



Global solutions for quality winemaking

## **CRUSHING SYSTEM “OPEN GRAPE”**

## Open Grape, *innovative crushing system*

### Introduction to the project

- ✓ The project of the crusher Open Grape originated by observing the traditional crushing systems, normally widespread in Europe, which do not accomplish fully its function. If on the one hand the traditional systems are characterized by excellent levels of productivity and strength, on the other hand they cannot always ensure a perfectly crushed product.
- ✓ The crushing should aim at breaking the skin and exposing the contents of the berry to the following pressing or maceration operations. The traditional crushing systems crush only the berry producing the outflow of a part of the contents but leaving the skin closed in itself with part of the juice and pulp inside of it.

## Open Grape, *innovative crushing system*

### Operation principles

- ✓ The Open Grape crushing represents an innovation in the crushing principle as, not only it crushes the berry and releases its contents, but at the same time it opens the skin outward.
- ✓ The Open Grape crushing, by exposing the interior of the skin, improves both pressing operations for white grapes and the extraction of the compounds of the skin during the fermentation and not fermentation maceration processes.
- ✓ In the Open Grape process, the outflow of the juice and pulp is not due to the crushing of the berry but to the complete opening of the skin. This happens by avoiding the laceration of the vegetable parts and seeds, reducing the quantity of solids in the juice.

## Open Grape, *innovative crushing system*

### Technical description

The Open Grape crushing unit is characterized by the following:

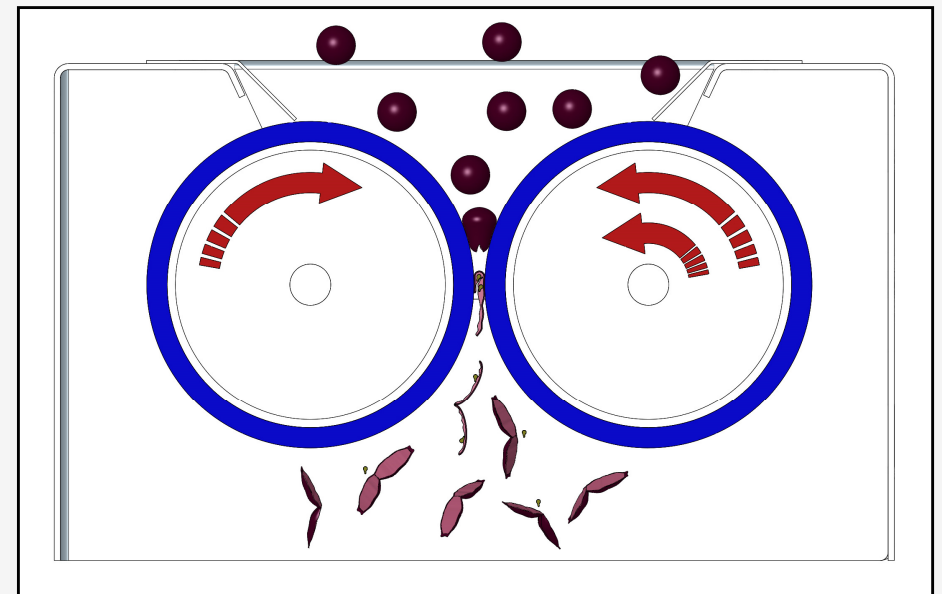
- ✓ Cylindrical rubber coated rollers
- ✓ Constant clearance between the crushing rollers
- ✓ Differential speed rotation of the rollers
- ✓ Motorizations of the independent rollers
- ✓ Adjustment of the difference of roller rotation speed controlled by inverter



## Open Grape, *innovative crushing system*

### Execution principle in the Open Grape crushing

- ✓ The berry passes through the clearance between the rollers and is deformed till the break of the skin in two halves.
- ✓ The contact time between the rollers and the berry is very short and lasts for a few rotation degrees. This reduces the stress and consequent forming of solids.
- ✓ The differential speed of the rollers ensures the opening of the berry, with the interior turned outward, and the separation of the juice and of the pulp.
- ✓ The differential speed of the rollers is adjusted according to the variety of grape and desired opening degree of the berry. A higher opening degree produces a bigger separation of the pulp and of the juice and of the polyphenols during the maceration phase.

