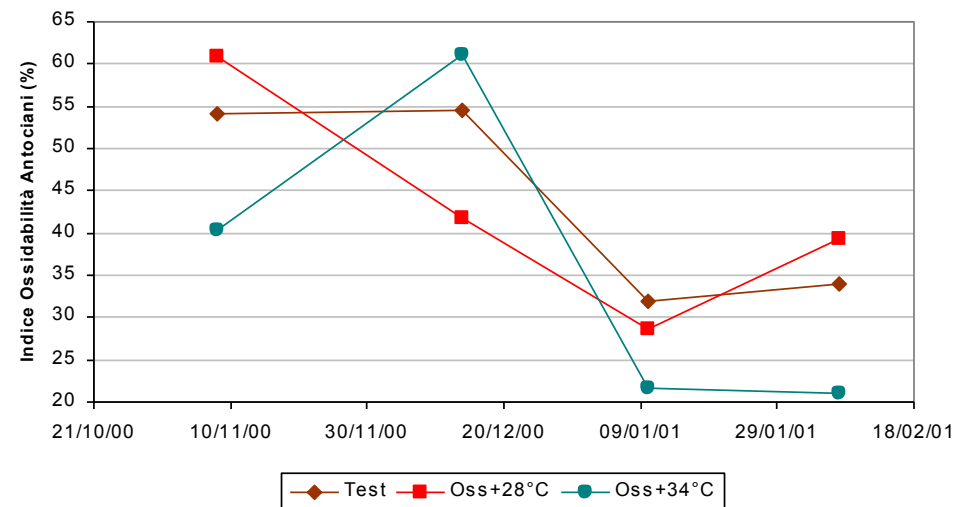
Oxygen vs Temperature

The oxygenation from the 3rd day, at a temperature of 34°, permitted us to obtain wines with more phenolic structure and with more stable color.

Cabernet



Cabernet



Conclusions



Therefore it's possible to produced structured wines, ideal for aging, by managing the process variables with the right combination.

The comparison have to be real, with the same crushed grapes, in this way we can also correctly use datas coming from single industrial trial

It's obvious that is very difficult to realize trials replicated in the winery on large volumes of crushed grapes (at least 3 for the statistic analysis), consequently we have to do single trials but with analitic results really usables.

Otherwise our time is lost and our datas are useless.

Conclusions



- La macerazione non deve essere considerata obbligatoria per tutte le uve bianche, vanno valutati i caratteri compositivi dell'uva, i vantaggi dell'estrazione e gli obiettivi enologici
- La pressatura diretta del pigiato rimane sempre una tecnica valida per certe produzioni e per certe tipologie di vino
- La macerazione è da considerare soprattutto per vini aromatici e per vini strutturati
- La potenzialità enologica di certe uve consente di elaborare vini diversi, anche con la macerazione delle bucce
- Sulle uve bianche la macerazione consente di differenziare le tipologie di vino prodotte, sfruttando il vero potenziale qualitativo della materia prima
- La variabilità aromatica delle uve bianche deve essere considerata per la gestione della macerazione

Acknowledgements

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Thanks for your attention