An Innovative System for Mechanical Harvested Grape Fruit Transport to avoid Must Chemical and Microbiological Modifications

L. Pari [1], F. Pezzi [2]
[1] Agricultural Engineering Research Unit (CRA-ING)
Tel. : 0690675249 – Fax: 0690675250
luigi.pari@entecra.it
Via della Pascolare, 16 - 00060 - Monterotondo (RM) – Italy

[2] Agricultural Economics and Engineering Dept. University of Bologna, Italy
Tel.: 0512096187
fabio.pezzi@unibo.it
Via Fanin, 50 - 40127 Bologna – Italy

ABSTRACT

The mechanical gathering of grapes presents some negative aspects due to the must leakage from the grape damage, often stressed by the long period elapsing from harvesting and processing the product, as well as by the high temperature. In addition, the must presence in the harvested product, sometimes reaching 25-30% of the total product, causes inevitable drawbacks. For that reason, an innovative system of handling and grapes transporting was developed in order to separate, once harvested, the liquid part (must) from the solid one (bunch of grapes and single grape), thus to apply different working process on each of them. Thanks to this system, it was possible to isolate the must in a closed tank and thus, immediately, preserve it by dry ice or liquid carbon dioxide, with the addition of enological chemicals to avoid (sulphur dioxide, ascorbic acid and tannin) chemical and microbiological modifications. The evaluation of wines throughout tests and sensorial analysis, highlighted the better quality of the wines obtained by the proposed technique compared to the traditional one cause of higher presence of primary fragrances, better color, and a better balanced structure of the wine preserved by oxidation action.

Keywords: Must, innovative transporting system, dry ice, sensorial analysis, Italy.

1. INTRODUCTION

The reduced work force in the wine industry has made the use of mechanized labour almost a necessity allowing for a reduction of the harvest cost. In order to make the mechanical harvest a

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good method of processing grapes, it needs to solve some negative aspects such as the high quality of the product that has to be always maintained.
The mechanical gathering of grapes, in fact, presents several drawbacks due to the must leakage from the grape damage, often stressed by the long period elapsing from harvesting and processing the product, as well as by the high temperature. In addition, the must presence in the harvested product, sometimes reaching 25-30% of the total product, causes inevitable drawbacks:

- ✓ Oxidation of phenolic and aromatic components;
- ✓ Initiation of fermentation by yeast;
- ✓ Premature maceration of the skins;
- ✓ Assignment of unpleasant hints from leaves and small bunches.

Today, several techniques aimed at reducing the negative effects of the grapes must preparation, hence at maintaining the quality level of the harvested grapes, are being studied. However, high costs and little practical application strong limit their diffusion.

In order to economical and technological evaluate an innovation system to treat grapes harvested by machine during transport, experimental tests were carried out.

2. TECHNIQUES

The technique consists of the separation of the liquid part from the solid one directly on the wagon used for transporting grapes from field to wine cellar, in order to separately apply different winemaking procedures prior to processing (Fig. 1). Following to this, must, which is the most precious and delicate part, is isolated in a closed tank where you can perform techniques of grape processing such as cooling, air alteration by inert gas (CO_2 or N_2) and injection of wine products. In addition, when the must arrives in wine cellar, it is immediately put into the tank; hence all the procedures in ordinary usage for grapes processing, are not considered/applied at all (hopper unload, removing and pressing grapes from the stalks….).

Figure 1. Grapes mechanically harvested and unloaded into the wagon modified for the must separation

3. PROOF

The trials were conducted in the period 2005-2007. Studies of the first two years compared results of mechanical harvesting in relation to the transport system by the traditional and must separation methods.
The experimental machine used in first year of the trial consisted of a wagon used for unloading grapes (from harvester) and for the must separation, and a tank (separated from the wagon) where must was pumped into in order to immediately treat with 4 kg / hL of dry ice (solid CO_2) and 5 g / hL of ascorbic acid.
In the wine cellar the separated must was then directly transferred into tanks where it was subsequently put together with that one just separated in field (thesis A).
At the same time and with the same machine, the harvesting of grapes (on alternate rows) transported by the "traditional" method was carried out. According to this, 20 g / hL of an antioxidant (50% of K metabisulphite, 30% of ascorbic acid and 20% of ellagic tannins) was treated on the product without any separation of the must (thesis B).
The processing of the two products was carried out on quantity of about 50 hL until defecation, after which two fractions of 100 L were separated in order to complete the wine-making in a place where the control is guaranteed until bottling. After two months, the wines were subjected to chemical and sensory analysis (triangle test, a hedonic test with scores and test of the descriptors).
The tests were carried out on two grape varieties: Chardonnay trained to GDC (test 1) and Pignoletto trained to spur pruned cordon (test 2).
Differently, in the second year, the tank was directly put into the wagon (base). In addition, the use of CO_2 instead of dry ice in the must and 40 hL instead of 100 L in the processed product, represent the only innovations in respect to methods and rules of the previous year tests. The test was performed only on Pignoletto trained to spur pruned cordon (test 3).