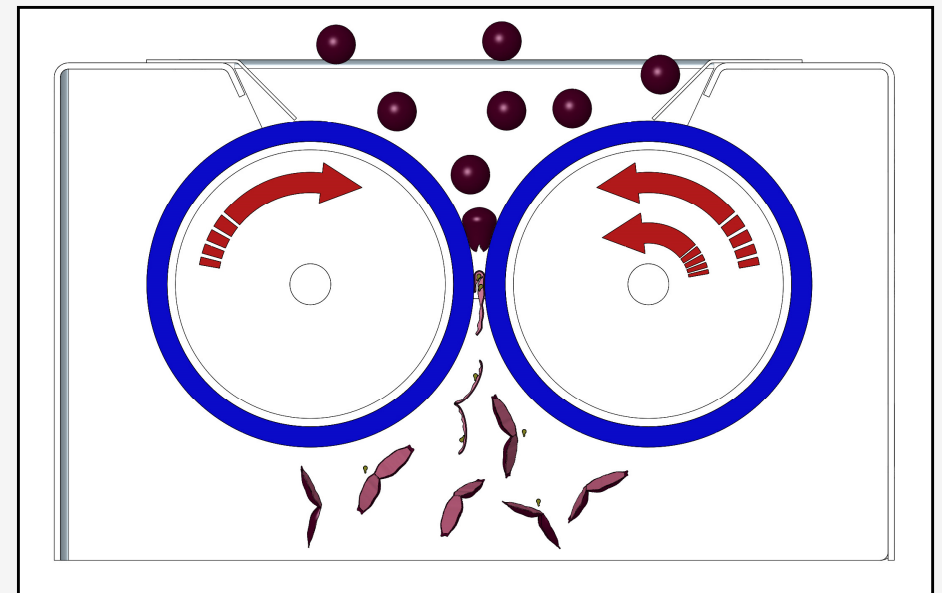


## Open Grape, *innovative crushing system*

### Execution principle in the Open Grape crushing

#### Originality:

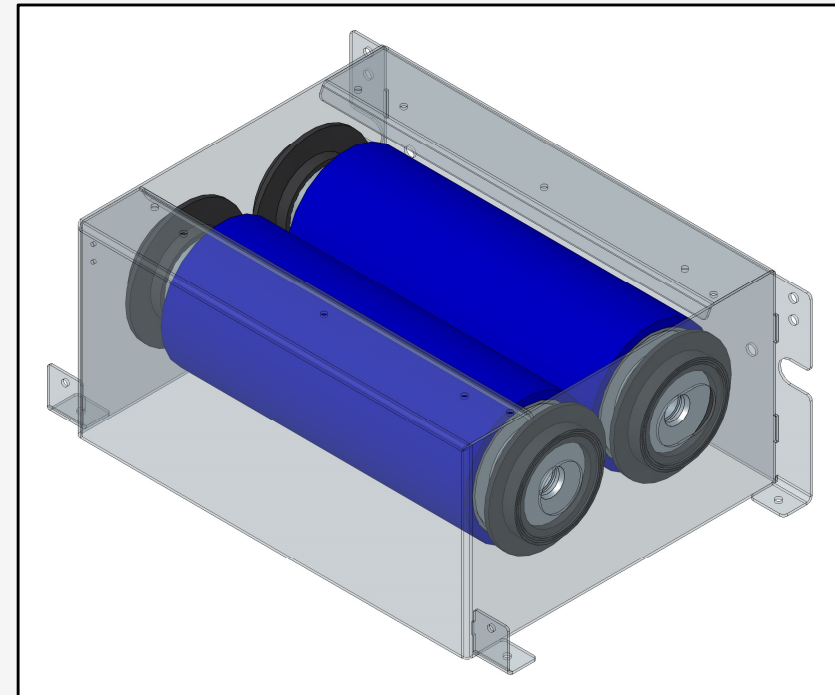
- ✓ The combined action of two special cylindrical and parallel rollers rotating at differential speeds, which force the berries to rotate on themselves in the room through the clearance separating the rollers.
- ✓ The combined action on the berry causes the complete opening of the skin with consequent total exposure of the pulp outward.
- ✓ In order to have the suitable grip which triggers the opening of the skin, the rollers are coated with special food grade polyurethane and a special design of the roller gives a lined surface.



## Open Grape, *innovative crushing system*

### Execution principle in the Open Grape crushing

- ✓ The roller' lined surface is coated with food grade rubber characterized by a specific elasticity to ensure the best adherence on the skin during the opening phase and to avoid stress on the product.
- ✓ The design adopted to execute the lined surface of the roller ensures the largest respect of the product's quality, facilitates the wash operations and it is hardwearing for a long time.

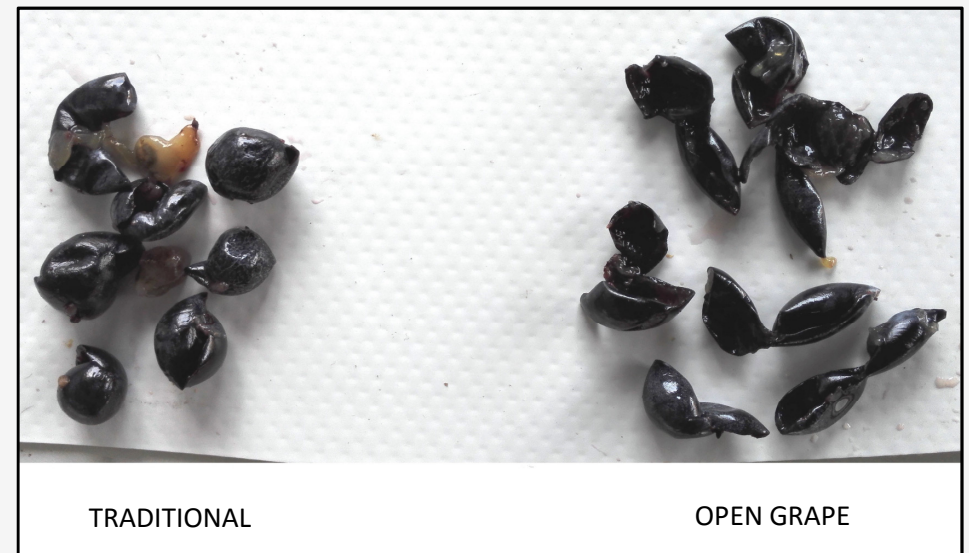


Note: the image above does not reproduce the roller' surface as patent pending.

## Open Grape, *innovative crushing system*

### Results from Open Grape crushing

- ✓ Excellent opening of the skin
- ✓ Outward exposure of the skin's interior
- ✓ Complete separation of the pulp
- ✓ Juice release
- ✓ Separation of the seeds





## Open Grape, *innovative crushing system*

### Performances of the Open Grape crushing system

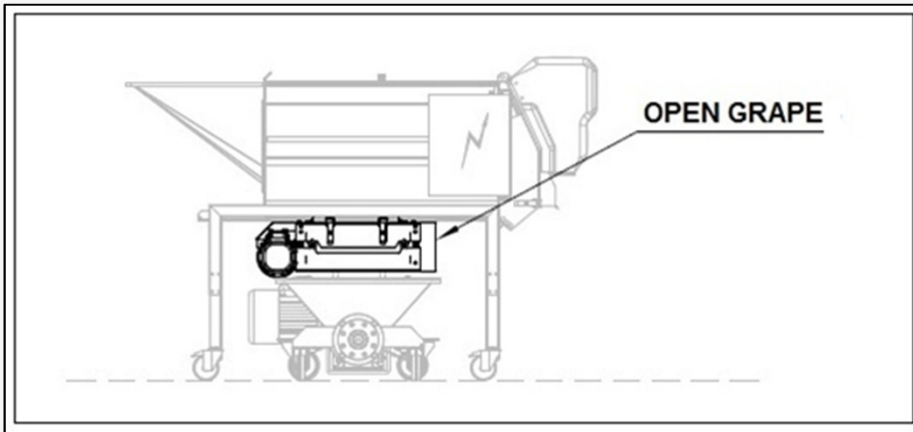
#### Range of models

- ✓ The roller rotation speed (absolute and relative) and the feed angle of the crushing unit assure excellent flowrates without penalize the treatment efficacy and the quality of the obtained product.
- ✓ The crushing rate is constant with minimum 98%, independently of the feed flowrate.
- ✓ Range of models Open Grape from 0,5 to 60 ton/h

