Assessment and restoring soil functionality in the degraded areas of organic vineyards. Preliminary results of the ReSolVe project in the Italian vineyards

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INTRODUCTION

Vineyards can have some areas with problems in vine health, grape production and quality, because of sub-optimal soil functionality, often caused by an improper land preparation before vine plantation. Different causes for soil malfunctioning can include: poor organic matter content and plant nutrient availability; imbalance of some element ratios (Ca/Mg, K/Mg, P/Fe, and Fe/Mn); pH; water deficiency; soil compaction and/or scarce oxygenation.

Aim of this preliminary study was to assess soil functionality and decide the kind and amount of specific restoration practices

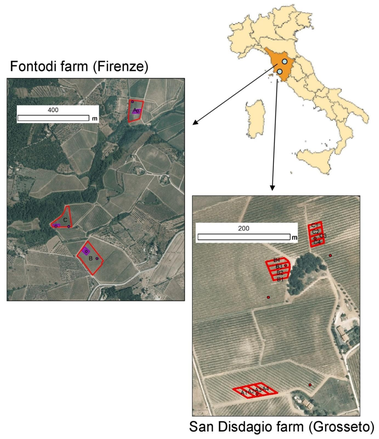
Deep soil preparation for vineyard

Degraded area within a vineyard

Exposed vine roots because of topsoil erosion

ASSESSMENT OF SOIL FUNCTIONALITY IN DEGRADED AREAS

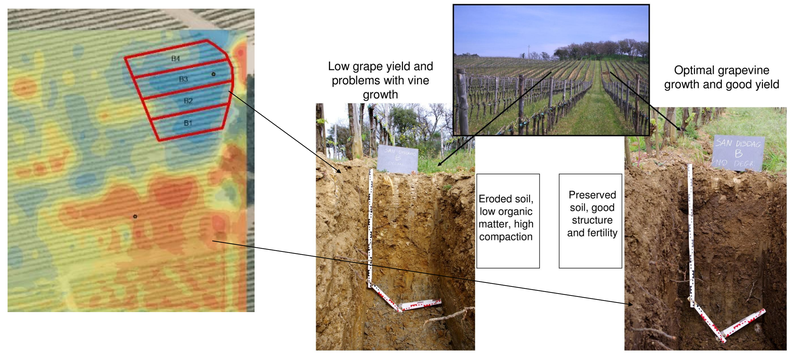
The two Italian experimental farms are located in: Fontodi (Panzano in Chianti, FI) biological farm for more than 10 years and San Disdagio (Civitella M.ma, GR) farm in biological conversion.



Nematods

	Abundance	Taxa richness	Trophic groups					Nematode indicators	
			Bact.	Fung.	Omni.	Pred.	Pl. Par.	MI	PPI
Fontodi									
Degraded	307.2±86.7	4.8±0.3	50.9±3.01	0.03±0.03	10.3±1.2	1.4±0.7	37.5±3.8	1.6±0.1	2.8±0.1
Non-degraded	416.0±16.8	5.3±0.3	40.1±2.3	0	12.3±1.9	0.1±0.1	47.6±0.44	1.7±0.1	2.7±0.2
San Disdagio									
Degraded	102.3±35.8**b**	4.0±0.4	56.6±4.7	0	8.8±1.4	0	34.7±4.0	1.4±0.1	2.5±0.3
Non-degraded	827±134.4 **a**	4.3±0.3	47.3±1.8	3.8±3.8	11.8±5.7	0	37.1±11.1	1.6±0.2	2.8±0.1

Soil degradation effect on total abundance, taxa richness (standard error), nematode indicators and rellative abundance of trophic groups extracted by 100 ml soil.Levels of significance are indicated by letters a, b for P<0.05. Bact., bacterial feeders; Fung., fungal feeders; Omni., omnivores; Pred., predators; MI, maturity index; PPI, plant parasitic index.

