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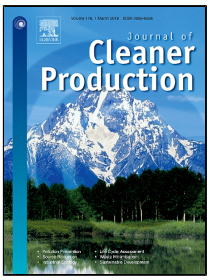

Land-Water-Energy Nexus of Sugarcane Production in Thailand

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Land-Water-Energy Nexus of Sugarcane Production in Thailand

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Abstract: Agriculture is a key economic sector for developing countries confronting challenges on the overexploitation of land and water resources for food and biofuels crop production. Sugarcane is recognized as a promising crop serving both food and bioenergy needs that are being promoted leading to expansion of the plantation areas. The study assesses the land-water-energy nexus of irrigated and non-irrigated sugarcane production systems in the Chao Phraya and Chi watersheds of Thailand using carbon footprint, ecological footprint, and water scarcity footprint. The results indicate that freshwater resource is essential to sugarcane productivity improvement. Irrigation helps increase the sugarcane yields around 23-54% as compared to the non-irrigated system; the carbon and ecological footprint of sugarcane products are also consequently decreased by around 11-36% and 15-35%, respectively. Nevertheless, the water scarcity potential would be increased. Hence, the efficient irrigation technology like drip irrigation is an important factor to drive sustainable sugarcane production in the future. Land-water-energy nexus management measures for improving sustainability of sugarcane production are also recommended.

Keywords: Nexus; Sugarcane; Land; Water; Energy; Climate Change

1. Introduction

Agriculture is known as the key economic sector for developing countries vis-à-vis their socio-economic development; human well-being and economic prosperity of people rely heavily on the development of agro-industry supply chains. The rapid development nowadays raises the demands for food, feed and fuels, and brings about increased concerns on the competition between land, water and energy resources as well as consequences on greenhouse gases (GHG) emissions. The demands for freshwater, land, and energy for food have been projected to increase significantly in the next decades due to population growth, urbanization and economic development (Hoff, 2011). Water crises have become one of the top five key global risks over the past five years (2011-2016) as reported by the World Economic Forum (WEF, 2017). Meanwhile, agriculture is the most freshwater consumptive sector accounting for around 85% of global freshwater consumption (Hoekstra and Chapagain, 2007). To meet the global demands for food in 2050, food production needs to be increased by about 60% (FAO, 2011). This has raised concerns on water scarcity caused by the overexploitation of water for food and biofuels along with climate change effects (Zhang et al., 2013; Gheewala et al., 2014; 2017). In view of the impact from climate change, food production accounted for 19–