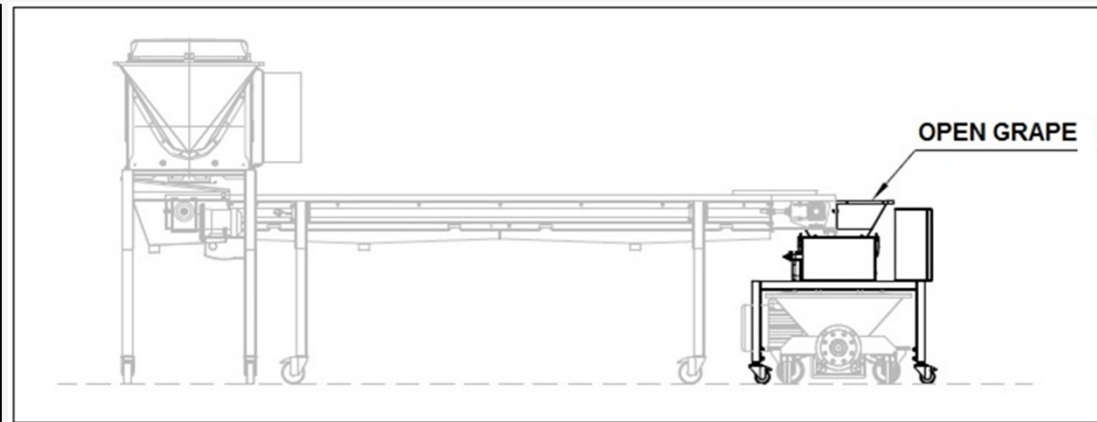
# Open Grape, *innovative crushing system*

