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A web-based greenhouse gas calculator to empower climate-aware young farmers toward low-emission agriculture in Indonesia

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Abstract

According to IPCC 6th Assessment Report, the agriculture sector contributes 22% of the total greenhouse gases (GHG) emissions. To mitigate the emissions from this sector, it is importance to imposed capacity building for the farmers. This study aimed to evaluate the implementation of a web-based GHG calculator as a decision-support tool for enhancing climate awareness among young farmers. The web-based GHG calculator is a user-friendly tool designed to enhance emission accounting and promote climate awareness among young farmers, thereby supporting the transition toward low-emission agricultural practices. The project “Rural Youth Climate Action Movement for Cool Farming (RYCAM)” has been developed with funding support from IKI international to develop a practical web-based GHG calculator tailored to smallholder agriculture in Indonesia context. This tool was based on the GHG Protocol methodology, covering Scope 1 and Scope 2 emissions, and applied a combination of Tier 1 IPCC emission factors and Tier 2 national emission factors. It featured a user-friendly interface to ensure accessibility for young farmers and integrated a basic profit-and-loss analysis to assess the economic feasibility of climate-friendly practices. The tool was implemented in the Young Cool Farmer Challenge (YCFC) program involving five groups of young farmers engaged in diverse crop and livestock enterprises. Participants recorded daily farming activities, calculated monthly emissions, and compiled cumulative emissions over one production cycle. The result shows the GHG calculator enabled systematic emission quantification across farming systems. During the 4-month YCFC program, total emissions per group ranged from 87.91 to 376.14 kg CO₂-eq for crop and livestock production. Crop-based activities contributed approximately 87.91 to 126.96 kg CO₂-eq, while livestock systems accounted for 217.47 to 376.14 kg CO₂-eq. Major emission sources from crop production (horticulture) included chemical fertilizer, fuel, and electricity, while emissions from livestock production mainly originated from feed production and manure management. The use of the tool also enhanced farmers’ awareness of emission hotspots and encouraged the initial adoption of mitigation practices such as circular bioeconomy approaches, climate-resilient farming, and regenerative agriculture.

Keywords: Calculator, climate change, greenhouse gasses, low-emission agriculture, young farmers

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