

Earthworms and wine: circular economy in the wineries

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This presentation provides an overview of the potential of earthworms and vermicomposting for circular economy and sustainable agriculture through the development of an integrated cycle that allows convert “in situ” the waste generated in the wine industry in high quality vermicompost with beneficial biofertilizer and plant-defence properties. Grape is the largest fruit crop worldwide and most grapes harvested worldwide are used to make wine. Winemaking generates annually millions of tons of grape marc as a leftover by-product. Grape marc or bagasse consists of the skin, pulp, and seeds that remain after pressing the grapes. It is a valuable resource to produce ethanol, grape seed oil, bioactive compounds (mainly polyphenols) and animal feed. It can also be used as a nutrient-rich organic soil amendment, however, if applied directly to soils (without treatment), it can damage crops due to the presence of phytotoxic polyphenols. On the other hand, vineyards are usually managed intensively to maximize wine production, and this intensification reduces soil biodiversity, decreases soil fertility and cause environmental problems such as changes in primary production and nutrient cycling, reduction of aboveground biodiversity, high soil erosion rates, eutrophication and contamination of groundwater and global warming. I will present the results of a case study in which grape marc derived from white and red wine were processed on a pilot-scale vermireactor to yield a high quality organic, polyphenol-free fertilizer, as well as grape seeds. Vermicomposting reduced substantially the biomass of grape marc and the process yielded a nutrient-rich, microbiologically active and stabilized peat-like material that can be easily separated from the seeds by sieving. The separation and removal of the seeds eliminates the residual polyphenol-associated phytotoxicity in the vermicompost. The seeds can be easily processed to obtain polyphenol-rich extracts and fatty acid-rich seed oil. Moreover, the vermicomposting process produced large numbers of earthworms that can be processed as fish bait, and as a source of animal feed protein. The vermicompost derived from the different wine varieties was applied in different formulations (solid and liquid) to the grapevines in the same vineyards where the grapes were harvested to make wine and the grape marc obtained. The effects of the vermicompost in the vineyard soil and in the grapevines were studied during several crop seasons in vineyards belonging to two biogeoclimatic areas and two different denominations of origin. In the wineries in whose vineyards the experiments were conducted, wine was made from grapes fertilized with grape marc derived vermicompost. The wine was compared with the standard wine (not fertilized with vermicompost) produced in the wineries. In another application or ecological service, grape marc-derived vermicompost can be used as a rich-source of enzymes to improve soil biochemical performance and to detoxify pesticide-contaminated soils. The results of these investigations provide an important advance in the knowledge of the interactions between earthworms and microorganisms during the decomposition processes and they will be fundamental for the elaboration of biofertilizers and bioplaguicides derived from organic wastes and by-products of the wine industry. They also address other important issues, not only from the point of view of the biotreatment of organic residues, but also for soil ecology, agroecology and microbial ecology.

Keywords: wine and winery by-products; vermicomposting; earthworms; vermicompost; polyphenols; grapevine; vineyards; sustainable agriculture; circular economy.

EWINE

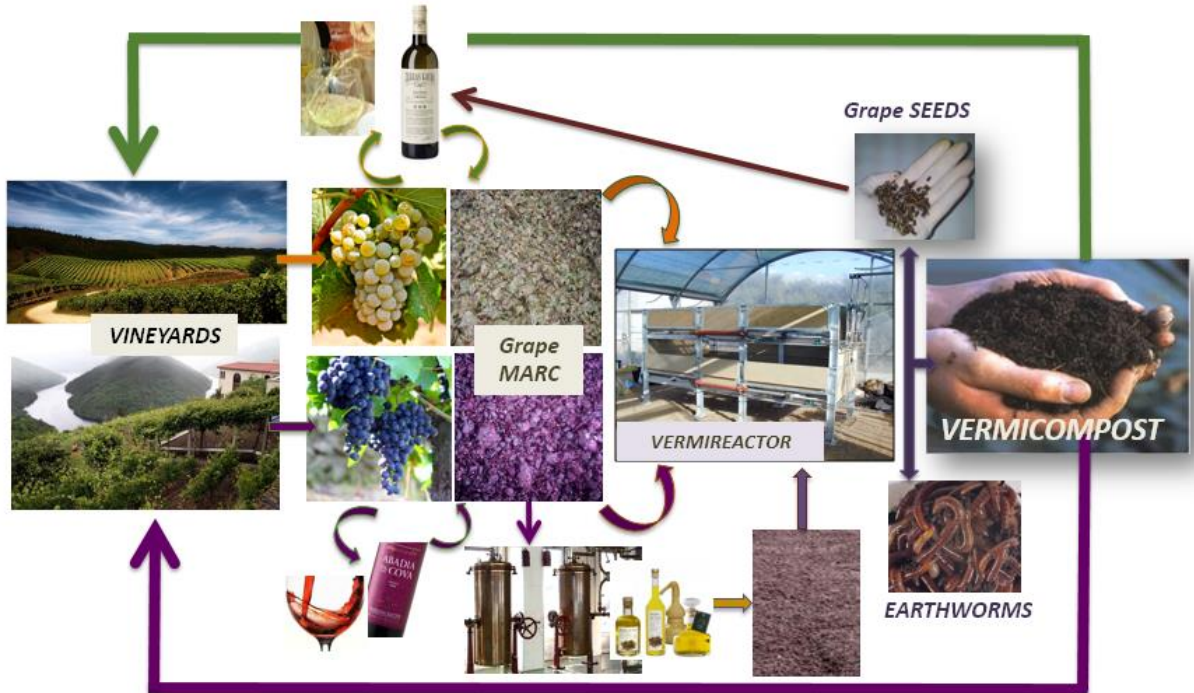


Figure 1. Summary of an ongoing project called “EWINE”, started 8 years ago, and grown up to close a cycle that allows to convert different types of grape into vermicompost and to apply those vermicomposts to the vineyards as biostimulants for the grapevines, finally rendering more natural wines.