## Applications of the Open Grape crushing system

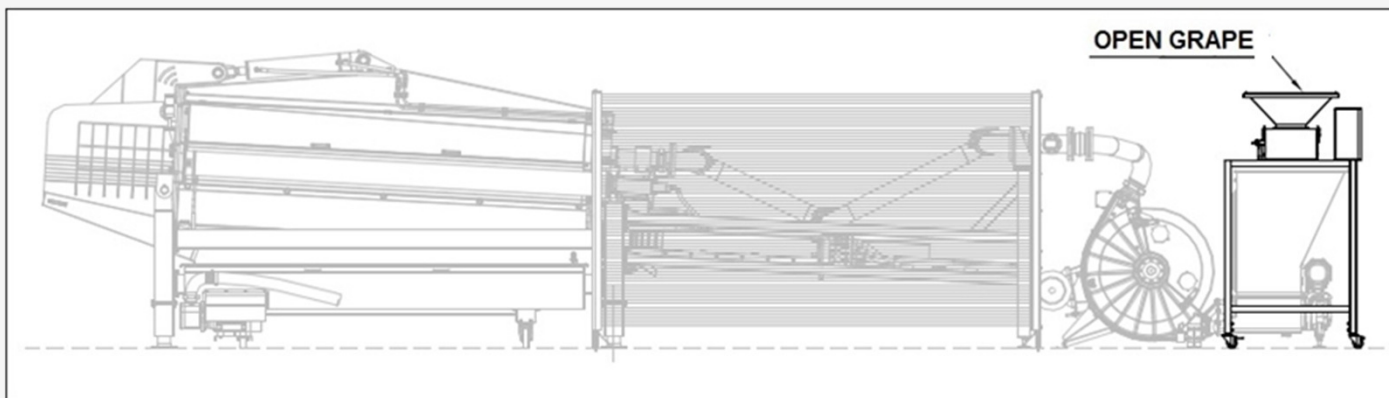
Installation with destemmer



Installation in selection line

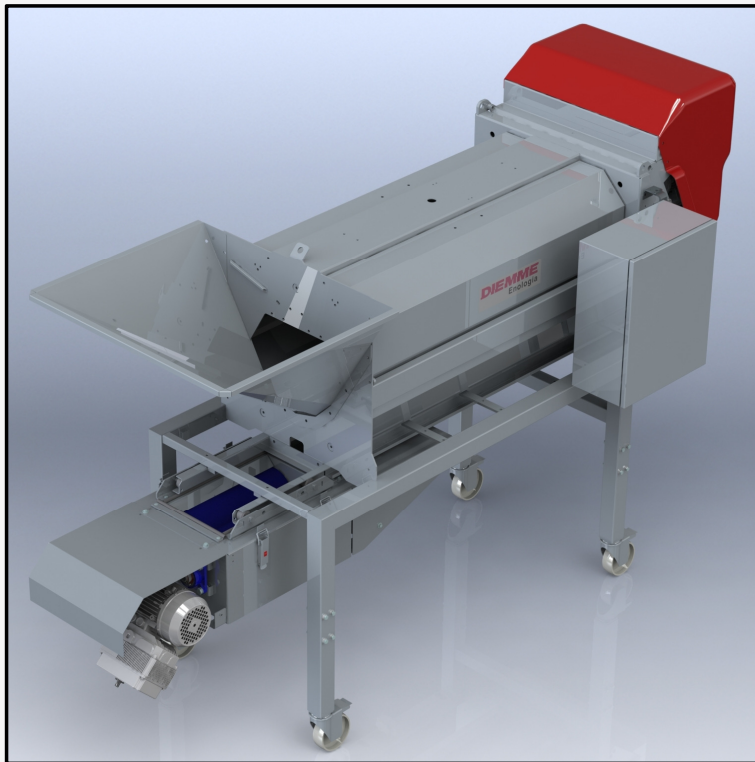


Installation on continuous line QC 620 Diemme Enologia

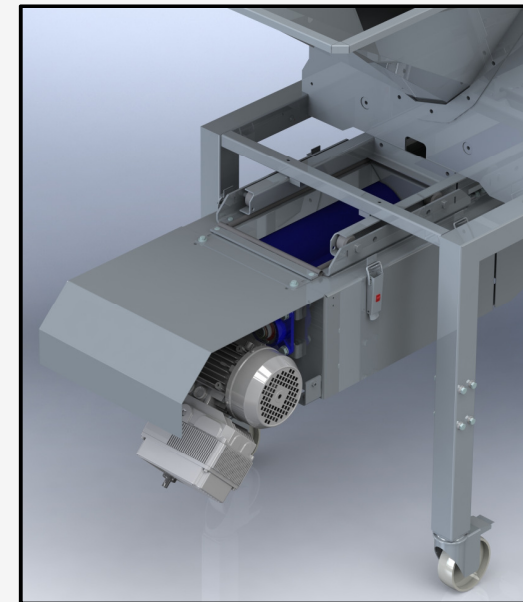


## Open Grape, *innovative crushing system*

### Applications of the Open Grape crushing system – Installation with destemmer



Simplicity of use



Easiness of washing and sanitization

## Open Grape, *innovative crushing system*

### Validation test of Open Grape crushing

The Open Grape system was tested during the harvest 2015 in Italy and 2016 in South Africa.

In Italy the tests were carried out on white and red grapes with the main purpose to validate both the quality and the process impact of the Open Grape crushing and compare these results with the ones got with a traditional crushing system.

In South Africa the tests were carried out to check the production capacity and the resistance to the wear of the Open Grape system. The results got in Italy were also validated during these tests.

## Open Grape, *innovative crushing system*

### Open Grape, red grape winemaking – harvest 2015 Italy

- ✓ Validation tests were carried out on three homogenous lots of 5000 kg high quality Cabernet grapes coming from the same plot. Grapes have been processed and fermented using exactly the same winemaking protocols, with the exception of the crushing system.
- ✓ In order to validate this process, the samples underwent chemical analysis at the certified laboratory “Astra Tebano” and afterwards sensorial evaluations were carried out in different stages of fermentation and post fermentation.

## Open Grape, *innovative crushing system*

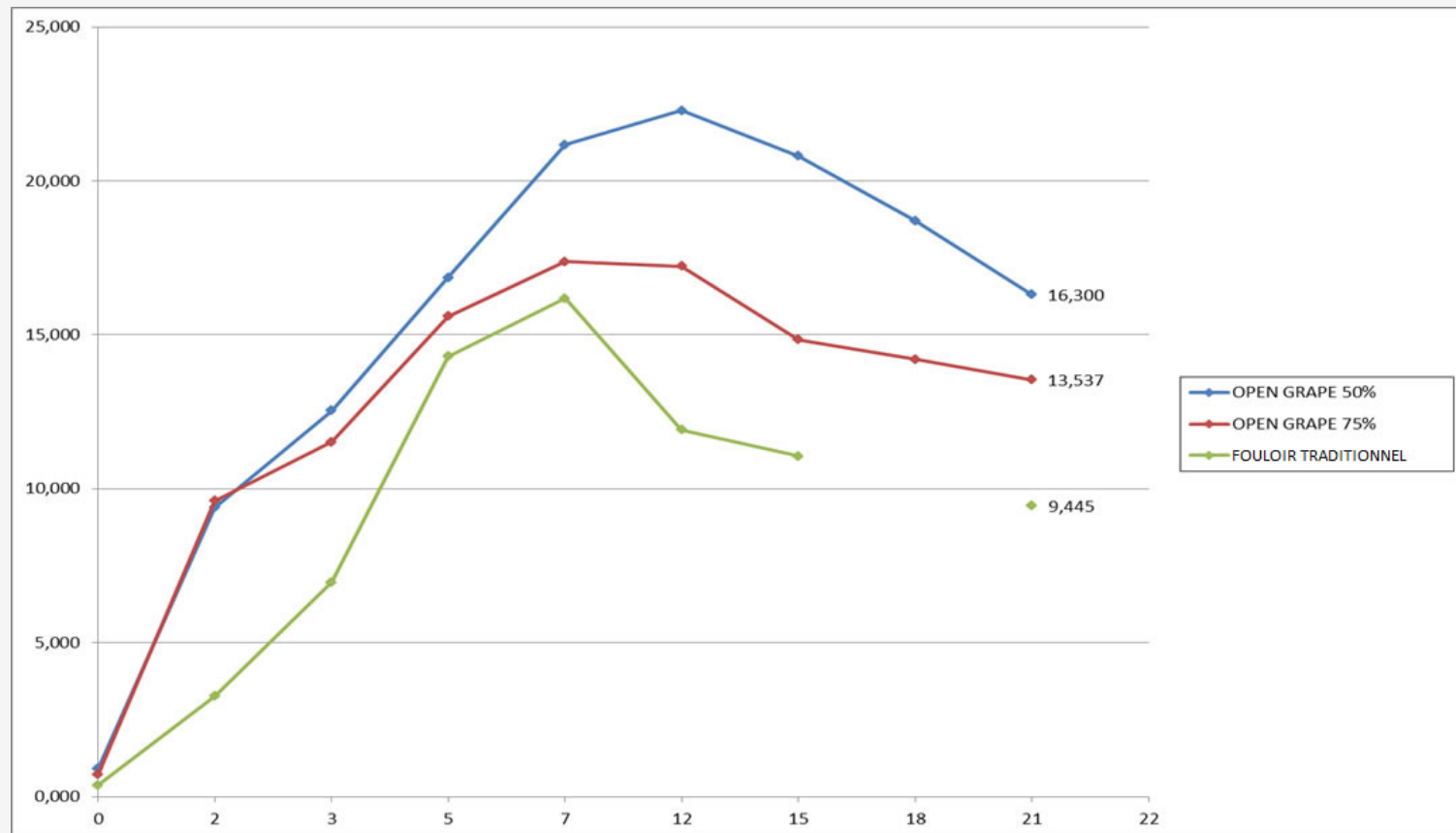
### Open Grape, red grapes winemaking – harvest 2015 Italy

We compared three different crushing methods:

- ✓ **OPEN GRAPE 50%:** it represents the product got by Open Grape crusher with 50% roller rotation speed ratio. The fast roller rotates at a speed double than the slow roller.
- ✓ **OPEN GRAPE 75%:** it represents the product got by Open Grape crusher with 75% roller rotation speed ratio. The slow roller rotates at a speed equal to  $\frac{3}{4}$  of the fast roller, thus getting a less extreme effect.
- ✓ **TRADITIONAL CRUSHER:** it represents the product got by a traditional crusher Kappa15 Diemme Enologia.

