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Soil Organic Carbon Stocks of Citrus Orchards in Yongchun County, Fujian Province, China

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ABSTRACT

Studies related to the quantitation and distribution of soil organic carbon (SOC) under different land use types can help to meet knowledge gaps in estimating the amount of carbon stored in soils globally. Orchards serve as an important land use type in southern China; the total area (1.15×10^7 ha) of China's orchards comprise approximately 20.5% of all orchard area worldwide. The present study assessed soil organic carbon density (SOCD) in citrus orchards in Yongchun (YC) County (consisting of 22 towns), Fujian Province, China in 1982 and 2010. The southeastern part of YC County, an area featuring extensive citrus farming with a gently sloped landscape and low rates of water erosion, had the highest SOC content. In contrast, the lowest SCOD were observed in the northern part of the YC County, where steep hills with severe erosion problems are common and citrus orchards are sparsely distributed. From 1982 to 2010, the mean SOCD in citrus orchards increased from 22.1 to −41.7 Mg ha^{-1}, which indicated that the current management practices enhanced soil carbon stocks. Additional surveys of SOCD extending throughout all of Fujian Province are needed. In addition, the agricultural soil carbon pool is closely linked to agricultural practices, such as fertilization, irrigation, cultivation, etc. Further in-depth studies addressing the effects of these measures on carbon sequestration would be worthwhile to support efforts to mitigate global carbon emissions.

Key Words: carbon cycle, carbon sequestration, geographic information system (GIS), Kriging, mitigation

INTRODUCTION

Soil organic carbon (SOC) forms the largest terrestrial organic carbon pool, and has recently received considerable attention because of the rising levels of atmospheric CO_2. Soil organic carbon (SOC) influences world food security by supplying nutrients, improving soil structure, and increasing soil water nutrient holding capacity; the presence of SOC also decreasing the risks of erosion and soil degradation, and helps to degrade and filtering contaminants, while also affecting the global climate as a source and sink of atmospheric CO_2 (Lal, 2004). Considering the massive carbon storage capacity of soils, small changes in rates of mineralization of the SOC pool caused by changes to climate and/or land use and management will directly affect atmospheric CO_2 concentrations (Stockmann *et al.*, 2013). To mitigate climate change and sustain ecosystem processes in support of food production and environmental quality, developing agricultural management strategies that will result in increased SOC stocks is a global priority (Lal, 2010; Powlson *et al*., 2011).

The factors that affect the SOC concentration and stock are linked to environmental and anthropogenic conditions, including climate and soil mineralogical composition (Wang *et al*., 2010), landscape type (Fernández-Romero *et al.*, 2014), slope, latitude (Hontoria *et al.*, 2004), soil management practices (Muñoz-Rojas *et al*., 2012; Parras-Alcántara *et al*., 2014) and natural disturbances such as fire and soil erosion (Bodí *et al*., 2011; Häring *et al*., 2014). Agricultural management that increases carbon input from crop residues, manure, biochar, etc. (Bhaduri *et al*., 2016; Novara *et al*., 2016; Shi *et al*., 2016) and reduces tillage intensity (Carr *et al.*, 2015; Guo *et al*. 2016) can generally result in an increase in the SOC pool. In temperate climates, several studies have been conducted to estimate differences in SOC

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