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Interactive comment on "Short term recovery of soil physical, chemical, micro- and mesobiological functions in a new vineyard under organic farming" *by* E. A. C. Costantini et al.

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Dear Referee, thank you for comments. Our response was also posted as supplement pdf document.

Kind regards

The authors

Comment N. 1

The Referee: Confusion stands in the introduction because many concept are cited

without choosing one. Soil quality and soil health are synonymously used but are not equal concept. Soil quality is still a debate but most studies refer to two different soil qualities as inherent and dynamic. The latter referring to dynamic properties influenced by crop management. The extent of measurable variations of each dynamic indicator depends of inherent soil properties. In the present study, soil are calcareous, therefore some dynamic indicators are more relevant than those used by authors (see Salomé et al. 2014 Ecological Indicators). For example, I do not understand why total CaCO3 content is used as a dynamic indicator, because even if pH difference is significant, I don't think that a difference of 0.1-0.2 pH unit have an ecological relevance. Beyond this particular example, the selection of the different indicators should have been better justified to soil functions but also for the short term issues. Indeed, in Coll et al (2012, Applied Soil Ecology) used different indicators, and some have a delayed response after conversion while others are more sensitive to conversion.

The authors: rejected It's quite difficult to understand and reply to this comment, it being rather generic and lacking any specific reference, especially in the first part. For clarity, we splitted our response into two parts:

- Soil quality, health and resilience We would like to clarify that we never used the term "health" as a synonym of "quality" in our manuscript, nor did we confuse among soil health, quality and resilience. The only case in which we used the term "soil health" was in the introduction (page 4, line 16), just to emphasize the integration of biological with chemical and physical features of the soil. The concept of resilience is the heart of our work; in Ecology it is defined as "the ability of a system to recover after disturbance". So, why should our work not be regarded as a study on the resilience? We monitored comparatively a number of soil properties in a new vineyard, established after strongly impacting earthworks, and a 14 year older vineyard, on the same soil type and under the same environmental conditions. In our objective, results and discussion we always referred to changes in soil quality over time and our evaluation was based on soil chemical, physical and biological properties (microrganisms and microarthropods).

- Soil inherent and dynamics indicators As stated before, our work was aimed at assessing the impact of pre-planting earthworks on soil properties in a new vineyard and monitoring their changes over time, in order to evaluate the dynamics and the rate of a possible recovery of soil functions. Here we are presenting the results from the first five years of investigation. The monitoring concerned a range of soil parameters, some of which can be, in general, regarded as relatively static (including texture and lime) and some as relatively dynamic (soil OC, N, C/N, biological activity and diversity), all of them contributing to define the capacity of a soil to function in a given ecosystem. However, even relatively static properties, such as texture and lime, can change rapidly in response to strong soil disturbance events (e.g. earthworks, slope reshaping, erosion). This actually occurred in the new vineyard for CaCO3 and soil texture, as a consequence of the overturning of soil layers caused by pre-planting earthworks. In particular, the topsoil experienced a remarkable increase of the lime content (by 70% as total CaCO3 and 67% as active CaCO3), along with an increase of the silt fraction. We did not choose lime as dynamic indicators, but in our opinion it was a very important parameter to consider, being a dominant feature of the lythotype composition of the experimental site and one of the most influential factor on soil chemistry (soil reaction, nutrient dynamics). Of course, we didn't expect to see a full recovery of the CaCO3 original status in a few years, and we can reasonably state that the time for this to occur is impossible to foresee, the process being controlled by a range of interacting pedological and environmental factors. However, our results demonstrate that soil CaCO3 content can undergo significant changes even within a short time span; in fact, a decrease in the CaCO3 level occurred over the last three experimental years, possibly due to leaching processes enhanced by the above-average rainfalls during that period. This decrease affected both vineyards, since they have been under the same climatic influence. That said, our selection of soil properties was not confined to soil CaCO3 or other relatively static soil features for the evaluation of soil quality. As above mentioned and clearly described in the article, a number of proper dynamic indicators were selected to monitor soil quality over time, including chemical (soil OC,

N, C/N ratio) and biological properties (microbial activity and diversity, microarthropod abundance and biological quality index), which are widely recognized to be valuable and very sensitive to soil management.

Comment N. 2

- The Referee: The experimental design is difficult to understand. I don't understand why authors compared "old" and "new" vineyards because the two vineyards does not have same land use before plantation. More, the "new" and "old" vineyards have different soil and weed management which can drastically influenced the responses of indicators independently of compost application. I don't agree the pooling of grass covered and tilled inter row data because authors did not present their values nor the indicators. It is quite surprising that the grass cover has not influenced biological activities of soils. Authors claimed that organic practices have been used; by only compost application is succinctly described. I would expect copper application rates and a better description of practices to evaluate the traffic in the vineyards. In most studies, the organic C mineralization is estimated on larger time span, at least 3 days and if possible over 28 days. In the present study, mineralization is only measured during 1 day, but mineralization fluxes can occurred immediately after soil re humectation and does not reflect the real mineralization.

- The Authors: rejected The experimental design, indeed, is quite simple. Our survey was carried out within a region which has been under vine-growing for centuries. According to the ordinary management, the vineyards are periodically uprooted and re-planted, with a rest period between the old and the new vineyard. Soil and plant management practices have always been the same over time and the whole experimental area is on the same soil type and under the same climatic influence.

During the first years after planting, the whole vineyard is kept free from weeds by tillage, in order to limit root competition for water and nutrients between the young vines and the naturally-developing grass, thus reducing the risk of water and nutritional

stress in grapevine. An additional aim for us was just to ascertain whether this could have a significant influence on the selected soil indicators.

We opted to pool the tillage and the grass-cover data together due to the lack of significant effects of the natural grass on the considered soil properties. This result was not so surprising to us, because all samplings have been carried out before the first grass mowing. In this regards, it must be considered that, during the time span from autumn to the beginning of spring, natural weed rapidly develops all over the vineyard floor; furthermore, tillage creates a kind of seed bed that may even enhance germination of naturally-spreading weed seeds. Of course, soil biological activity tends to follow mostly the production of fresh organic materials from residues, since a real organic matter accumulation is quite limited.

The vine disease control is actually based on copper treatments, but this aspect was not studied. Anyway, no particular fungal or pest desease was recorded over the considered experimental period. Obviously, within the new vineyard, there has been comparatively less machine traffic, because of a lower need for plant management and protection treatments, due to the overall lower plant development and missing or poor grape yields. Despite that, possible traffic-related differences between the two vineyards are supposed to be negligible, since soil mechanical stress in the old vineyard is reduced by the grass cover (as well known, this is one of the main benefits which the grass covering is direct to).

We agree with the referee's comment about the 1-day C mineralization procedure. However, a number of experimental evidences demonstrate that the results from this procedure, despite being less reliable in representing the real soil respiration than those from long-term methods, are closely related to both soil microbial biomass and the presence of labile substrates (Anderson and Domsch, 1978), and can thus provide consistent information on soil biological reactivity. We would like to point out that we also measured the 28-day C mineralization (we can present the data if required), but in our opinion it relates better to the basal metabolism and the organic matter availability,

while the short term mineralization is more effective in highlighting the soil resilience potential, fitting better to the purposes of our study.

Please also note the supplement to this comment:
http://www.soil-discuss.net/1/C774/2015/soild-1-C774-2015-supplement.pdf

Interactive comment on SOIL Discuss., 1, 1165, 2014.