## Open Grape, *innovative crushing system*

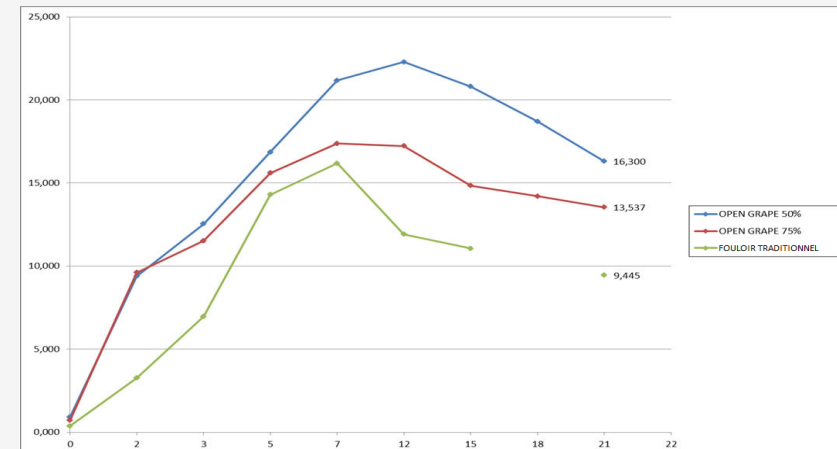
### Open Grape, red grapes winemaking: COLORING INTENSITY



## Open Grape, *innovative crushing system*

### Open Grape, red grapes winemaking: COLORING INTENSITY

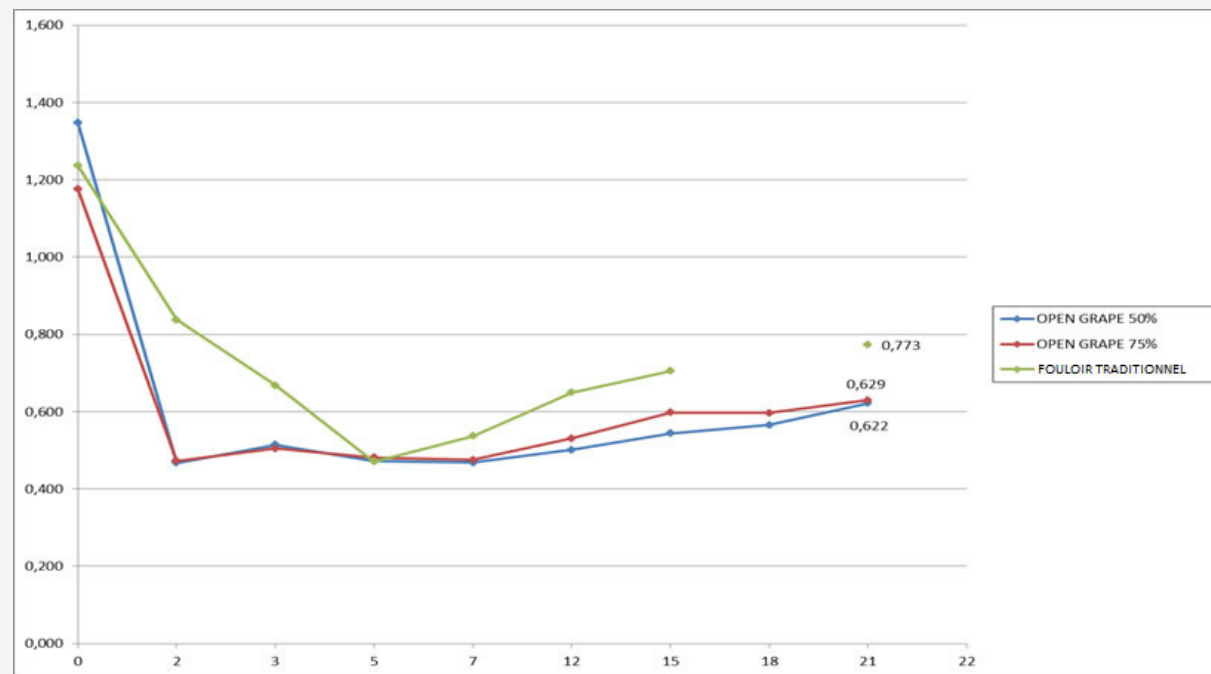
- ✓ The progressive increase of coloring intensity highlights extraction levels clearly higher concerning the thesis under examination, confirming greater extraction capacity of the treated product by the Open Grape crushing.
- ✓ The curves show an increasing progress of the coloring intensity up to a maximum included between the seventh and the twelfth day. Then this value tends to decrease for likely co-pigmentation phenomena and tends to stabilize on a plateau which confirms the higher extraction power of the Open Grape. The coloring intensity got then stronger during the ageing, keeping significant differences among modes under examination.
- ✓ The Open Grape crusher shows to be able to assure a faster and more efficient color extraction process. The analysis after de-coloring with SO<sub>2</sub> shows that Open Grape samples have also a greater content of pigments resistant to decoloring (tannin-antocian complexes).