4. RESULTS

From tests results, vineyard as well as harvest systems can affect the must preparation/making, with higher values for Pignoletto harvested by horizontal shaking (Table 1). In the first year, the dry ice usage in good quantity allowed to decrease the must temperature of 3.5-4 °C and to create a CO_2 inert atmosphere into the tank. In the second year, with the liquid CO_2 usage, great attention was to the inert process that provokes a lower unimportant heat.

Table 1. Must process and temperature in the thesis A (first three tests)

Proof	1	2	3
Date	2-9-2005	16-9-2005	18-9-2006
Grape-gathering machine	Tanesini tech.	Pellenc	Braud
Free must (%)	18	33	30
Initial must temperature (°C)	25,0	26,5	26,0
Final must temperature (°C)	21,0	23,0	25,5

The chemical analysis of wines (Table 2) showed a good similarity between the samples (two) of each test with sensory differences due to the two different wine-making techniques.
For sensory analysis, by seasoned tasters performed, the compared tests in each test resulted in significantly different to the triangular test. According to the hedonic testing, the best choice was the thesis A (Table 3). In general, the separation and must treatment in the field provided better results for a wider, persistent and smell fine as well as by an harmonious taste (Figure 2).

Table 2. Chemical analysis on wine of the three proof

Proof	1		2		3	
Year	2005		2005		2006	
Vineyard	Chardonnay		Pignoletto		Pignoletto	
Thesis	A	B	A	B	A	B
Alcohol eff. (% vol.)	10,30	9,84	12,28	12,27	13,99	14,03
Sugars(g/L)	1,70	3,88	2,06	2,57	2,50	2,50
pH	3,26	3,30	3,25	3,30	3,40	3,55
Total acidity (g/L)	9,60	9,50	6,24	6,40	5,08	5,06
Vol. acidity (g/L)	0,20	0,22	0,38	0,41	0,30	0,34
Poliphenols (mg/L)	245	220	309	295	712	831
DO 380 nm	2,20	1,30	2,89	2,89	2,85	2,95

Table 3. Results of triangular and hedonic testing on each trial

Proof	Tasters	Prizes	P Value	Pref. thesis A	P Value
1	28	15	0,03	16	n.s.
2	23	14	0,01	16	0,05
3	20	15	0,001	15	0,05

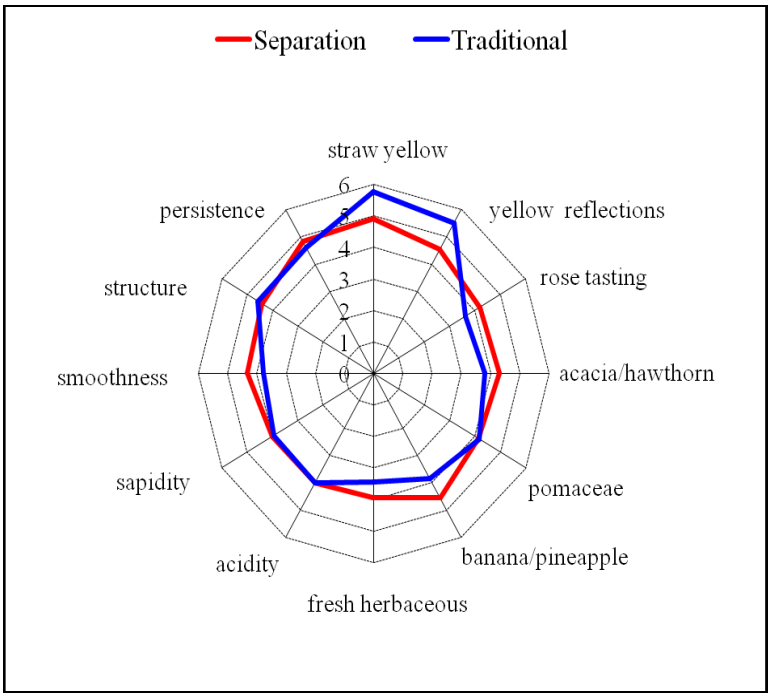

Figure 2. Quantitative descriptive analysis (QDA) of Pignoletto (two thesis) harvested in 2006.

5. CONCLUSIONS

Preserving quality of grapes mechanical harvested based on separating free must in field is a good result carried out from all these experimental tests. Although further improvements needed, the used method resulted in opportune to advance the protection of the liquid fraction, more delicate, but even more "easy" for a correct protection, by chemical or physical means.
The must separation in field can also provide technological benefits in the usage of grapes, mechanically harvested, for wine processing that needs no contact between must and oxygen (wine making in reducing white grapes) or skins fermentation free (Pinot noir having sparkling base). The operational benefits can be due to the initial processing of the grapes with the only solid component, with a better functionality and machine productivity.

6. REFERENCES

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