A method to estimate the reduction in life cycle greenhouse gas emissions from rice cultivation caused by the use of alternate wetting and drying

Production | Demonstration | Item: Paddy rice | GHG emission reduction

Outline

A life cycle assessment (LCA) method was developed to estimate greenhouse gas (GHG) emissions from farmers during the life cycle‡ of rice cultivation using alternate wetting and drying (AWD).

‡Life cycle: The developed method includes every stage from the production of material and machinery for rice cultivation to harvesting/rice straw management.

Background/effect/note

Alternate wetting and drying (AWD) saves water and mitigates GHG emissions from paddy field when compared with continuous flooding. In AWD, paddy soil is repeatedly re-flooded after several days of drying (Fig. 1). The LCA method that we developed calculates the life cycle greenhouse gas (LC-GHG) emission by summing up emissions from agricultural material production to rice cultivation stages (Fig. 2). This method allows the evaluation of the impact of AWD, considering potential trade-offs (e.g. decrease in soil CH_4 emissions and increase in N_2O emissions). Additionally, this method can be used in the Asian-Monsoon region for policy-making and further dissemination of AWD. For example, estimations from the LCA method indicated AWD reduces LC-GHG emission by 41% (Fig. 3). However, this method partly used Intergovernmental Panel on Climate Change (IPCC) guidelines that enable easy calculation but does not reflect country or site differences. The use of field data (CH_4 and N_2O emissions from soils) at each site (if available) is more desirable than the estimates based on IPCC guidelines.

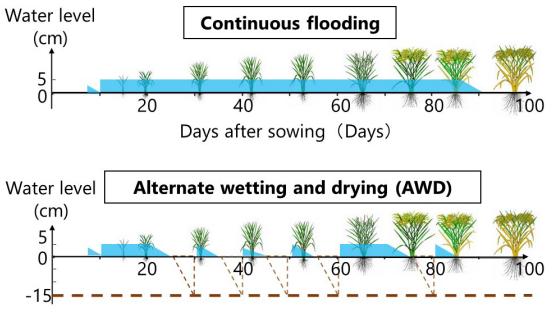

Fig. 1. An example of conventional water management (continuous flooding) and alternate wetting and drying (AWD) during a cropping season

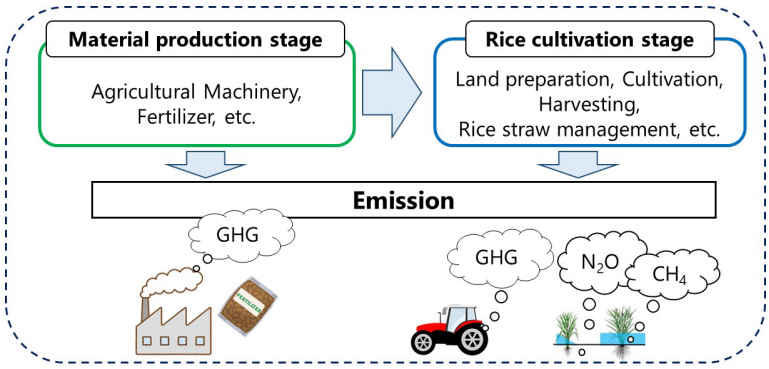

Fig. 2. Life cycle greenhouse gas (LC-GHG) emissions from rice cultivation

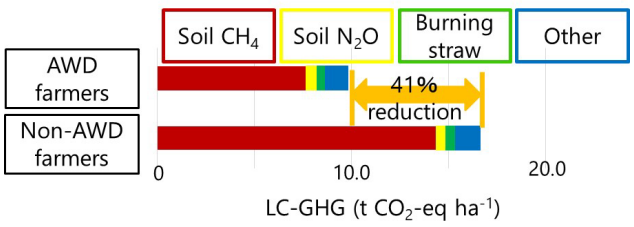

Fig. 3. Comparing greenhouse gas (GHG) emissions between alternate wetting and drying (AWD) farmers and non-AWD farmers

Technical details:
https://www.jircas.go.jp/en/publication/research_results/2020_a02

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