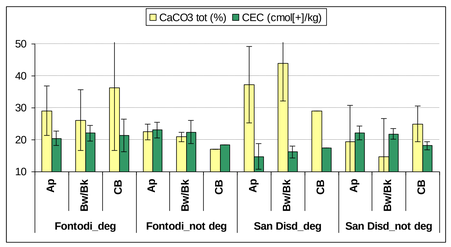


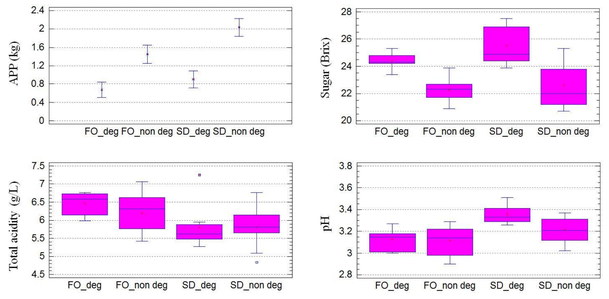
San Disdagio farm, plot individuated by the map of gamma-ray total count (TC), measured by gamma-ray spectroscopy.

Soil chemistry and biochemistry, and grape yield

FONTODI	TOC (g kg^{-1})	TN (g kg^{-1})	Cellulase	Acid phosphatase	ß-glucosidase	Arylsulphatase
0-10 cm						
Degr.	10.6 (a)	1.7 (a)	25.9 (a)	146.2 (a)	231.9 (a)	40.5 (a)
Not degr.	9.6 (a)	1.6 (a)	26.0 (a)	147.5 (a)	257.4 (a)	42.5 (a)
10-30 cm						
Degr.	7.2 (a)	1.5 (a)	15.2 (a)	112.8 (a)	127.0 (a)	28.6 (a)
Not degr.	7.4 (a)	1.4 (a)	15.9 (a)	119.7 (a)	110.6 (a)	32.3 (a)

SAN DISDAGIO	TOC (g kg^{-1})	TN (g kg^{-1})	Cellulase	Acid phosphatase	ß-glucosidase	Arylsulphatase
0-10 cm						
Degr.	***5.6 (a)***	***1.0 (a)***	***11.4 (a)***	***124.6 (a)***	***94.7 (a)***	***16.3 (a)***
Not degr.	***11.1 (b)***	***1.5 (b)***	***26.5 (b)***	***174.6 (b)***	***214.4 (b)***	***33.9 (b)***
10-30 cm						
Degr.	***4.5 (a)***	***0.9 (a)***	***7.8 (a)***	123.5 (ab)	***62.2 (a)***	***15.9 (a)***
Not degr.	***9.9 (b)***	***1.4 (b)***	***17.3 (b)***	167.6 (ab)	***140.5 (b)***	***31.9 (b)***



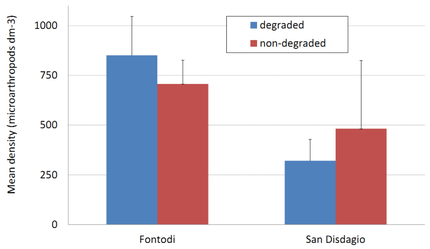


In the degraded areas, grape production (APP) never reached 1 kg per plant. The reduced productivity caused an excessive accumulation of sugars (> 25° brix). Acidity was similar instead.

"Degraded area"

"Non degraded area"

Microarthropods



CONCLUSIONS and TAKE HOME MESSAGE

Degraded and non-degraded surface soil characteristics differed more at San Disdagio (one year of organic management) than at Fontodi (ten years of organic management).

Nevertheless, plant production was significantly lower in the degraded areas of both farms, as conventional organic farming was not able to recover optimal functionalities of the subsoils.

Specific and intensive organic treatments were needed, that is:

Specific organic treatments to restore soil funtionality

Farm Compost (3 kg/m^2 dry matter)

Sowing barley+ faba bean in fall (8g+8g/m^2) and incorporating in late spring

Sowing squarrose clover in fall (4g/m^2) as cover crop and dry mulching

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