# Role of time and cover crop on soil chemico-physical traits in an olive orchard in a semiarid area

Farah MLAIKI[1,2], Imene DRIDI[1], Ahlem TLILI[1], Sergio SAIA[2,3]

[1] Department of Geology, Faculty of Sciences of Tunis, University of Tunis El Manar, Tunis, Tunisia

[2] Department of Veterinary Sciences, University of Pisa, Italy

[3] Centre for Climate Change Impact (CIRSEC), University of Pisa, Italy,

**ABSTRACT**

Olive orchards in semiarid areas are usually kept with bare soil, with harmful effect on soil. This study digged into the role of age of the orchard (ORC_AGE) and Cropping System (Crop_sys) based on cover crop (CC) on Soil Organic Carbon (SOC), Bulk Density, and other soil traits in a semi-arid region of Tunisia. ORC_AGE consisted in a mature and a young olive orchards (aged 50 and 15 years, respectively), both subjected to tillage. Crop_sys consisted in 3 contrasting CC treatments (faba bean [FB] CC, vetch-oat [VO] intercrop CC, and bare soil [NC] as a control). Samples were taken below the olive canopy from the 0-10 cm layer. The experimental design was a split plot with ORC_AGE as a main plot. Non-correlated variables at |r| > 0.7 were selected, standardized, and included in a canonical discriminant analysis (CDA, SAS/STAT 9.4) to capture the multivariate effect of treatments on the experiment variability and relationship among variables. Differences by the treatments and interaction on each variable were checked by a general linear mixed model (SAS/STAT 9.4). Few correlations were found (data not shown). A negative correlation was found between SOC and BD (r=-0.98). This may have been due to a lower soil mass sampled in the sampling points with lower BD, which can directly affect the SOC estimation, as reported by Vandenbygaart & Angers (Can. J Soil Sci 2006. 86(3): 465-471) and Baldock and Grundy (Proc. GSOC, FAO 2017: 35-41). The treatments showed unclear effects on most of variables, including soil texture, with the exception of $CaCO_3$, Ca and P, which were 85.2%, 9.4%, and 92.4% higher in the old than the young orchard. These differences may be due to a potential soil transport through erosion, despite the P concentration may have been also due to unaccounted fertilization applications. The CDA yielded on significant explanatory variable (Figure 1) explaining 80.9% of the total variability, and showed that the ORC_AGE was a main discriminant of the whole variability. So far, Crop_sys showed a distinctive pattern within ORC_AGE: the young-NC orchard could not be distinguished from both the old NC and FB orchards. Lastly, the CDA unveiled similar behaviours of P, Mg, and Ca from the one side, and SOC, EC, and pH from the other side (Figure 2), which may be related to fertilization, and a short term effect of the cover crop, respectively. In conclusion, it is noteworthy that SOC did not vary between orchards, despite a long term tillage operation in both plots, and the CC had a minimal effect on the variables.

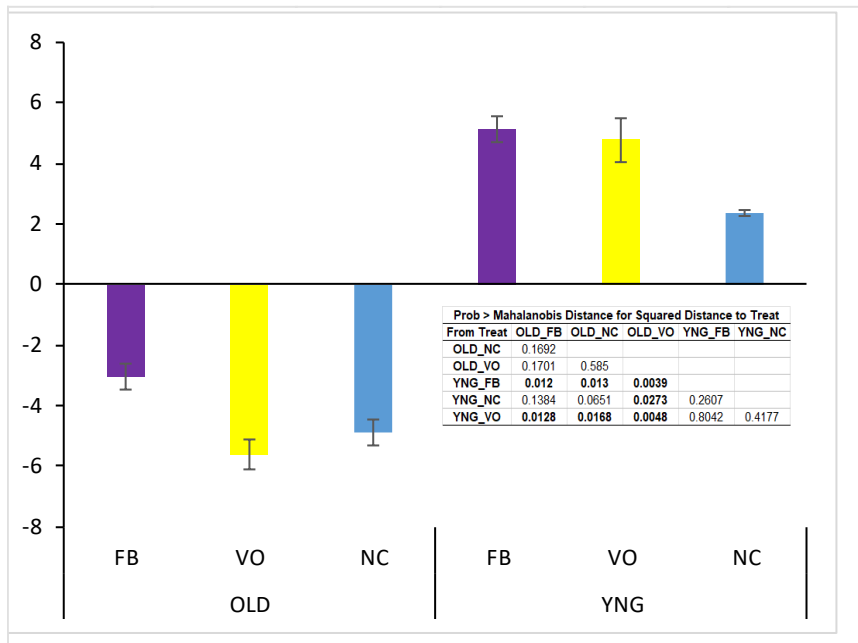| Prob > Mahalanobis Distance for Squared Distance to Treat | | | | | |
|---|---|---|---|---|---|
| From Treat | OLD_FB | OLD_NC | OLD_VO | YNG_FB | YNG_NC |
| OLD_NC | 0.1692 | | | | |
| OLD_VO | 0.1701 | 0.585 | | | |
| YNG_FB | 0.012 | 0.013 | 0.0039 | | |
| YNG_NC | 0.1384 | 0.0651 | 0.0273 | 0.2607 | |
| YNG_VO | 0.0128 | 0.0168 | 0.0048 | 0.8042 | 0.4177 |

Figure 1. Projection of treatments on the CA1. In the nested table, the p test of the treatment distance compared to the Mahalanobis distance
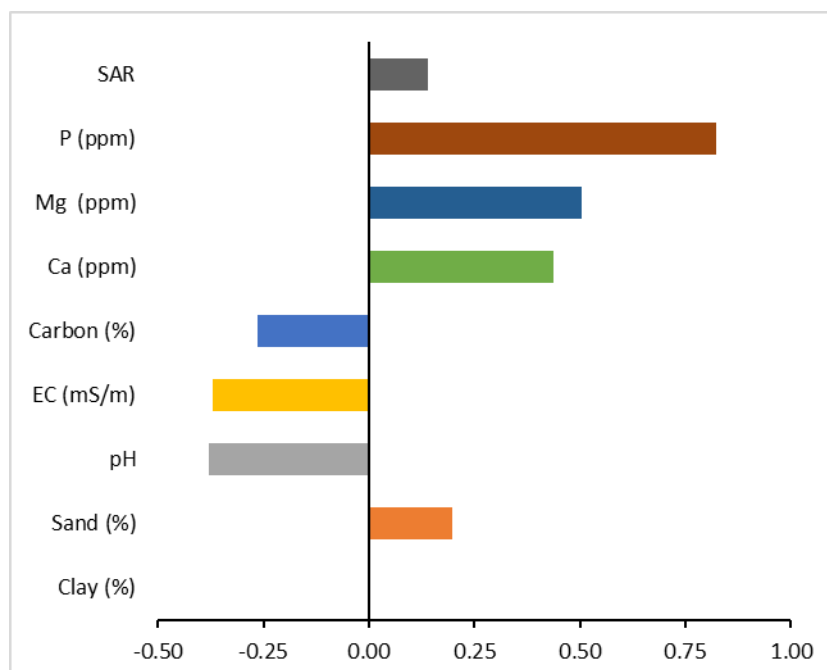


Figure 2. Correlation between each variable and the CA1