# Open Grape, *innovative crushing system*

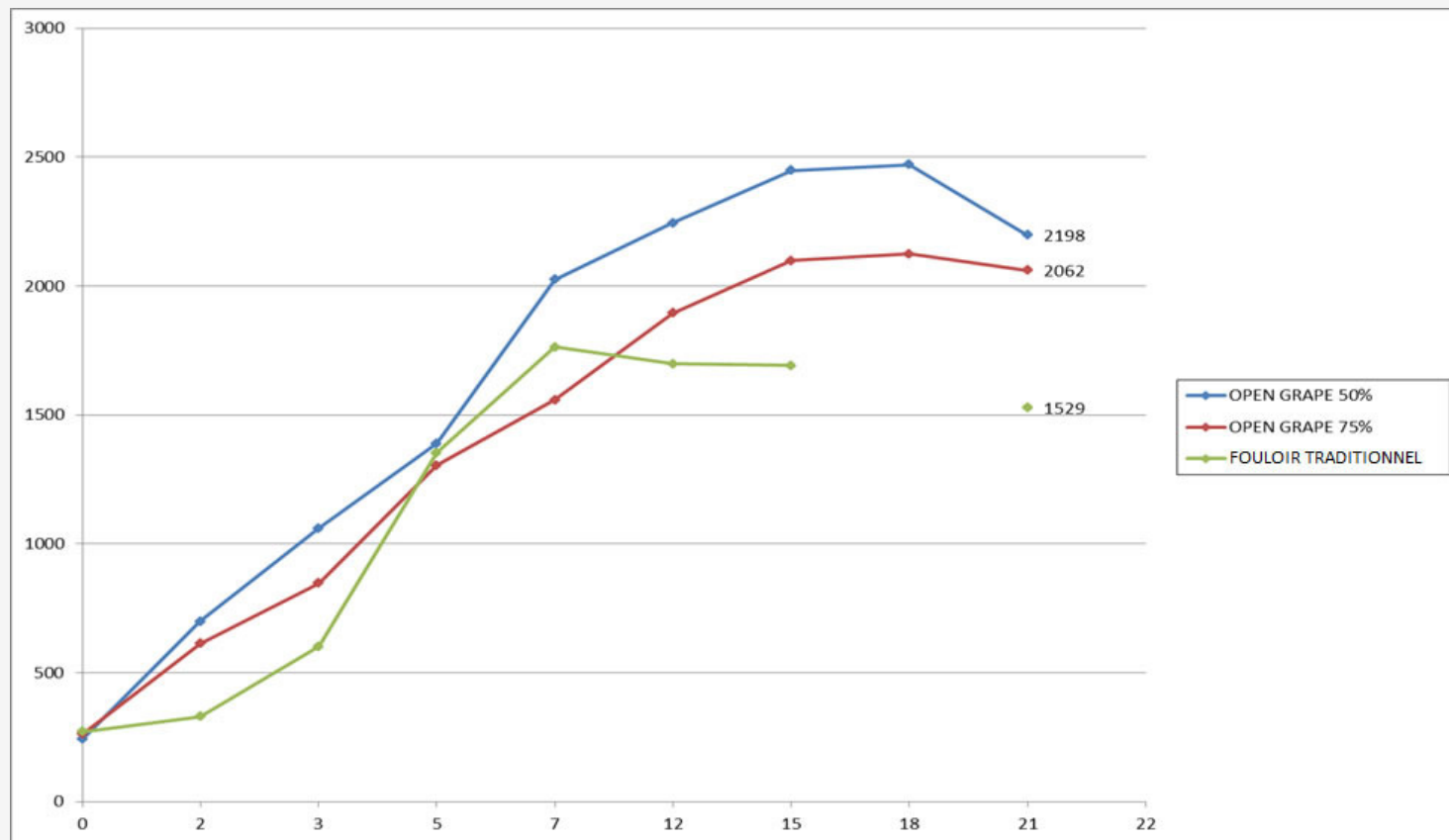
## Red grapes winemaking: SHADE



The shade evolution shows a different progress concerning the product got by traditional roller crushing, which has values higher than the Open Grape crushing. Wines obtained by Open Grape crushing are characterized by younger shade and evolve in a more balanced way.

# Open Grape, *innovative crushing system*

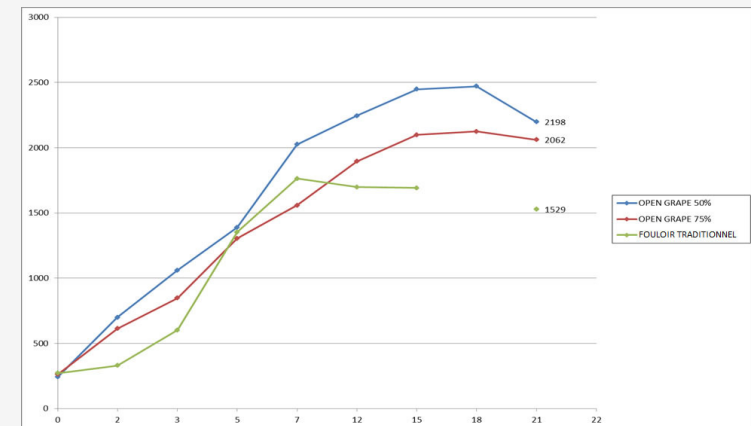
## Red grapes winemaking: POLYPHENOLS



## Open Grape, *innovative crushing system*

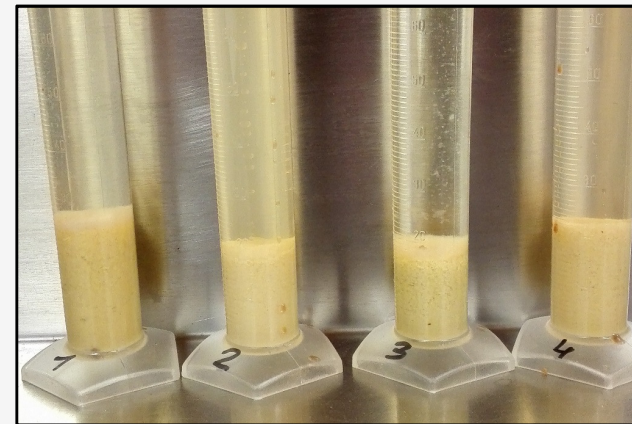
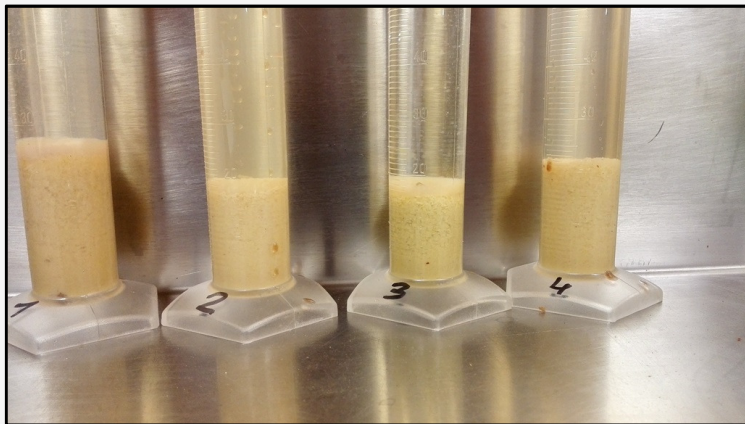
### Red grape winemaking: POLYPHENOLS

- ✓ The polyphenols extraction is characterized by a trend similar to the coloring intensity.
- ✓ Curves relevant to Open Grape crushing highlight both a quicker going up and a higher final polyphenolic property. This confirms further on that the «open» structure of skins favors the contact with the liquid part and consequent extraction.
- ✓ The higher polyphenolic content probably explains also the higher content of stable tannic-anthocian complexes noticed with the analysis by decoloring. These complexes assure better color stability in the time, assuring the maintenance of the property got in the maceration phase.



