



GEORGOFILI WORLD

Newsletter of the Georgofili Accademy

HOW TO RESTORE SOIL FUNCTIONALITY IN DEGRADED AREAS OF VINEYARDS

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June 16 2016



The preparation stages of a vineyard, like many other multi-annual crops (orchards, olive groves, forestry) often have a large impact on the soil, as they can create excessive leveling, plowing and plowing too deep, excessive crushed bedrock, the disproportionate application of background fertilizers and earth fills. The same manipulation of the natural contours of

the land, such as the mixing of horizons, truncation and burial, can disturb the existing natural chemical, physical, biological and hydrological balances. The most common problems arising from these interventions are a reduction of organic substances, the enrichment of calcium carbonate and soluble salts on the surface up to levels too high for the grapevines, a reduction of water retention capacity and consequent increased summer water stress, a decrease in water permeability and circulation of oxygen in the soil, an increased water runoff, surface erosion and landslide risk, the reduction of biodiversity and the limitation of biochemical processes (organic matter mineralization, bioavailability of nutrients, etc.).

The functionality of the soil can degrade even after the planting phases, as a result of accelerated erosion, compressing by agricultural vehicles, excessive loss of organic matter and nutrients, and the accumulation of heavy metals such as copper. In both conventional and organic vineyards, it is quite common to have areas characterized by problems in vine health, grape production and quality, that show a bad soil functioning. Causes for soil malfunctioning can be manifold and they sometimes interact such as, for example, the low biological activity and the scarce availability and decomposition of the organic matter with the resulting reduced amount of nutrients that plants can use.

If one can try to remedy production dysfunctions through chemical fertilizer in traditionally managed vineyards, the problem of restoring the productive function in organic viticulture is certainly more difficult to solve. The EU Organic Farming Regulations (834/2007 and 889/2008) provide general considerations on the maintenance of soil fertility and biodiversity, but do not include guidelines on the preparation of soil for planting of perennial crops and the maintenance of its functionality.

The recovery of optimal production and ecosystem functionality of degraded vineyards is the object of the research project of ReSolVe- Restoring optimal Soil functionality in degraded areas Within organic Vineyards, funded for the years 2015-2018 by the European Fund FP7 ERA-net Project, CORE Organic Plus. In particular, the project aims to answer the question: "can the soils of degraded areas within a vineyard recover their optimal functionality for the cultivation of grapevines through biological soil management techniques?"

In the ReSolVe project the effects of biological soil management strategies specifically selected to restore the optimal function of the soil are monitored in degraded areas within vineyards in some European countries. The project aims to identify the most common causes linked to this loss of soil functions in vineyards and experiment with different recovery strategies such as adding compost, adoption of green manure with different species, cover crops and dry mulching.

The effects of different strategies will be evaluated for the following expected results: i) increase in organic matter, improved soil structure and nutrient availability, both in surface and subsurface soil horizons; ii) increase in microbial biodiversity and microfauna of the soil, with particular attention to antagonistic species of root diseases; iii) increase of root development of the grapevines and the mycorrhization level; iv) reduction of copper toxicity risk for plants and microorganisms; v) improving the efficiency of the grapevines in terms of production, quality and stability during different years; and vi) decrease in root disease. Italy is participating in the project through the Council for Research in Agriculture and Analysis of the Agrarian Economy (CREA) with 3 partners: i) CREA-ABP (Agrobiology and Soil Science Research Centre, Florence) which coordinates and has expertise in soil science, detection and monitoring of soil characteristics (organic matter, nutrients, hydrology, enzymatic activity), soil microbiology, soil arthropods and nematodes; ii) CREA-VIC

(Viticulture Research Unit, Arezzo) which has expertise in monitoring grapevine physiology and wine production; iii) CREA-ENO (Oenology Research Unit, Asti) which has expertise in study wine quality and isotopic analysis (DC13) of wines for monitoring water stress suffered by grapevines. Bordeaux Sciences Agro is participating for France. It is both a national school for agronomy and a research institute. The department involved in the project is Science et Gestion du Végétal, centered on the study of agro-environmental ecosystems. A university spin-off of technology and innovation transfer dedicated to viticulture (Vitinnov Bordeaux) is also participating. The University of La Rioja in Logroño represents Spain. This is Spain's largest university center dealing with viticulture and oenology. The research group Televitis, expert in precision viticulture, sensors, monitoring grapevine physiology, and the winemaking production is involved in this project. Turkey is represented by the Faculty of Agriculture, University of Cukurova, Adana, with research groups from the Department of Horticulture, soil science and irrigation, together with the Alata horticulture research station, which is a research station supervised by the Turkish Ministry of Agriculture. The center's research topics are grapevine genetic selection, performance of new varieties of table grapes, and defense against pathogens. Slovenia is represented by the Agricultural Institute of Slovenia in Ljubljana, a public body that is involved in research, consultancy, innovation transfer and verification of product quality. Its research team deals with microbiological studies (fungi and bacteria), grapevine pathogens, and biological control agents. Finally, Sweden's University of Agricultural Sciences in Uppsala is also a project partner. It is the only Swedish state university involved in agriculture, forestry and food industry. Its research team for the project is specialized in the microbiological study of soil and pathogens in the root systems.

More information is available on
<http://www.resolve-organic.eu/>