SPATIAL VARIABILITY OF IMPORTANT SOIL CHARACTERISTICS IN SEMIARID ECOSYSTEMS, A CASE STUDY IN ARSANJAN PLAIN, SOUTHERN IRAN

Majid Baghernejad and Mostafa Emadi

Soil Science Department, College of Agriculture
Shiraz University
Shiraz, Fars Province, Iran

ABSTRACT

Efficient tools to measure within-field spatial variation in soil are important when establishing agricultural field trials and in precision farming. Therefore, soil samples were collected at 0-30 cm depth in highly calcareous soils (Arsanjan plain) and chemically analyzed for nitrate (NO_3^-), electrical conductivity (EC_e), available potassium (K), available phosphorus (P), and available zinc (Zn). Coordinates of each of the 100 points were recorded with GPS. Results herein indicated that selected soil fertility properties had the spatial distribution and spatial dependence level varies within location. Variograms of K, P, Zn in study area showed spatial structure approximated by spherical model, whereas EC_e, NO_3^-, and pH showed the exponential model. The range of spatial dependence was found to vary within soil selected properties. Generally, NO_3^- had the shortest range of spatial dependence (69.4 m) and the K had the longest (543.3 m). In general, all parameters exhibited strong to moderate spatially dependence. Strong spatial dependency of soil fertility properties would lead to the extrinsic factors such a ground water level and quality. In addition, the quantitative information obtained from these predicted maps could be used to facilitate sit-specific management in the study region and applying variable-rate technology in field for best management.

Keywords: Spatial variability, Kriging, Semiarid soils, Iran

INTRODUCTION

In the last decades, important contributions has been made by geostatistics to understand soil distribution patterns within the landscape, which are required for effective land management. Samples close to each other have more similar properties than those located far from each other. However, the classical statistic, assuming the measured data independent, is not capable to analyze the spatial dependency of the variable (Ardahanlioglu et al., 2003). Although these studies provided very precise information for site-specific recommendations, such information for soils of Arsanjan plain with semiarid condition is lacking and

thus, need to be assessed. Moreover, it is important to consider the fact that spatial variability of soils depends on the specific soil studied. The Arsanjan plain is one of the most important agricultural production areas of Fars province (southern Iran).

The aims of this study were to (1) examine spatial variability in nitrate (NO_3^-), electrical conductivity (EC_e), available potassium (K), available phosphorus (P), and available zinc (Zn) and (2) assess spatial distribution patterns of saline and sodic soils in Arsanjan plain.

RESULTS

The coefficient of variations (CV) of soil properties except nitrate was fairly high, indicating that soil properties were generally heterogeneous. Anisotropic semivariograms did not show any differences in spatial dependence based on direction and therefore isotropic semivariograms were chosen. The geostatistical analysis indicated different spatial distribution models and spatial dependence levels for the soil parameters.

The spatial distribution and spatial dependence level of soil properties can be different even within similarly managed farms. Variography and kriging can be useful tools for designing effective soil sampling strategies and variable tare application of inputs for use of in site-specific farming.

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