SOIL DIAGNOSIS IN VINEYARDS IN SOUTH OF FRANCE EVOLUTION OF ORGANIC AND MICROBIAL MASS

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ABSTRACT

Since 1996, we study the soil in viticulture, especially in the South of France. In the field, we delimit soil units and observe soil profiles and take samples to analyse its physical, mineral, organic and microbial mass composition. We also analyse the rate of roots mycorhization.

We have adopted Xavier **SALDUCCI** (**CELESTA-LAB**) analysis menu: two compartments of organic matters, microbial mass and mineralization activities of carbon and nitrogen.

Here are shown the results of 100 organic and biological analyses done before conversion to "organic" farming:

- Carbon level is low to very low (less than 10 g /kg): 56% of the plots.
- Nitrogen level is low to very low (less than 1 g/kg): 64% of the plots.
- Microbial mass is low in 71% of the plots (less than 200 mg of microbial C /kg). No plot has a level higher than 400mg of microbial C /kg.
- Carbon Mineralization Activity is high to very high, more than 400mg mg $C\text{-}CO_2$ /kg/28 days, in 49% of the plots
- Nitrogen Mineralization Activity is low to very low (less than 1 mg de $N\text{-}NO_3^-$ $N\text{-}NH_4^+$ /kg/28 days): 53% of the plots.

We control, 5 years later, organic and biological evolution especially in plots where green manures and composted organic matters have been used.
In plots where the analysis showed a very high lake of organic matter and microbial mass, we noted that:

- The organic matter level has been partially improved, but the rate is still low, less than 10 g of Carbon/kg.
- The microbial mass has been really improved.

Even, if the levels of organic matter are still low, the improvement of microbial mass had a real effect on the plant: the vine is healthier, doesn't present any more nutrients deficiency symptom and its growth is more homogenous. The yield and the crop quality have increased, with a real expression of the "Terroir".

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INTRODUCTION

Since 1996, we study soils in agriculture and especially in vineyards in south of France.

Some farmers are yet certified in organic farming and others wants to change some of their technical methods in aim to improve wine quality and the expression of "Terroir".

In our approach we define the different type of soil of the farm and then we observe soil profile [1] holes and take soil samples in each layer.

We choose to analyse organic and microbial Mass [2] of the soil added to classical parameters (texture after destruction of limestone part, pH water and KCl, EEC Cobaltihexamine, etc.)

Our paper, present the results of 100 analyses realised in south no France. All the soils are rich with limestone (pH water > 7).

MATERIAL AND METHOD

All the organic and microbial mass analyses have been done with Celesta-Lab Laboratory (Mauguio- South of France), managed by X. SALDUCCI microbiologist. [3]

Soil has been taken in the topic part of the profile (0-30 cm). The analysis has been done on spring period.

- Measurement of total carbon (NF ISO 14235), g/kg
- Measurement of total nitrogen (NF ISO 13878), g/kg
- Microbial biomass : this is the quantity of microscopic organisms in soil, mainly fungi and bacteria (FD ISO 14240-2), mg/kg:
- Carbon Mineralization Activity expressed in mg C-CO2/kg/28 days.
- Nitrogen Mineralization Activity: expressed in mg N-mineral (NO3- et NH4+)/kg/28 days

RESULTS AND DISCUSSION

Here are shown the results of 100 organic and biological analyses done before conversion to "organic" farming:

- Carbon level is low to very low (less than 10 g /kg): 56% of the plots.
- Nitrogen level is low to very low (less than 1 g/kg): 64% of the plots.
- Microbial mass is low in 71% of the plots (less than 200 mg of microbial C /kg). No plot has a level higher than 400mg of microbial C /kg.
- Carbon Mineralization Activity is high to very high, more than 400mg mg C-CO_2 /kg/28 days, in 49% of the plots
- Nitrogen Mineralization Activity is low to very low (less than 1 mg de N-NO_3^- N-NH_4^+ /kg/28 days): 53% of the plots.

We control, 5 years later, organic and biological evolution especially in plots where green manures and composted organic matters have been used.