## Open Grape, *innovative crushing system*

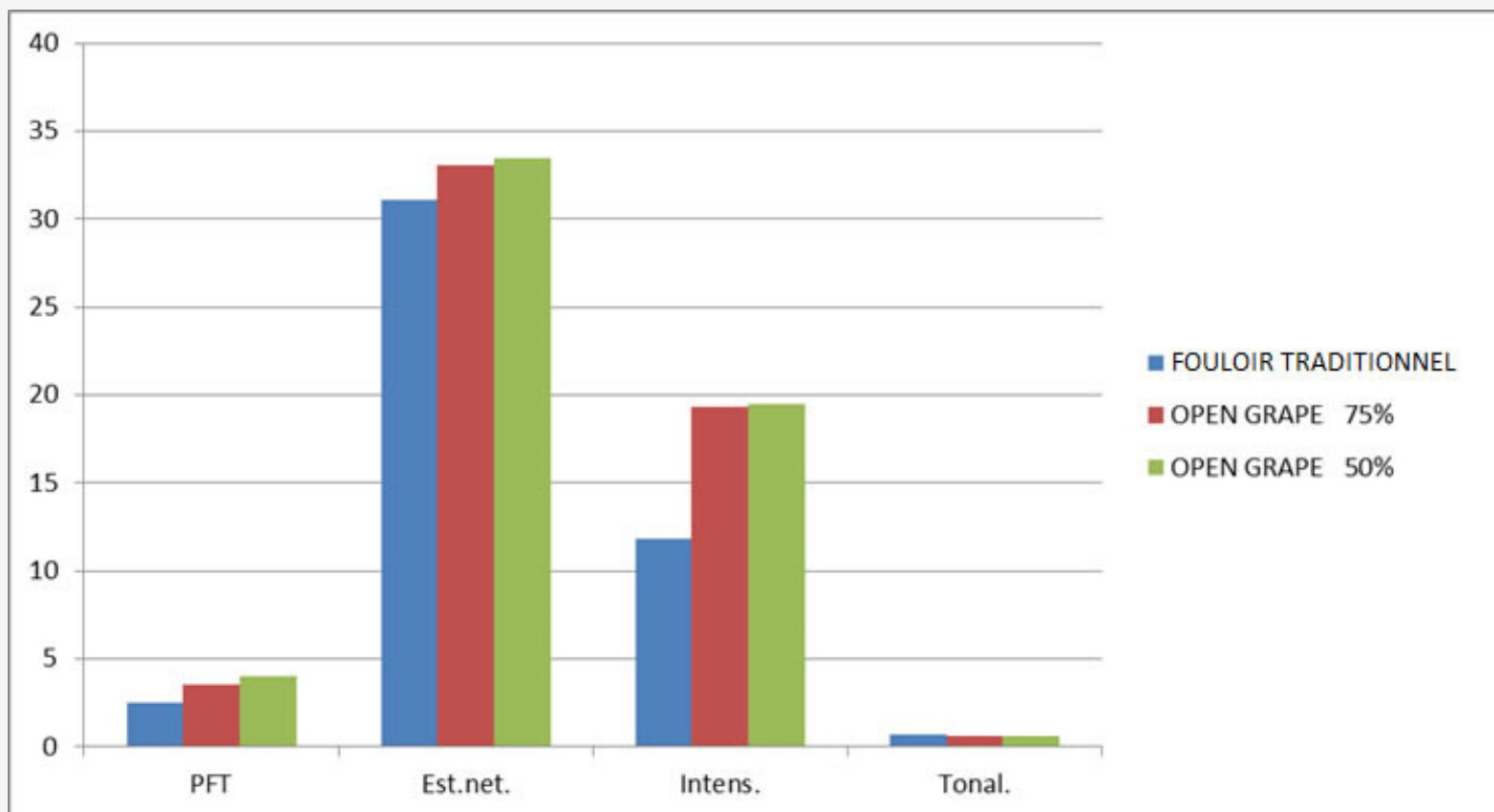
### Red grapes winemaking: **SUSPENDED SOLIDS**



- ✓ The cylinders show the quantity of suspended solids got by sedimentation after adding 10g liter SO<sub>2</sub>.
- ✓ The sample 1 is relevant to traditional crushing; samples 2, 3, and 4 to Open Grape crushing.
- ✓ The quantity of suspended solids contained in the juice coming from Open Grape crushing is smaller to the one produced by the traditional crushing.
- ✓ In the traditional crushing the distance between the rotation surfaces is not constant and might damage the solid parts by squeezing.
- ✓ In the Open Grape crushing the roller distance is constant and adjusted so that it lets skins and seeds pass without squeezing.

