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Report: Microvinification from each harvest

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1. Introduction

The project involves five wineries located in different part of Italy; three in the North, one in the Center and one in the South. The aim is to identify different areas that can be representative of the different viticulture areas in Europe.



In the context of each testing site a specific vineyard has been identified to carry out research investigation (see also Milestone B2.1 - Identification of parcels and set up of comparisons tests).

The vineyards where the tests were conducted were selected also on the basis of the vineyard homogeneity: plants should be uniform for cultivar, ages, rootstocks and training system. This characteristics are essential to allow vegetative-productive impact evaluation.

2. Activities description

In each vineyard three different types of organic fertilization were used: compost, solid fraction of digestate and manure. Each treatment was distributed both incorporating the organic fertilization into the soil and leaving it on the surface. It

was also selected a test not fertilized where the soil was both tilled and not tilled for a total of eight treatments.

TREATMENT CODE	TREATMENT DESCRIPTION
TL	Test non fertilized and non tilled
TNL	Test non fertilized but tilled
CL	Compost incorporated into the soil
CNL	Compost not incorporated into the soil
DL	Solid fraction of digestate incorporated into the soil
DNL	Solid fraction of digestate not incorporated into the soil
LL	Manure incorporated into the soil
LNL	Manure not incorporated into the soil

In the vineyard of BDM was decided to add an extra comparison with and inorganic fertilizer:

TREATMENT CODE	TREATMENT DESCRIPTION
TL	Urea incorporated into the soil
TNL	Urea not incorporated into the soil

To allow a collection of data useful for the subsequent statistical processing it was necessary to divide the total surface of testing vineyard in different parcels.

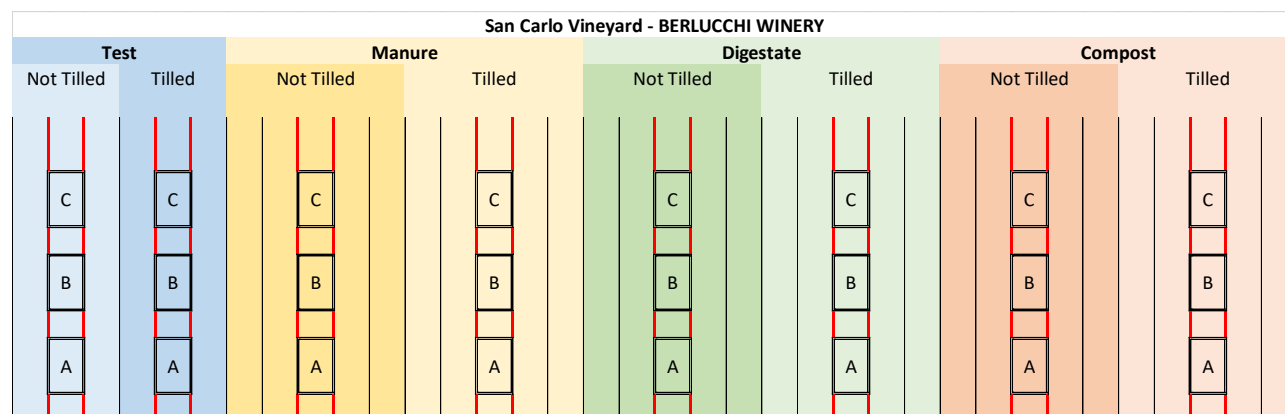


Figure 1. Example of the experimental vineyard of Berlucchi winery.



For each treatment were selected three different replicates (A, B and C in figure 1) to achieve a stronger statistical significance.

The experimental harvest consisted in selecting between six and twelve plants for replicates; for each plant the grapes were collected and weighted, the number of bunches was counted as the number of buds and shoots.

The selected plants were signed (figure 2) and during the winter period the same plants were pruned and the wood produced in the year was weight to calculate the Ravaz index.



Figure 2. Experimental harvest and detail of a signed plant



For the year 2017 were selected about 1.300 plants, for the year 2018 about 1.000 plants and for the year 2019 about 700 plants. In 2019 vintage was not possible at Bosco Del Merlo winery.

All the data were treated with a statistical software to reduce the error due to the sampling.

For each selected plant the first bunch of the middle shoots for a total of three bunches per plant were collected; then the bunches were manually pressed and the must was analyzed in the laboratory (figure 3) to determinate the pH, the acidity and the sugar content.

