World Academy of Science, Engineering and Technology
International Journal of Agricultural and Biosystems Engineering
Vol:17, No:07, 2023

Energy Budgeting, Carbon and Water Footprints Under Conventional and Conservation Tillage Practices of Rice-Wheat Double Cropping System

Authors : Ahmad Latif Virk, Naeem Ahmad, Muhammad Ishaq Asif Rehmani

Abstract : Amid the present environmental crises, developing environment-resilient and cost-effective conservation agriculture strategies to feed the world's ever-growing population is pertinent. Therefore, a field study was conducted to test the hypothesis that residue retention under no-till (NTR) would enhance energy productivity (EP) and energy use efficiency (EUE) while offsetting the carbon footprints (CF), water footprints (WF) and greenhouse gases emissions (GHGs) in rice (Oryza sativa L.)-wheat (Triticum aestivum L.) double cropping system. Two tillage systems viz., conventional tillage (CT) and conservation tillage (no-till; NT), with or without residue retention, were combined into four treatments as CT0 (puddled rice, conventional wheat - residue); CTR (puddled rice, conventional wheat + residue); NT0 (direct rice seeding, zero-tilled wheat - residue); NTR (direct rice seeding, zero-tilled wheat + residue) were evaluated. Overall, results showed that the NT system had 34.2% lower energy consumption, 1.2 times more EP than CT system. Moreover, NTR had 19.8% higher EUE than CT0. The overall system grain yield ranged from 7.8 to 9.3 Mg ha−1 under NT0 and CTR, respectively. The NTR had 56.6% and 17.9% lesser CF and WF, respectively, than CT0. The net GHGs emissions (CO2-eq kg ha−1) under CT0 were the highest, while NTR had the lowest emissions. The NTR enhanced carbon sequestration in soil that can offset half of the system's CO2 emissions. The findings of this study might help develop a suitable strategy for resource/energy conservation and higher productivity while offsetting GHGs emissions in the Indo-Gangetic Plains.

Keywords : residue, yield, indirect emissions, energy use efficiency, carbon sequestration
Conference Title : ICAAMSS 2023 : International Conference on Advances in Agriculture Mechanization and Soil Science
Conference Location : Tokyo, Japan
Conference Dates : July 17-18, 2023