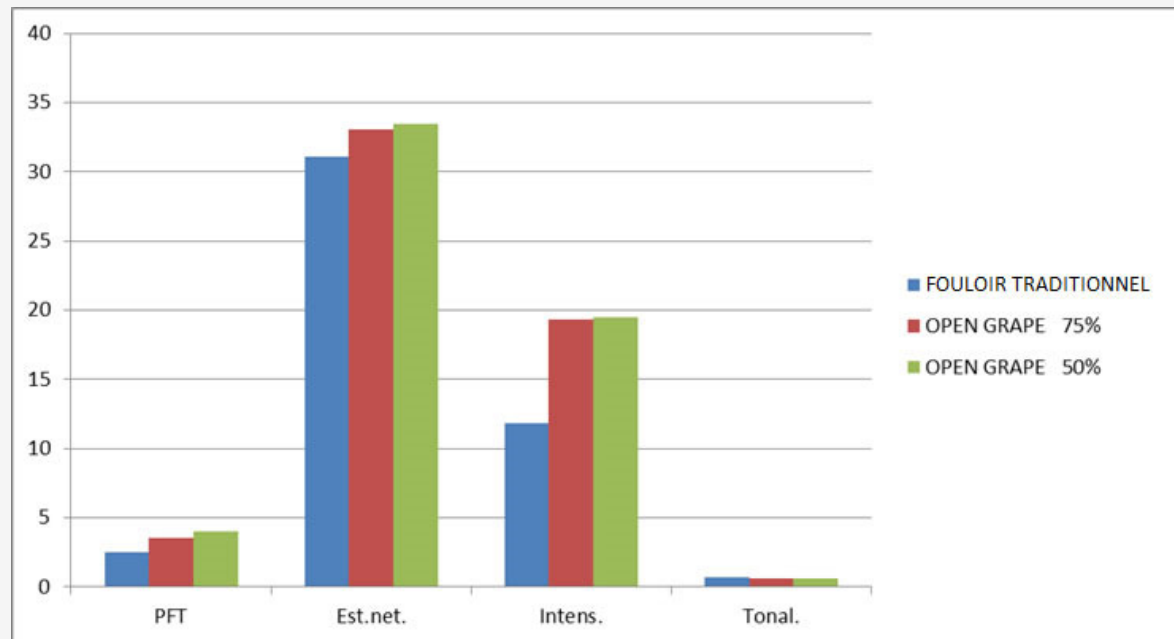
# Open Grape, *innovative crushing system*

## Red grapes winemaking: CHARACTERIZATION OF AGED WINES



# Open Grape, *innovative crushing system*

## Red grapes winemaking: CHARACTERIZATION OF AGED WINES



The evolution of tested wines, after eight month ageing in tank, puts in evidence how the differences noticed at the end of the fermentation and maceration phase are kept nearly unchanged. This demonstrates not only that the Open Grape crushing is able to improve the results of the fermentative maceration, but it allows also a balanced extraction of phenolic compounds which remain stable in time.

## Open Grape, *innovative crushing system*

### Red grapes winemaking– harvest 2016 South Africa

Validation tests were carried out in two different wineries and went on for the whole harvest period.

Tests had the purpose to check the production capacity and the resistance to wear of the Open Grape system. The tested model results to be the smallest size ever made.

Results:

- ✓ Productivity: from 500 to 20.000 kg/h (with Open Grape 15)
- ✓ Perfect resistance to the wear
- ✓ No quality variation of the crushed product when changing the feed flowrate

## Open Grape, *innovative crushing system*

### White grape winemaking– harvest 2015 Italy

The advantages of the Open Grape crushing technology in white grapes winemaking concern the easiness of the juice separation, allowing to increase greatly the productivity of pressing operations with any system, both continuous and discontinuous.

Validation tests were carried out on two lots of Trebbiano grape, comparing the productive parameters of a Diemme Enologia pneumatic press Mod. Velvet 50 with capacity 5 m<sup>3</sup>.

#### **Traditional crusher**

Loading time: 1h 05'

Loaded weight: 11.000 kg

Pressing time: 2h 15'

#### **Open Grape crusher**

Loading time: 1h 15'

Loaded weight: 13.500 kg

Pressing time: 2h 05'



## Open Grape, *innovative crushing system*

### Results of white grape winemaking– harvest 2015 Italy

- ✓ The Open Grape crushing allows to load a larger product quantity into the pneumatic press, reducing the air volume necessary to the very same pressing.
- ✓ The reduction of dead times of membrane inflation and deflation allows to reduce the total pressing time without influencing the product squeezing degree.
- ✓ The reduction of working times of blower and air compressor involves a higher energy efficiency.
- ✓ The possibility to reduce pressing times and cake breaking revolution number can allow a quality improvement of the extracted juice, reducing the quantity of suspended solids and the skin contact time.
- ✓ The Open Grape crushing can be interesting in the application to grapes for enzymatic maceration and cryomaceration. These applications will be tested during next test activities.

## Open Grape, *innovative crushing system*

### OPEN GRAPE ADVANTAGES IN RED GRAPE WINEMAKING

- ✓ Better **colour extraction** bringing to higher coloring intensity level in short times.
- ✓ Wider **polyphenolic richness** thanks to faster and complete extraction in every maceration phase.
- ✓ The open skin conformation replaces the Delestage operation and increases the **re-pumping efficacy**.
- ✓ Sharp and early seeds separation allows a **greater control** in the extraction of phenolic compounds.
- ✓ **Increase of productivity and yield** of fermented pomace pressing processes thanks to better separation of the liquid part.

## Open Grape, *innovative crushing system*

### OPEN GRAPE ADVANTAGES IN WHITE GRAPE WINEMAKING

- ✓ **Increase of productivity and yield** of juice extraction processes in all continuous and discontinuous pressing systems thanks to grape berry opening and pulp and juice separation.
- ✓ **Increase of loading capacity** in pneumatic membrane pressing thanks to higher dejuicing yields.
- ✓ **Reduction of pneumatic membrane pressing times** thanks to larger volume of product loaded and to juice extraction easiness.
- ✓ **Reduction of compressed air need** for the pneumatic membrane pressing cycle and consequently **energy saving**.
- ✓ **Increase of productivity and yield** of juice in the pressing process with new Diemme Enologia continuous line QC620 or with traditional continuous screw type pressing lines.
- ✓ **Quality improvement** in all continuous and discontinuous pressing systems, as it is possible to reduce pressure, mechanical stresses and process times, while keeping a high juice yield level.

## Open Grape, *innovative crushing system*

### ECONOMICAL, ENVIRONMENTAL ADVANTAGES, SAFETY

#### Economical advantages

- ✓ Improvement of productivity and global performance
- ✓ Optimization of energy consumption (inverter)
- ✓ Possible replacement of the crushing unit installed on existing destemmers

#### Economical-environmental advantages

- ✓ Global reduction of energy consumption
- ✓ Control of washing water consumption

#### Safety

- ✓ Noiseless (no gears)
- ✓ Movement stop in case of introduction of foreign body

Rooted in tradition, strong in innovation



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