ABSTRACT

Greenhouse gases (GHGs) emissions data from large-scale agricultural activities are available. In developing countries, e.g. Kenya, agriculture is dominated by smallholder farming, data on the assessment of possible contributions of smallholder agriculture to GHG emissions and GHG fluxes data from smallholder farming systems in the tropics is scarce. The study area is a 10 square km area also called the ―Lower Nyando Block‖ in Western Kenya. The basin varies in landscapes (low lands, slopes and uplands) and climates (humid and sub-humid). The aim of the study was to assess the contribution of smallholder agricultural systems and seasonal variations in GHG fluxes within the block. The objectives were; to determine soil-atmosphere GHG fluxes under different land covers and crop types; establish effect of different landscape units on soil-atmosphere GHG fluxes and determine seasonal variations effect on soil-atmosphere GHG fluxes from smallholder farms in the lowland in Nyando Block. Study design was complete randomised design on 60 farms randomly selected within the landscape units. The farming activities include livestock keeping, fallows, woodlots and crop production. Farmers continued with their normal activities during data collection. GHG fluxes were estimated using static chamber method. Samples were analysed for CH_4, CO_2 and N_2O, then subjected to analysis of variance and paired T test. Grazing lands had lower ($p \leq 0.05$) CH_4 uptake than fallow and crop areas with absorptions ranging between -0.15 to -0.85 mg C-CH_4 m^{-2} day^{-1}, but had higher emission of CO_2 than fallow and crop areas with emissions ranging between 3.13 to 1.20g C-CO_2 $m^{-2}day^{-1}$. No difference ($p \leq 0.05$) was observed in N_2O emission in the various land covers having emissions between 0.29 to 0.05 µg N-N_2O $m^{-2}day^{-1}$. There was no difference ($p \leq 0.05$) in GHG fluxes in the landscape units. CH_4 absorption increased ($p \leq 0.05$) (-0.48 to -0.66 mg C-CH_4 $m^{-2}day^{-1}$), but CO_2 and N_2O emissions decreased ($p \leq 0.05$) (2.2 to 1.54 g C-CO_2 $m^{-2}day^{-1}$ and 0.15 to 0.06 µg N-N_2O $m^{-2}day^{-1}$) from long to short rainy seasons respectively. The low emissions levels demonstrate that small scale farming systems in Nyando Block are not significant contributors to atmospheric GHGs. The activities were net absorbers of methane thereby mitigating climate change that could arise from GHG. However, grazing lands could have potential to be major emitters of CO_2 if animal keeping is intensified. It is recommended that the farmers continue with their farm practices and those in the lowland increase farm input to improve yields without adverse GHGs emissions.