Application protocol on productive vineyard

Protocollo di applicazione di Zeowine su impianto in produzione

Deliverable Action B3

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A fertilization programme is generally included in viticulture to ensure a desirable health and growth of vine plants. Many variables like climate, soil pH, texture etc. interfere with the availability of nutrients absorbed from the soil, so that controlled release fertilizers are commonly used for vine plants.

These guidelines provide indications on how to use the ZEOWINE compost produced from winery wastes and zeolite as an amendment in productive vineyard soils.

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Summary

1 Introduction

Due to the increasing pressure imposed to agricultural soils and to their consequent reduction in fertility, the development of management strategies able to increase the productivity and quality of soils has become a common priority.
In particular, Mediterranean vineyards are exposed to severe risk of soil quality decline due to erosion, loss of organic matter, contamination and compaction. In intensive viticulture, the continuous working practices using heavy machinery and inappropriate tillage, for eliminating competition between vines and other plants for water and nutrients, are responsible for increasing soil erosion rates, and CO_2 emissions.
LIFE ZEOWINE is a demonstration project which aims to improve the protection and management of the soil, the well-being of the vine and the quality of grapes and wine, thorough the soil application of ZEOWINE compost, an innovative product deriving from the composting of wastes from the wine production chain and zeolite.
Starting from the results of previous experimentations, which aimed at evaluating the effectiveness of the application of zeolite and compost in a separate way in other productive chains, we proceed with the intention of applying, for the first time, either in a **new vineyard plant** and in **productive vineyards**, the ZEOWINE product, with effect in terms of performance in soil management and in soil and plant biodiversity.
The synergy of the positive effects of ZEOWINE on the soil and on the plant is demonstrated by the improvement of nutrients and water efficiency, the reduction of the need for fertilizer supply, the closure of the production cycle of the waste material from the supply chain and the improvement of the quality of the wines produced.

2 ZEOWINE demonstration trials

The following demonstration sites were selected for the experimentation in the San Miniato area (Pisa, Tuscany) in Central Italy.

The climate is typically Mediterranean, semiarid, with a mean annual precipitation of 859 mm and a mean annual temperature of 14.3°C.
Soil classification was Calcixerept (Soil Survey Staff, 2014) with a sandy clay loam texture (51.1% sand, 28.3% clay and 20.6% silt) (USDA classification), an organic matter (OM) content of 1.8% (±0.2), a high level of carbonate (bivalve shells were very common) and a slightly alkaline pH.

2.1 Productive vineyard

In the productive vineyard, **Sangiovese cultivar**, the vine spacing was 2.5 m between rows x 0.8 m between plants.

In this site the following treatments (**in triplicate**) have been applied:

- ✓ **Organic matter** (compost) (20 t/ha)
- ✓ **Zeolite** (10 t/ha)
- ✓ **ZEOWINE** (30t/ha)
- ✓ **Control soil** (untreated)
- ✓

The vineyard was divided into three plots (0.45 ha), where compost, zeowine and zeolite were applied, respectively, and mixed by plowing to a depth of 30 cm. So as to isolate soil variability, in each plot three sub-plots (0.15 ha, 40 m x40 m) were chosen and judged to be independent true replicates.

2.2 Selection of the ideal granulometry of the zeolite

Composting is represented by aerobic processes that lead to the decomposition of the organic substance and is particularly favored by conditions such as high humidity (50%) and an optimal circulation of water and nutrients in its structure.

From these considerations it was found that the company chose to use a larger grain size (1-2.5 mm) than the one initially envisaged by the project (0.2-1.0 mm). The particle size is in fact of fundamental importance to be able to expose the greatest possible specific surface to the contact with the matrix to compost without however representing an obstacle to the circulation of oxygen, water and nutrients. The granulometric fraction is thus the ideal size for the composting process and for subsequent soil conditioning.

2.3 Mixing zeolites with the wastes from the wine production chain

Two different rates of zeolite (10% and 30%) in zeowine preparation were carried out in order to identify the most suitable practical application for improving the winery wastes composting process and, at the same time, for saving on the cost of providing zeolite.

Three different composting piles were set up by mixing (w:w of fresh weight): 1) 0% of zeolite and 100% of organic residues (control pile); 2) 10% of zeolite and 90% of organic residues; c) 30% of zeolite and 70% of organic residues. Each pile was about 10 m3, with a form of a truncated pyramid (base length 3 m, height 2.5 m, top length 1 m).

The composting processes were performed in a completely randomized factorial design. Periodical turning of each pile in order to increase the oxygen supply to microorganisms, homogenize the materials and redistribute microorganisms, moisture and nutrients, was carried out at least twice a month, until the end of the composting process. Since microbial activity generates heat and evaporates water, the optimal moisture level of about 40 % was maintained by sprinklers on top of each pile. Temperature and humidity were monitored every two days until the end of the composting process. A cover system of each pile was predisposed. The composting was carried until mature composts were obtained (about 150 days).

3 ZEOWINE distribution

For the ZEOWINE distribution, spandicompost or self-filling machineries are preferable; this to ensure the simple and uniform spreading of ZEOWINE over the entire soil surface. The ZEOWINE can be easily distributed also by traditional manure spreader, adopting, if necessary, simple tricks which take into account the humidity and the size of ZEOWINE.

In all cases (**new vineyard plants** and **productive vineyards**) the ZEOWINE must be buried by means of mechanical plowing (digging, milling or hoeing).

4 ZEOWINE application rates

ZEOWINE should be considered a slow-release source of nutrients. ZEOWINE was applied at rates high enough to meet immediate vine nutrient requirements without determining an excess of nutrient availability for plants.

The amount of ZEOWINE to apply was calculated from the recommended rate of the priority nutrient and the plant-available nutrient content of the ZEOWINE. ZEOWINE application rates are based on available nutrients rather than the total nutrients.

Decisive for the amount of ZEOWINE to be apply is the warrantee of a balanced nutrient content. According to the rules of “good codes of practice” the optimal ZEOWINE dose, whereby positive balances of phosphor and potassium rarely arise, lies around 30 t/ha.

In case of unfavorable soil conditions, such as structural problems, higher ZEOWINE rates up to the upper level of 30 t/ha are allowed, in exceptional cases even higher, sometimes reasonable to achieve an efficient and quick soil improvement.

The following application periods and technical advices for the ZEOWINE application proved to be successful in practice. Basically, ZEOWINE should be spread before the start of the plant growth period. Hereby decisive is the good workability of the arable land, in order to avoid soil compaction through unfavorable conditions (e.g. wet soils). A convenient application time suitable for vineyards is between November and March.

Among the technical advices for ZEOWINE application the spreading intervals are the key aspect. The application of up to 30 t/ha in 8-years will be the usual case in vineyard soils on account of costs and spreading technique reasons because it guarantees low costs and less traffic on arable land.