Answer to referee 1.

We thank this referee for his positive comments. His remarks on the paper were quite relevant and helped us to improve the clarity and scope of the text.

1. **Line 91:** We have added two references to proximal sensing. There are many but this one is particularly interesting as it relates to an East European joint study with US colleagues and considers soils in a landscape context.

2. **Lines 112** and following: We have modified the text to show that our method to measure soil health is universal and applies to any soil at any time at any place. The referee is correct in stating that the Cornell protocol stratifies measurements by three texture classes and- important!- has separate frequency curves for the indicators for each class. We prefer a universal test for all soils resulting into comparable values rather than separate procedures for different texture classes. and we now state so clearly. We also feel that just distinguishing three texture classes does no justice to soil expertise that is available because there are major differences in soil behavior within each of these three very broad texture classes and that's why we present results for Italian soil series that provide much more info than just a texture class. We added a recent reference of Bouma (2020) that discusses use of soil data in models for those that want to read more about this. Next, we define soil quality in three ways for a given soil type, indicating the inherent character of the soil quality concept, showing a characteristic range of values for a given soil type, for different soils within regions and in the world at large, allowing comparisons among soils

3. **Line 114 plus**: We have explained the phenoforms in some more detail now. To establish a value for SH and SQ based on so-called and undefined "representative profiles" of soil survey interpretations is not as good as distinguishing several phenoforms of that particular soil that reflect effects of management because soil management can have significant effects on soil behavior while the name for the soil (the genoform) stays the same! Effects of management, as expressed by the phenoforms, strongly affect soil quality and cannot be ignored. The latter is important in our view and is now more clearly emphasized. This is illustrated in the presented figures of the Italian soil series. Of course, the examples are hypothetical and should in future be based on field research along the lines as presented by Sonneveld et al and Pulleman et al.

4. **Line 194**: equation (1) is OK. Soils with lower SH have lower Yw-phenoform/ Yw-ref. ratios, because soil degradation lowers Yw. Healthy soils have higher values. This corresponds with the tables.

5. A sentence is added mentioning the fact that soil production is directly related to economic aspects and a reference has been added. Also, we mention that once it has been shown that Yw is higher than Ya (the real yield) an analysis is needed to find out why this is the case and how management can be devised to overcome problems. A discussion of this is, however, beyond the scope of this paper as we mention in the revised text.

6. Suggestions for changes in punctuation have been followed. Thanks.

Answer to referee 2

We appreciate the positive comments of the reviewer on our paper. Her/His specific comments were relevant and quite helpful and have been adopted in the revised manuscript. Her/His question as to why Yw of soil P6 (a loamy sand) is higher than the other two soils (sandy loams) can be explained by the following:

- "Plant available water", defined as the water content between two pressure heads, does not represent the volume of water that is available for plants in a given growing season, as explained in the quoted letter to the editor in the Eur. J. of Soil Science by Bouma (2018) and thoroughly in this manuscript. Here, we use a dynamic sink term to express water uptake by roots resulting in varying water extraction as a function of the water content. These processes are highly non-linear, strongly depending on the shapes of the moisture retention and hydraulic conductivity curves.
- Furthermore, soil hydraulic properties – strongly dependent by the soil structure and only partially by the soil texture – cannot be tightly related to the latter. In fact, even the widely applied pedo-transfer-functions (PTF) are not able to fully capture the intrinsic complexity of soil hydraulic properties, showing sometimes a weak correlation between measured and estimated parameters (r=0.3 – 0.5).
- For these reasons we performed the soil water balance simulations by applying measured hydraulic properties and not estimated ones. This approach is even more important for our case studies because some of our soils (e.g. P6) show distinct hydraulic properties (Basile et al., 2007) due to the presence of short-range ordered clay minerals (e.g. allophane). Moreover, these soils are rather difficult to disperse due to their high variable charges (Mizota & van Reeuwijk, 1989), making textural analysis rather uncertain.
- Finally, field experience in the area (Agro Nocerino-Sarnese plain, south of Vesuvius volcano) where this soil occurs indicates relatively accessible water, leading to high productions when, of course, other agronomic factors are optimal.

Specific comments:

l. 377: remove period between quality and concepts: *Done*

l. 378-379: I suggest changing the phrase: "...that is determined by many other factors disciplines than soil." to "...that is determined by many factors other than the soil (i.e., insect invasions, plant disease, other factors).".

The sentence has been improved has requested by the reviewer

l. 384-386. I suggest rewriting this point as: Effects of climate change for the Italian soils being considered showed such a significant and large reduction of Yw for all degraded and non-degraded scenarios considered that agriculture may not be economically viable by the end of the 21st century if irrigation is not feasible.

The sentence has been improved has following:

Old sentence "Effects of climate change on Yw were significant for the Italian soils being considered with projected reductions in productivity, also for non-degraded soils including soils with higher organic matter contents that may not allow economically viable forms of agriculture by the end of the 21thcentury if irrigation is not feasible.".

New sentence (lines 403-405 new manuscript) "Effects of climate change for the Italian soils being considered showed such a significant and large reduction of Yw for all degraded and non-degraded scenarios, that agriculture may not be economically viable by the end of the 21st century if irrigation is not feasible."

l. 386: 21st century, rather than 21thcentury: *Changed*

l. 391-393: Point 7 is identical to point 5. One of these two points should be deleted.: *The sentence at point 7 has been deleted.*

l. 398: dr. should be capitalized to Dr.

Bouma, J.: Comment on: B. Minasny & A.B. Mc Bratney. 2018. Limited effect of organic matter on soil available water capacity, Eur. J. Soil Sci., 69(1), 154–154, doi:10.1111/ejss.12509, 2018.

Basile, A., Coppola, A., De Mascellis, R., Mele, G., & Terribile, F. (2007). A comparative analysis of the pore system in volcanic soils by means of water-retention measurements and image analysis. In Ó. Arnalds, H. Óskarsson, F. Bartoli, P. Buurman, G. Stoops, & E. García-Rodeja (Eds.), Soils of volcanic regions in Europe (pp. 493–513). Berlin, Heidelberg: Springer.

Mizota, C., & van Reeuwijk, L. P. (1989). Clay mineralogy and chemistry of soils formed in volcanic material in diverse climatic regions. Soil Monograph, 2. Wageningen, NL: International Soil Reference and Information Centre (ISRIC).