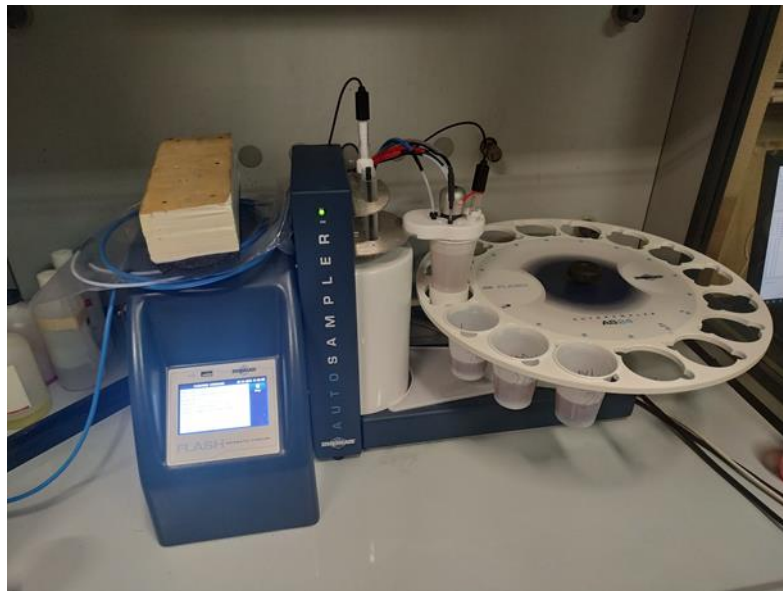


Figure 3. Instrument used for laboratory analysis

Once the samples were collected, 150 kg of grapes per treatment was harvested. Once the grapes arrived at the winery, we proceeded to extract the must with a water hydraulic press to obtain more or less 30L of must. After storing the tank with the must for one night in a refrigerated cell at a temperature of 10°C, the must was inoculated with prepared yeast.

When the fermentation was finished (after 7-10 days for white wines and 15 days for red wines), the wines were racked in another storage tank. Red wines were inoculated with selected bacteria for malo-lactic fermentation that lasted between one and two weeks.



After all the fermentations were finished the wines were bottled.

For the three years of the project 116 micro-vinification were done: 42 for the year 2017, 42 for the year 2018 and 32 for the year 2019 (in the last year grapes from Bosco del Merlo winery could not be processed).



Figure 4. Some of the micro-vinifications

Finished wines were sent to different laboratories for the analysis; the conventional analysis like pH, alcohol, residual sugar, malic and tartaric acid, SO_2 were made. In another laboratory, Fondazione San Michele all'Adige, a particular analysis, on the volatile organic compounds presented in the wines, was carried out.

Wines had also been part of different technical tastings organized during the three years of the project by a panel composed by oenologists of different wineries and some students of viticulture and oenology course of the University of Milan.

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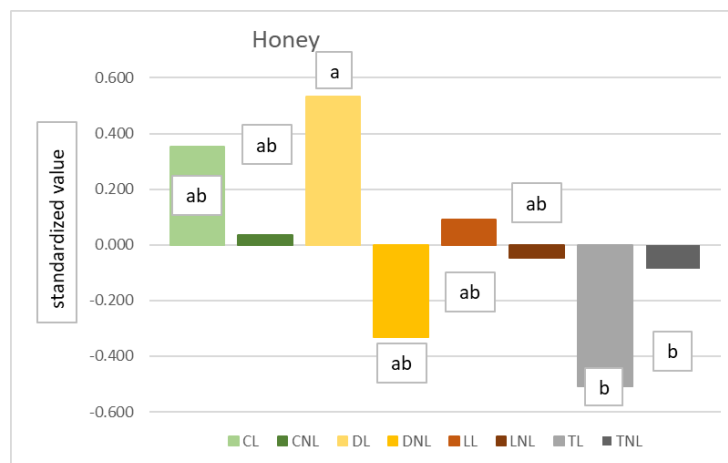
3. Main wine tasting results

