UNIVERSITY OF HOHENHEIM

in collaboration with

IRRI International Rice Research Institute

Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute)

Methane emission from rice production as affected by rice variety selection

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Introduction

- Rice production is a primary source of greenhouse gases which is attributed to the emission of methane generated in flooded soils.
- Changing farming practices namely water, nutrient and straw management have been identified as potential mitigation options, but the impact of selecting different rice varieties is still poorly understood.
- This field experiment in the Vietnamese Mekong Delta in 2020 applied the closed chamber method (Fig.1) to quantify methane emissions of 20 varieties in combination with Alternate Wetting and-Drying (AWD), an irrigation management proven to reduce GHG emissions.

Figure 1. GHG field sampling using the closed chamber method at experimental fields of Loc Troi Group in An Giang Province, Vietnam

Results and Discussion

- The seasonal emissions in Figure 2 show the differences in methane emissions between water management and rice varieties, which confirm higher emissions under Continuous Flooding (CF) as compared to AWD.
- The AWD Scaling Factors (corresponding to the ratio between CF and AWD) were between 0.25-0.53 with the mean value being 0.41.
- Figure 3 shows proof of the efficient control of water levels for CF vs AWD in the field.
- Figure 4a,b illustrates the seasonal patterns in methane emissions of 4 selected varieties. The differences between CF and AWD were noticeable starting 25 Days after Transplanting (DAT) when water levels were periodically below soil surface.

