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ORIGINAL PAPER

# The effects of hydrometer reading times on the spatial variability of soil textures in southeast Iran

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**Abstract** Soil texture is an important physical soil property that may contribute to variations in many soil functions as well as nutrient storage and availability, water retention, and soil erosion. Although several methods for determining the texture classes of soil particles have been proposed, differences among hydrometer reading times have presented challenges in determining the precise soil texture classes. Therefore, this study was conducted to evaluate the effects of hydrometer reading time on the spatial variability of soil textures in the Rafsanjan area, southeast Iran. To accomplish this, 77 soil samples were collected on a 500-m square sampling grid from depths of 0–40, 40–80, and 80–120 cm, and their particle sizes were determined through analysis for 40 s, 2 h, 6.5 h, and 8 h using the Bouyoucos hydrometer method. The results showed a strong spatial correlation in the soil particles among sampling soil layers and across the study area. Moreover, the differences among hydrometer reading times did not have a significant impact on determination of coarse soil texture classes, although they did influence determination of the finer classes. Although the 8 h reading time provided the most accurate response with respect to mechanical analysis of a soil, after 6.5 h the hydrometer could also largely (more than 80.0 %, on average) achieve this goal. Additionally, the 2 h hydrometer reading time could also be useful for the initial assessment or general overview of the soil texture in a certain region; however, it is not recommended for precision agriculture or site-specific management.

**Keywords** Bouyoucos method · Chaotic nature · Ordinary kriging · Particle size analysis · Site-specific management

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## Introduction

Soil texture, which designates the proportional distribution of minerals of different particle sizes comprising the soil, is one of the most important physical properties of soils (Meirvenne and Cleemput 2005). Indeed, soil texture influences most physical, chemical, and biological soil processes and reflects a number of soil characteristics or behaviors including permeability, water holding capacity, cation exchange capacity, organic matter percentage, and workability as well as other management practices (Cosby et al. 1984); accordingly, soil texture is considered a key property for soil management (Meirvenne and Cleemput 2005).

Several methods of determining the texture classes of soil particles have been proposed (Day 1965; Weiss and Frock 1976; Green 1981; Cooper et al. 1984; Lewis et al. 1984;

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