Sensorial analysis on wines

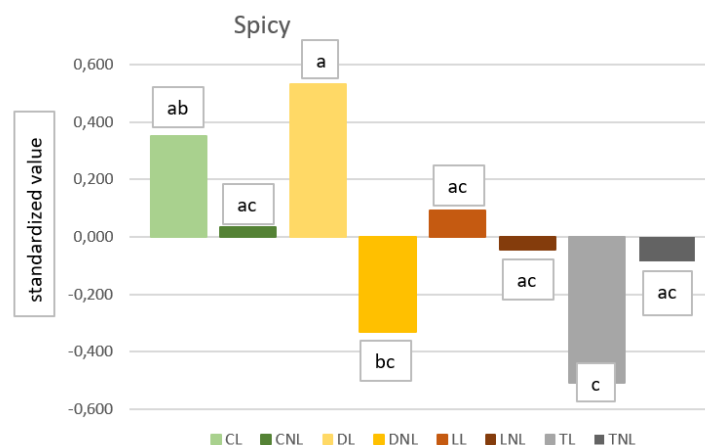
In the sensorial analysis it has shown an existence of a general trend in which thesis treated with manure, digestate or compost have a better evaluation but this trend is different for the specific sensorial descriptor and for each winery; the incorporation of the fertilizers also often determined a better quality in the wine.

It is therefore evident that in addition to their management, numerous factors come into play such as the meteorological and climatic conditions and the specific characteristics of the soil-above-ground complex.

Some of the results are presented in graphic 1 and 2. All the results are presented in "Annex – Wine tasting results".

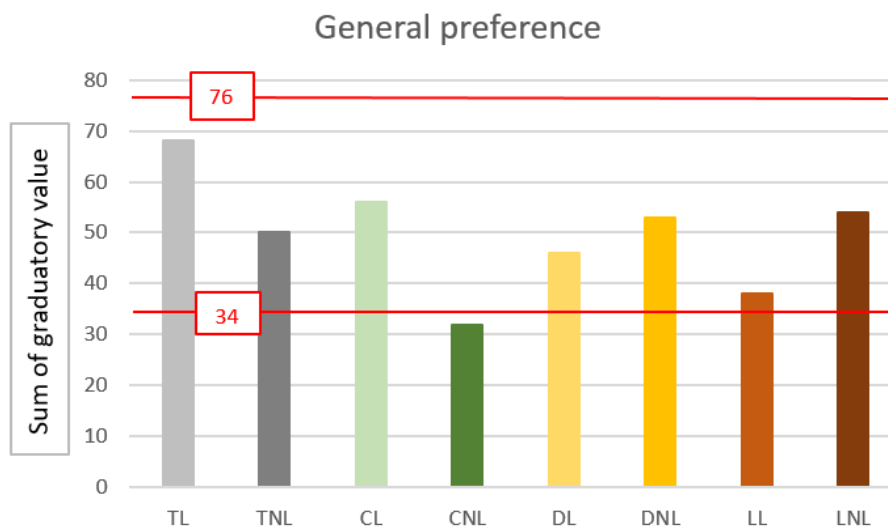


Graphich 1. Honey descriptor for Castello Bonomi Winery for 2019

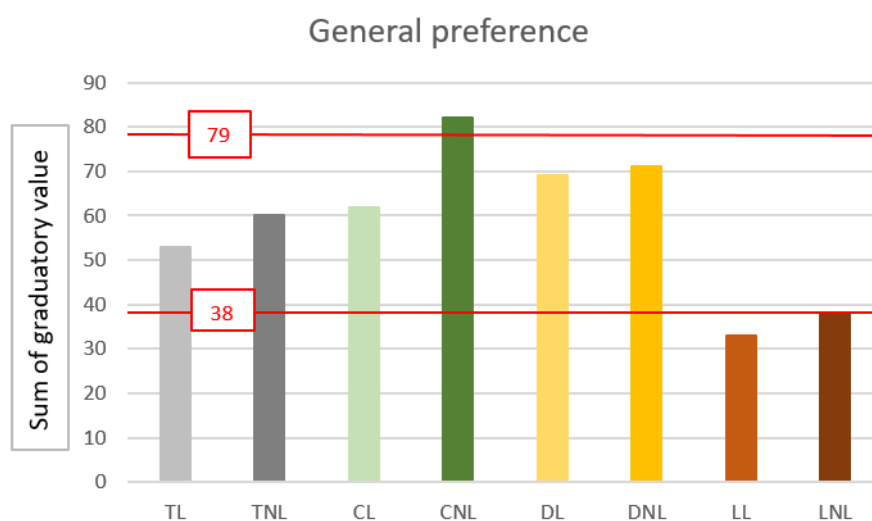


Graphich 2. Spicy descriptor for Conte degli Azzoni Winery for 2019

Evaluation on the general preference of the wines was also analyzed. All the results are reported in “Annex – Results of wine tasting” and some of them are reported in graphics 3 and 4.