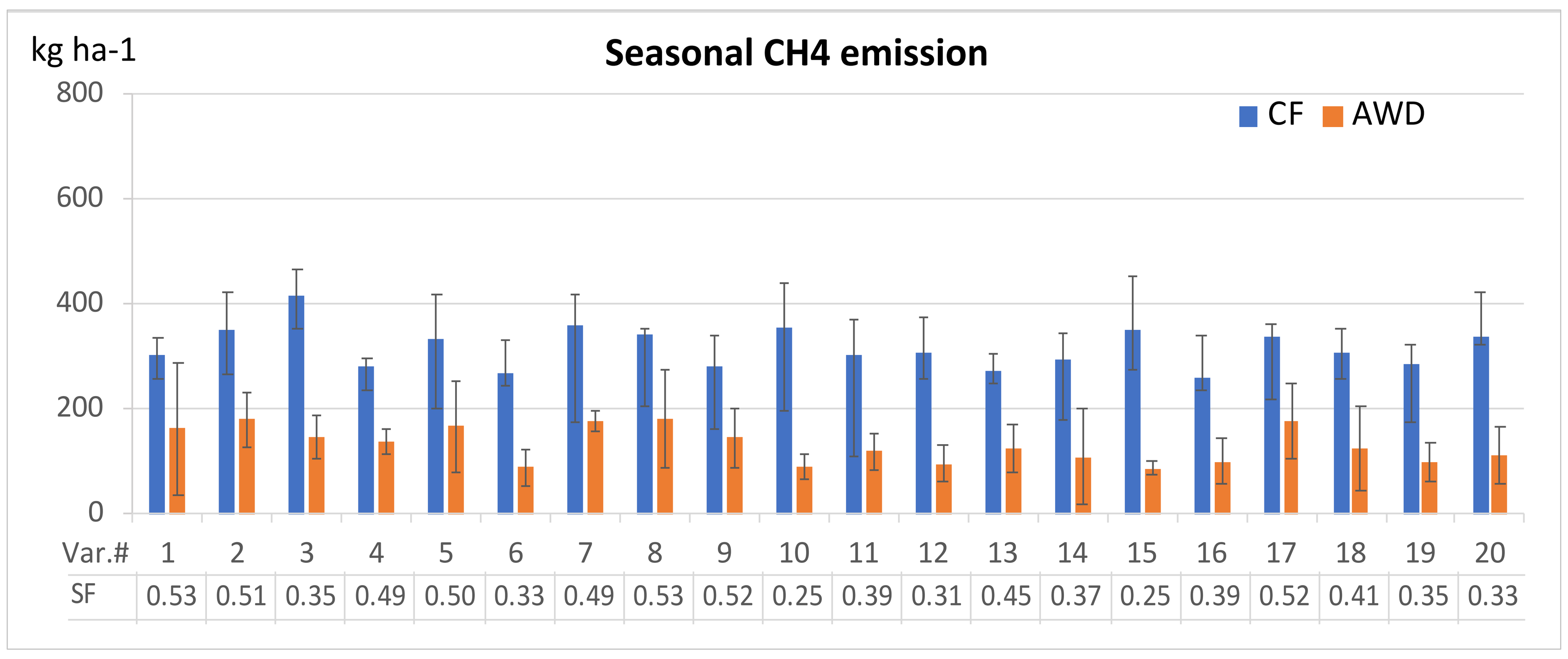


Figure 2. Seasonal CH_4 emission rates of 20 rice varieties including those commonly planted in the Mekong Delta. Results are expressed as the mean ± standard deviation. Statistical significance value at the confidence of 95% determined by one-way ANOVA: average emission of the two water management practices are significantly different, whereas, varieties show no significant differences; Var# = Running number of variety; SF: Scaling Factor