We have five plots which have been analysed in 2001 and controlled on 2006. Than we have eight others plots analysed in 2003 and controlled on 2008. Table 1 and table 2

Table 1: Organic matter and Microbial mass evolution from 2001 to 2006

	Organic Matter	**Organic Matter**	**Microbial Mass**	**Microbial Mass**
PLOT	**2001** **Total Carbon** g/kg of soil ***M.O. %***	**2006** **Total Carbon** g/kg of soil ***M.O. %***	**2001** **Microbial Mass** mg C/kg of soil ***BM/C* total %***	**2006** **Microbial Mass** ***BM/C total %***
1	1.74 g/kg ***0.3 %***	2.8 g/kg ***0.5 %*** Very low level No evolution	BM very low 9 mg C/kg *BM/C very low 0.5 %*	BM very low 51 mg C/kg *BM/C good level 1.8 %*
2	5.14 g/kg ***0.9 %***	7.9 g/kg ***1.4 %*** Medium Level Good evolution	BM very low 61 mg C/kg *BM/C good 1.2%*	BM good level for vine 173 mg C/kg *BM/C high 2.2 %*
3	5.3 g/kg ***0.9%***	6.95 g/kg ***1.2%*** Medium Level Good evolution	BM low 100 mg C/kg *BM/C good 1.8 %*	BM low 120 mg C/kg *BM/C correct 1.8%*
4	7.55 g/kg ***1.3 %***	8.4 g/kg ***1.5 %*** Medium Level No evolution	BM low 104 mg C/kg *BM/C 1.4 %*	BM low 154 C/kg *BM/C correct 1.8%*

BM/C is the microbial soil yield, the quantity of microbial mass produced by 100 Carbon.

Table 2: Organic matter and Microbial mass evolution from 2003 to 2008

	Organic	**Matter**	**Microbial**	**Mass**
Plot	**2003** **Total Carbon** g/kg of soil	**2008** **Total Carbon** g/kg of soil	**2003** **Microbial Mass** mg C/kg of soil	**2008** **Microbial Mass** g/kg of soil
5	9.4 g/kg	11.2 g/kg Medium Level Good evolution	187 mg/kg	357 mg/kg Good Level High evolution
6	9.1 g/kg	9 g/kg Low Level No evolution	142 mg/kg	177 mg/kg Low Level Slow evolution
7	7.7 g/kg	8.8 g/kg Low Level No evolution	104 mg/kg	210 mg/kg Medium Level Good evolution
8	7.2 g/kg	6.7 g/kg Low Level No evolution	128 mg/kg	162 mg/kg Low Level Good evolution
9	5.9 g/kg	7.4 g/kg Low Level slow evolution	119 mg/kg	182 mg/kg Low Level good evolution
10	9.1 g/kg	8.6 g/kg Low Level No evolution	222 mg/kg	167 mg/kg Low Level No evolution
11	6.8 g/kg	8.2 g/kg Low Level No evolution	155 mg/kg	169 mg/kg Low Level No evolution
12	9.5 g/kg	7.7 g/kg Low Level No evolution	169 mg/kg	232 mg/kg Medium Level Good evolution

Table 3: Nitrogen evolution from 2003 to 2008

	Nitrogen	**Nitrogen**
Plot	**2003** **Total Nitrogen** g/kg of soil	**2008** **Total Nitrogen** g/kg of soil
5	1.01 g/kg	1.038 g/kg Medium Level No evolution
6	1.09 g/kg	0.783 g/kg Low Level No evolution
7	0.97 g/kg	0.937 g/kg Low Level No evolution
8	0.85 g/kg	0.584 g/kg Low Level No evolution
9	0.72 g/kg	0.643 g/kg Low Level No evolution
10	1.1 g/kg	0.682 g/kg Low Level No evolution
11	0.9 g/kg	0.553 g/kg Low Level No evolution
12	1.09 g/kg	0.801 g/kg Low Level No evolution

CONCLUSION

We have a very slow improvement of organic matter level of soil 5 years later. The organic matter level has been partially improved, but the rate is still low, less than 10 g of Carbon/kg.

The nitrogen level decreased, the nitrogen level was low under 1g/kg. We think that nitrogen has been used by microbial mass for its own development.

The microbial mass has been really improved. Even if the level is still, in some cases lower than 200 mg Carbon per kg and if the levels of organic matter are still low to very low.

We observed that carbon mineralisation was high to very high regarding to nitrogen mineralisation which is low to very low.

Even, if the levels of organic matter are still low, the improvement of microbial mass had a real effect on the plant: the vine is healthier, doesn't present any more nutrients deficiency symptom and its growth is more homogenous. The yield and the crop quality have increased, with a real expression of the "Terroir".

Organic soil fertility can be improved but very slowly regarding to microbial Mass wich can be improved more quickly and easier.

Our experience in south of France, in very difficult soils, let us be optimistic that life goes always on. The period of convalescence can be short or very long depending of farmer chemical practices.

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