Refining Methane Inventory for Malaysian Rice Cultivation Using Country-Specific Emission Factor

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Abstract

Methane (CH_4) emissions from rice cultivation in Malaysia are currently estimated using a regional default emission factor (EF) of 1.60 kg CH_4 ha^{-1} day^{-1}, as a nationally derived EF has not yet been developed. This study aims to develop a country-specific EF for CH_4 emissions from Malaysian rice fields to refine national greenhouse gas (GHG) inventory reporting. The new EF was derived from eleven rice-growing seasons across granary and non-granary areas, incorporating data from field measurements, published literature and unpublished datasets from MARDI. Methane flux was quantified using the static chamber technique and CH_4 concentrations were analysed using a GC System (Agilent 7890A). The calculated mean EF was 1.80 kg CH_4 ha^{-1} day^{-1}, which lies within the range of default values provided by the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories; 2.00 kg CH_4 ha^{-1} day^{-1} (IPCC 1996) and 1.30 kg CH_4 ha^{-1} day^{-1} (IPCC 2006). Malaysia's hot and humid climate likely contributes to the higher EF value by enhancing methanogenesis activity by methanogenic bacteria, which are thermophiles that thrive at high temperatures, accelerating organic matter decomposition and increasing soil CH_4 emissions. In Malaysia's First Biennial Transparency Report (BTR1) submitted to the United Nations Framework Convention on Climate Change (UNFCCC), rice cultivation was reported as the largest source of CH_4 emissions within the agriculture sector, accounting for 89.27 Gg CH_4 (2,499.50 Gg CO_2 eq.) based on the existing regional EF. When applying the newly developed EF, emissions increase to 100.43 Gg CH_4 (2,812.04 Gg CO_2 eq.), reflecting a 12.49% rise in annual CH_4 emissions from rice cultivation. This increase is consistent with IPCC estimation protocols, where annual emissions are calculated by multiplying the daily EF by cultivated area and growing period. The development of a national EF remains an evolving process and continued collection of emission data from diverse agroecological zones will improve its accuracy in representing national rice cultivation emissions.

References/ Publications

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Access to relevant information

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