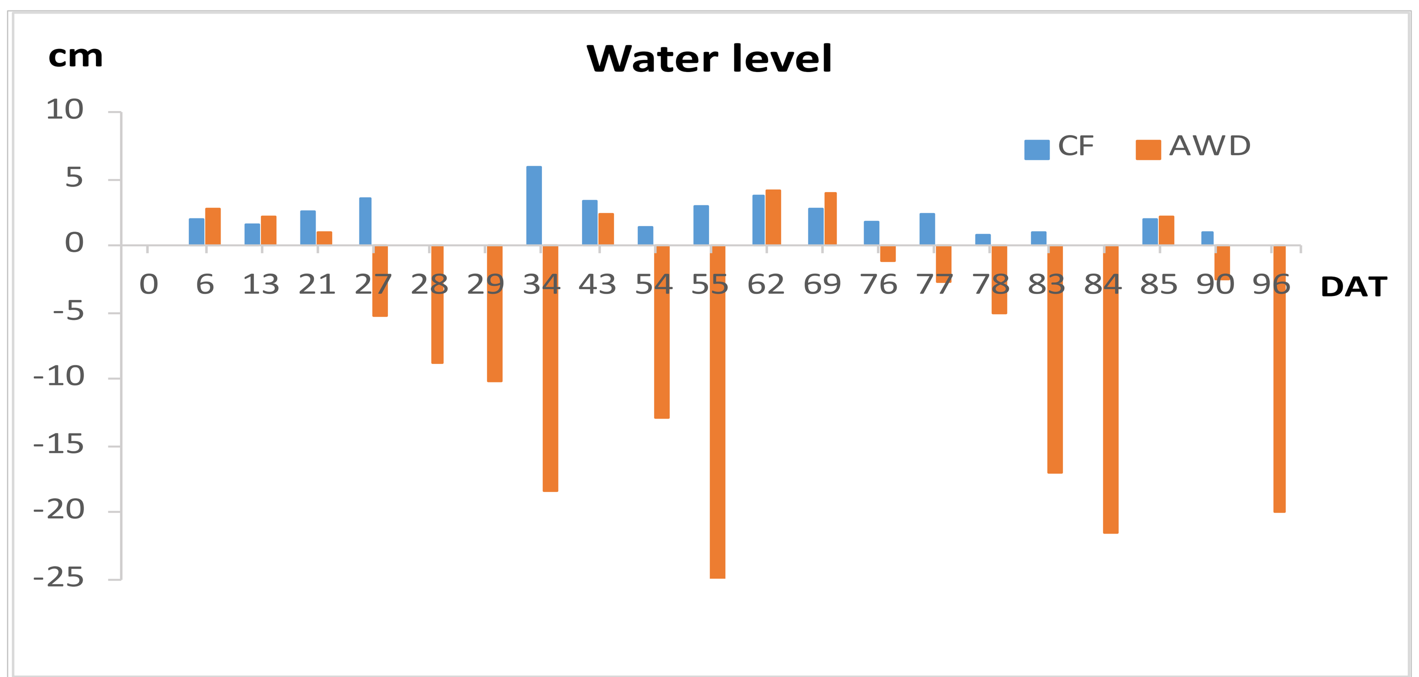


Figure 3. Seasonal Water management practices; DAT: Date After Transplanting

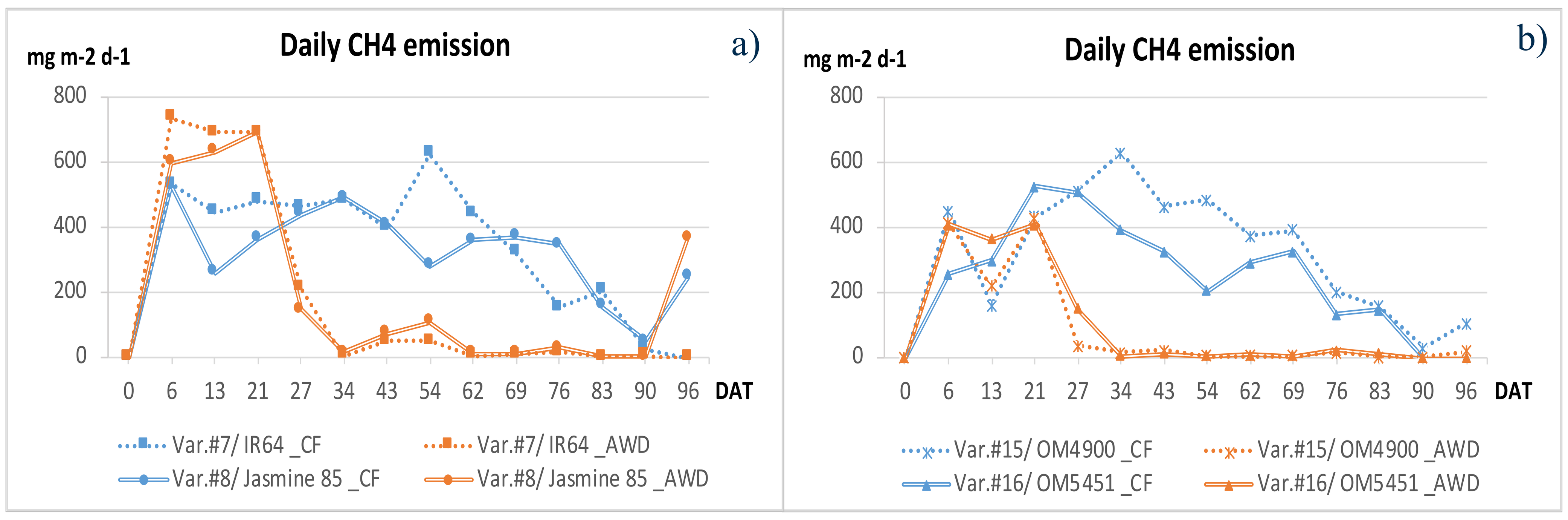
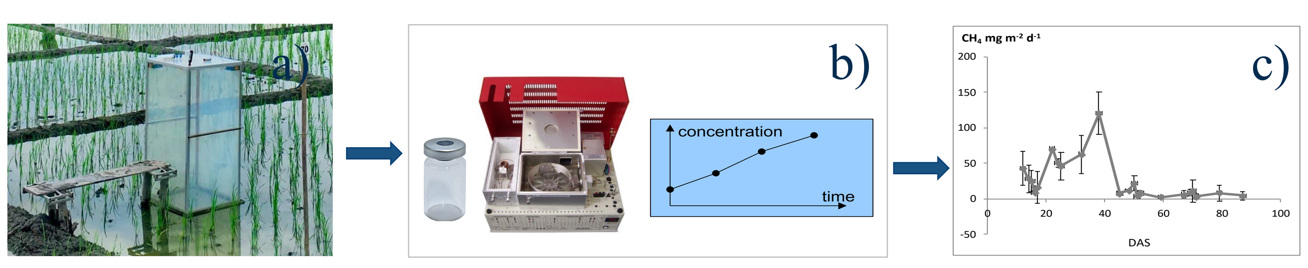


Figure 4. Daily CH_4 emission rates from selected four rice varieties. Fig. 4a) IR64: reference variety from IRRI and Jasmine 85 which is widely grown for export, Fig. 4b) OM4900 and OM5451 which are widely grown for domestic consumption.

Conclusion

- The available results confirm the pronounced differences between CF and AWD and thus, the strong mitigation potential of AWD in the Mekong Delta. For all varieties, the SFs of AWD were below the IPCC default value (0.55).
- In contrast, the differences among varieties were only small. In terms of mitigation, varietal selection can be regarded either as an additional measure to maximize the AWD effect or in locations where AWD is not possible.

Notes on Materials and Methods



Schematic presentation of individual steps of closed chamber approach:

a) Chambers for field sampling: three replicates were sampled in weekly intervals

b) Laboratory analysis: SRI 8610C gas chromatograph located at the laboratory at IRRI, Philippines.

c) Data evaluation: Flux rates calculated using the equation given by Minamikawa et al. (2015).