Journal of Water and Soil
Vol. 31, No. 4, Sept.-Oct.2017, p. 1215-1231

نشریه آب و خاک (علوم و صنایع کشاورزی)
جلد ۳۱، شماره ۴، مهر – آبان ۱۳۹۶،ص.۱۲۳۱-۱۲۱۵

Evaluation of Spatial Variability of Biological Indicators of Soil Quality in Wheat Farms of Pasargad Plain

V.A. JahandidehMahjenAbadi[1] - A. Karami[2*] - R. Mosavi[3] - H. Asadi Rahmani[4]

Received:13-12-2016
Accepted:18-03-2017

Introduction: Soil quality as an important part from soil resource sustainability, consistently isinfluenced by human activities.Today, the presence of accurate information about variability of soil quality properties is considered more than ever to apply this information in economic modeling, environmental predictions, accurate farming and natural resources management. Soil quality is defined as: "capacity of the soil to function, within the ecosystem and land-use boundaries, to sustain biological productivity, maintain environmental quality, and promote plant and animal health"; therefore, it is one of the most important factors in developing sustainable land management and sustaining the global biosphere. The definition of soil quality encompasses physical, chemical and biological characteristics, and it is related to fertility and soil health. Many indicators can be used to describe soil quality, but it is important to take into account sensitivity, required time, and related properties, than can be explained. Properties related to organic matter content, such as microbial respiration, microbial biomass carbon (MBC) and enzymatic activity (urease and phosphatases) can be used as soil quality indicators. They provide early information about mineralization processes, nutrient availability and fertility, as well as effects resulting from changes in land use or agricultural practices (e.g. tillage or application of different types of organic matter). In this context, biological properties have been used as soil quality indicators, because of their relationship with organic matter content, terrestrial arthropofauna, lichen, microbial community (biomass or functional groups), metabolic products as ergosterol or glomalin and soil activities as microbial respiration and enzyme production. This study was carried out for evaluation the spatial variability of biological soil quality indicators in wheat farms of Pasargad plain.

Materials and Methods: After reviewing the initial map of Pasargad, a total of 60 samples were provided using a systematic grid square sampling pattern with 500×500 m over the 1200 ha area of Pasargad at surface soil depth (0-30 cm). The characteristics of soil including organic carbon, pH, EC, microbial respiration, microbial biomass carbon , soil alkaline phosphatase and urease enzymes activity, ratio of microbial biomass carbon to organic carbon (MBC/OC) andmicrobial metabolic quotient(qCO_2) were measured and calculated. Results were analysed with SPSS, Excel, GS^+, and ArcGIS sotwares. Summary statistics were calculated for the 60 samples including mean, maximum and minimum, coefficient of variation (CV), kurtosis and skewness. In addition, Pearson correlation coefficients were calculated for untransformed data. For evaluation of different interpolation methods of soil characteristics in Pasargad plain root mean square error (RMSE), mean bias error (MBE) and mean absolute error (MAE) were used. We also constructed maps of the spatial distributions for each individual variable using best interpolators including kriging, inverse distance weighting (IDW) and cokriging methods.

Results and Discussion; The results showed that in the most cases the studied properties had too much variation. Based on the coefficient of variation, pHand qCO_2had the lowest and highest variations, respectively. There was significant linear correlation between most of soil properties. From lognormal transformation was used for normalization of EC and qCO_2. Best model for single semivariogram of organic carbon, microbial respiration, urease enzyme activity, microbial biomass carbon, qCO_2 and MBC/OC in the soil was spherical model, for pH in the soilwas exponential model and for EC and phosphatase enzyme activity was gaussian model. Also, the best interpolator for pH, EC, organic carbon, microbial biomass carbon, urease activity,

1- P.H.T student of Soil Science, College of Agriculture, Shiraz University, Shiraz, Iran
2- Assistant Professor of Soil and Water Research Department, Fars Agricultural and Natural Resources Research and Education Center, AREEO, Shiraz, Iran
(*Corresponding Author Email: ad.karami@areeo.ac.ir)
3- P.H.T Student of Soil Resource Management, Department of Science and Soil Engieenering, Tehran University, Tehran, Iran
4- Associate Professor of Soil and Water Research Institute, Agriculture Research, Education and Extension Organization, Karag, Iran

$qCO_2$and MBC/OC was kriging, for alkaline phosphatase activity was inverse distance weight, and for microbial respiration was cokriging method. Amount of pH increased from north to south of Pasargad plain, but amounts of EC and organic carbon were inverse of pH.The higher amounts of microbial respiration and urease activity were observed at the south and east, respectively. The amount of phosphatase activity in the soil of Pasargad plain was scattered, and wide area in the plain had the activity between 215-275 µg PNP/g.hr. The higher amount of MBC and MBC/OCand lower amount of qCO_2were observed at the west.

Conclusions: The biological soil properties were sensitive and rapid indicators of effects of soil management. Generally, according to the spatial variabilitymap, the areas in the region are critical situations in terms of biological indicators of soil. So the management techniques that are applied by farmers in these areas have to be changed. The results of this study used in the improvement of regional planning for sustainable management of soil.

Keywords: Biological properties variability, Geostatistic, Soil quality