EGU2020-3779
https://doi.org/10.5194/egusphere-egu2020-3779
EGU General Assembly 2020

Strong mitigation of net global warming potential (GWP) via short-term aerobic pre-digestion of green manured soil in rice paddy

Hyeonji Song[1], Jin Ho Lee[1], Songrae Cho[1], Hogyeong Chae[1], and Pil Joo Kim[1,2]
[1]Gyeongsang National University, Department of Applied life science, Korea, Republic of (hyenji0909@gmail.com)
[2]Gyeongsang National University, Institute of Agriculture and Life Sciences, Korea, Republic of

Cover crop cultivation is strongly recommended during fallow season to increase soil organic carbon (SOC) stock. However, since its biomass recycling as green manure can dramatically increase greenhouse gas (GHG) emission, in particular, methane (CH_4) during rice cropping season, smart cover crop management strategy should be developed. In our previous research, CH_4 emission during cropping season was dramatically reduced via short-term aerobic decomposition before irrigation (Lee et al.). However, due to a fast response rate of aerobic decomposition, the effect of mitigating CH_4 emission could be offset by SOC depletion which results in accelerating global warming. To evaluate the comprehensive impact of the short-term aerobic decomposition on global warming, net global warming potential (GWP), defined as the difference between GWP and SOC stock change was employed. SOC stock change was estimated using net ecosystem carbon budget (NECB), a balance between soil C input and output. The mixture of barley and hairy vetch cultivated during the dried fallow season, and then its whole biomass was incorporated 0-30 days before irrigation for rice transplanting. The aerobic decomposition of cover crop biomass significantly reduced CH_4 emission by 24-85% over control but negligibly influences N_2O emission. Total C input and output were unaffected by the aerobic digestion. Although carbon emission before flooding dramatically increased after biomass application in aerobic decomposition treatments, the mineralized C losses exhibited no differences among treatments. Based on these results, NECB values were similar in all treatments. This implies the aerobic decomposition did not stimulate SOC depletion, compared to the control. Finally, the net GWP highly decreased by 30-86% by the aerobic digestion due to the significant reduction of CH_4 emission. In conclusion, earlier application of cover crops before irrigation is a smart strategy to decrease methane emission, maintaining soil carbon sequestration effect of cover crop biomasses application.