The impact of nitrogen fertilizer use on greenhouse gas emissions in an oil palm plantation associated with land use change

ABSTRACT

The emissions of greenhouse gases (GHGs) in an oil palm plantation associated with land use change have been evaluated on a site-specific basis. Nitrous oxide (N2O) emissions from the application of nitrogen fertilizers during the growth stages of the palm oil were analyzed for palms of different ages within the plantation. The N2O release ranges between 19.11-22.17 kg of N2O-N/ha, resulting in the emission of 1052.26-1209.51 kg of CO2-eq/ha. However, there is no clear relationship between the emissions of N2O or CO2-eq and the age of the oil palms. On the other hand, the impact from land use change for the development of the site was also evaluated by assessing the emissions from carbon stock changes within the plantation. The transformation of a rubber estate into an oil palm plantation loses the soil carbon content (i.e., release of carbon emissions). However, this phenomenon has been anticipated in literature. Overall, fertilizer-related emissions and fuel emissions during the growth stages contribute to about 79 and 21%, respectively, of the total GHG emissions from the plantation. Therefore, it is likely that the application of nitrogen fertilizer may increase the existing carbon emission from the conversion of rubber to oil palm plantation, but the values are within the estimated for a Malaysian oil palm plantation.

Keyword: Carbon stock changes; Global warming; Greenhouse gas emission; Nitrous oxide; Nitrogen fertilizer; Oil palm plantation