Geophysical Research Abstracts
Vol. 20, EGU2018-2652, 2018
EGU General Assembly 2018

Biochar can improve the sustainable use of rice residues in rice production systems

Ali Mohammadi (1), Annette L. Cowie (1,2), Paul Kristiansen (1), Oscar Cacho (3), Thi Lan Anh Mai (4), Stephen Joseph (1,5,6)

(1) School of Environmental and Rural Science, University of New England, Armidale, NSW 2351, Australia, (2) NSW Department of Primary Industries, Beef Industry Centre, Trevenna Rd., Armidale, NSW 2351, Australia, (3) UNE Business School, University of New England, Armidale, NSW 2351, Australia, (4) Thai Nguyen University of Sciences, Thai Nguyen University, Thai Nguyen Province, Viet Nam , (5) Discipline of Chemistry, University of Newcastle, Callaghan NSW 2308, Australia, (6) School of Materials Science and Engineering, University of New South Wales, Sydney, NSW 2052, Australia

Abstract

Application of biochar, a solid product of thermal decomposition of biomass, has been demonstrated to be a potential technique to improve soil properties and reduce climate change by storing carbon in soil for long periods of time. Nonetheless, biochar stability in soil alone is not sufficient to determine the sustainability of biochar for crop residue disposal. This study investigated the climate change, human health and economic impacts of using rice straw and rice husk to make biochar for application in paddy fields compared with the conventional practice of open burning of residues. The climate change and health effects of biochar application were quantified using life cycle assessment (LCA) while the economic impacts were assessed using net present value (NPV). In comparison with open burning of residues, producing biochar from rice residues would provide controlled and cleaner combustion; could produce recoverable energy; would release less GHG emissions; and could provide agronomic benefits, such as a decrease in fertiliser requirement and enhanced crop productivity. The review of biochar LCAs shows that the use of biochar significantly mitigates the carbon footprint of rice production systems through carbon sequestration and the suppression of soil GHG emissions. The soil application of biochar also enhances the NPV of rice and reduces the non-renewable energy intensity relative to rice production with traditional residue management, due to its agronomic benefits. However, high application rates of biochar increase farm costs. The development of enriched biochar through co-composting of biochar with organic residues and additional of nutrient minerals could enable lower application rates, and so overcome economic constraints to biochar adoption. Consequently, substantial benefits in climate change mitigation, human health and economic returns are possible in rice cropping systems by ceasing the open burning of residues in the field and instead using residues to produce biochar for addition to soils.

Keywords: Climate change, human health, economic benefits, carbon sequestration, life cycle assessment