Graphich 3. General preference of Castello Bonomi wines for 2019



Graphich 4. General preference of Conti degli Azzoni wines for 2019

It is not possible to define a very clear trend in the preference analysis but it is more related to the winery and to the year more than the different type of fertilizer; in graphic 3 and 4 for examples it seems to be more appreciated wines connected to manure fertilization, but this result is not always confirmed.

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Chemical analysis on wines

In the following table are reported the chemical analysis for each year:

year	treatment	total alcohol %	Total acidity (tartaric acid- g/l)	pH	Malic acid (g/l)	tartaric acid (g/l)	K (mg/l)	Color intensity (420+520+620)
2017	CL	11,79	7,17	3,2	2,47	3	775,8	9,29
	CNL	11,46	7,76	3,15	4,05	3,2	798,8	8,85
	DL	11,9	7,33	3,23	2,79	2,72	797,4	6,75
	DNL	11,78	7,55	3,2	3,91	2,98	809,6	9,26
	LL	11,95	7,41	3,21	3,72	2,92	799,6	9,69
	LNL	11,94	7,9	3,15	3,28	3	776,4	9,92
	TL	11,67	7,37	3,17	2,84	2,89	761,4	10,08
	TNL	11,43	7,47	3,15	4,06	2,98	755,6	10,98
2018	CL	12,53	5,98	3,37	1,66	2,46	982	11,35
	CNL	12,4	6,05	3,36	2,56	2,45	982	10,7
	DL	12,67	6,11	3,35	1,73	2,46	1002	9,54
	DNL	12,75	6,37	3,38	1,95	2,57	1080	11,29
	LL	12,45	6,14	3,37	2,83	2,5	996	10,44
	LNL	12,22	6,48	3,37	1,98	2,29	1040	9,5
	TL	12,2	6,32	3,33	2,36	2,57	984	9,97
	TNL	12,32	6,52	3,32	2,49	2,6	992	11,42
2019	CL	12,27	7,13	3,32	2,23	3,66	1192,5	12,87
	CNL	12,34	7,06	3,39	2,2	3,52	1166,67	10,8
	DL	12,16	7,31	3,32	2,19	3,73	1150	11,43
	DNL	12,42	7,49	3,36	2,41	3,65	1175	11,57
	LL	12,6	6,9	3,36	2,69	3,4	1159,75	12,06
	LNL	12,06	6,46	3,37	2,53	3,42	1175	12,84
	TL	12,32	7,18	3,33	2,83	3,56	1097,5	13,21
	TNL	12,34	7,53	3,32	3,12	3,75	1150	13,82



There is a trend in which thesis treated with organic fertilizers determined a higher total alcohol volume than the ones not treated, even if this difference is small especially for 2019.

Then there are differences if we consider the analysis for each winery (all the data are presented in "Annex – Wines chemical characterization").

With reference to Berlucchi winery, the main variations are related to the content of potassium, tartaric acid and the pH which in all the thesis analyzed is shown an increase in 2019 compared to 2017. We can find the same trend for Castello Bonomi winery and this can be due to the localization of this winery that is quite close to Berlucchi one, so they had similar weather conditions. In Castello Bonomi there is also a difference between thesis with incorporation of fertilizers and thesis treated with fertilizers but not incorporated. For Castelveccchi winery thesis treated with organic fertilizers seems to have a higher percentage of alcohol while for Conti degli Azzoni wines we find a higher color intensity for the ones where organic fertilization was used.

Analysis of polyphenols and volatile organic compounds (VOC) can be found in "Annex – Wines VOC analysis".

4. Conclusions

One of the main factors responsible for the qualitative of the wines is represented by the seasonal climatic trend, which can influence the evolution dynamics of the organic matrices within the soil and at the same time the vegetative-productive responses in the different phenological phases of the vine. The improvement of soil fertility determined by the use of organic matrices and the way which nutrients are available for the plant depending on the weather conditions have impacts on the final quality of wines.

The use of organic fertilization seems having positive reflections of different character of wines, from chemical analysis to sensorial analysis. The positive effects are often connected to other related parameters like the climate and the soil, so there is an object difficulty to determinate a specific trend related to the use of a specific organic fertilizer.

But what it is possible to say is that the use of organic fertilizer has for sure a better impact on the final production of wine, and these positive effects can be found both on chemical and on sensorial aspects.