Appendix B: Supplemental guidance for Water Management in Rice Paddy Fields

The success of water management to reduce methane (CH_4) emissions depends on weather and anthropogenic factors. Water management also needs to consider the effect on rice growth and yield. This appendix details specific requirements, recommendations, and tips to implement water management in rice paddy fields. See also the appendix C for how to decide the SF_w in specific cases.

1. Rice growth stages not to be severely drained

Rice paddy fields do not need to be continuously flooded to attain sufficient rice yield. However, there are known specific rice growth stages in which the fields should not be severely drained. One is the rooting stage for stable plant establishment, and another is the heading stage for physiological water demand. For avoiding the risk of rice yield loss, these growth stages should be taken into consideration when designing the water management plan before starting the project.

2. Artificial drainage

Artificial drainage by using pump and/or opening water outlet is not originally implemented under AWD for the primal purpose of water saving. However, there are cases that irrigation water is plentiful depending on time and location. This methodology therefore does not exclude the implementation of the artificial drainage as far as it does not cause significant rice yield reduction.

3. Timing of implementing single drainage

Single drainage, called midseason drainage, is a common practice in East Asia for sound rice growth and the resultant better yield. The midseason drainage is typically implemented in the tillering stage. This period is usually consistent with when CH_4 flux (emission rate) increases, thereby it reduces the seasonal total emission. The timing of the single drainage should be decided with considering CH_4 emission reduction as well as sound rice growth.

4. Number of days of which the water level is between 0 cm and −15 cm

This methodology assumes that every farmer aims at lowering the water level to −15 cm to achieve one drainage event as defined. However, lowering the water level to −15 cm is not always achievable because of rainfalls (especially in wet seasons), low location,

etc. Through compiling the scientific evidence[1], this methodology considers the following conditions are practically equivalent to one drainage event in a conservative manner: keeping the water level between 0 cm and −15 cm for total of 10 days consisting of at least 3 consecutive days. This alternate index can also be used for monitoring of water (non-)existence by remote sensing if project participants demonstrate its satisfied accuracy.

5. Water level during nitrogen fertilizer topdressing

The water level of which, during a few days and after the nitrogen (N) fertilizer topdressing, affects the N use efficiency of rice plants and the N_2O emission. To minimize the N loss through the ammonia volatilization as well as N_2O emission, fields should be kept flooded during this period, if not continuously flooded. Therefore, farmers need to pay attention to the water level when conducting N fertilizer topdressing in single- or multiple-drained fields. The water level at the basal fertilizer application can be assumed to be equivalent among the fields with different water management practices.

[1] Jiang et al. (2019) analyzed a global dataset and reported that CH_4 emission decreased with increasing the number of unflooded days during a rice growing period except the end of season drainage. By recalculating raw data in Minamikawa et al. (2021), it is confirmed that keeping the water level between 0 cm and −15 cm for total of 10 days during a rice growing period except the end of season drainage can decrease CH_4 emission comparable to the single drainage (i.e., SF_w; reduction by 29%).