Overview of the Paddy Rice Research Group

5th Council Meeting

8-11 September 2015
Des Moines, Iowa,
U. S. A.

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Paddy Rice Research Group – Vision

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- Paddy rice production causes significant **methane emissions** in comparison to other cropping systems.
- The Paddy Rice Research Group is working together to find ways to reduce the emissions intensity, while improving overall production efficiency of paddy rice.
- Trade-offs with emissions of **nitrous oxide** and changes of the quantity of **carbon stored in paddy soils** are also being considered.

Paddy Rice Research Group

- **Co-chairs**

  Kazuyuki Yagi, NIAES, Japan 

  Gonzalo Zorrilla, INIA, Uruguay 

- **Action plan:**

  1. Standardize measurement techniques
  2. Database of experimental sites
  3. Increase country participation
  4. Pilot multi-country experiment
  5. Network for mitigation and adaptation synergies

Paddy Rice Members

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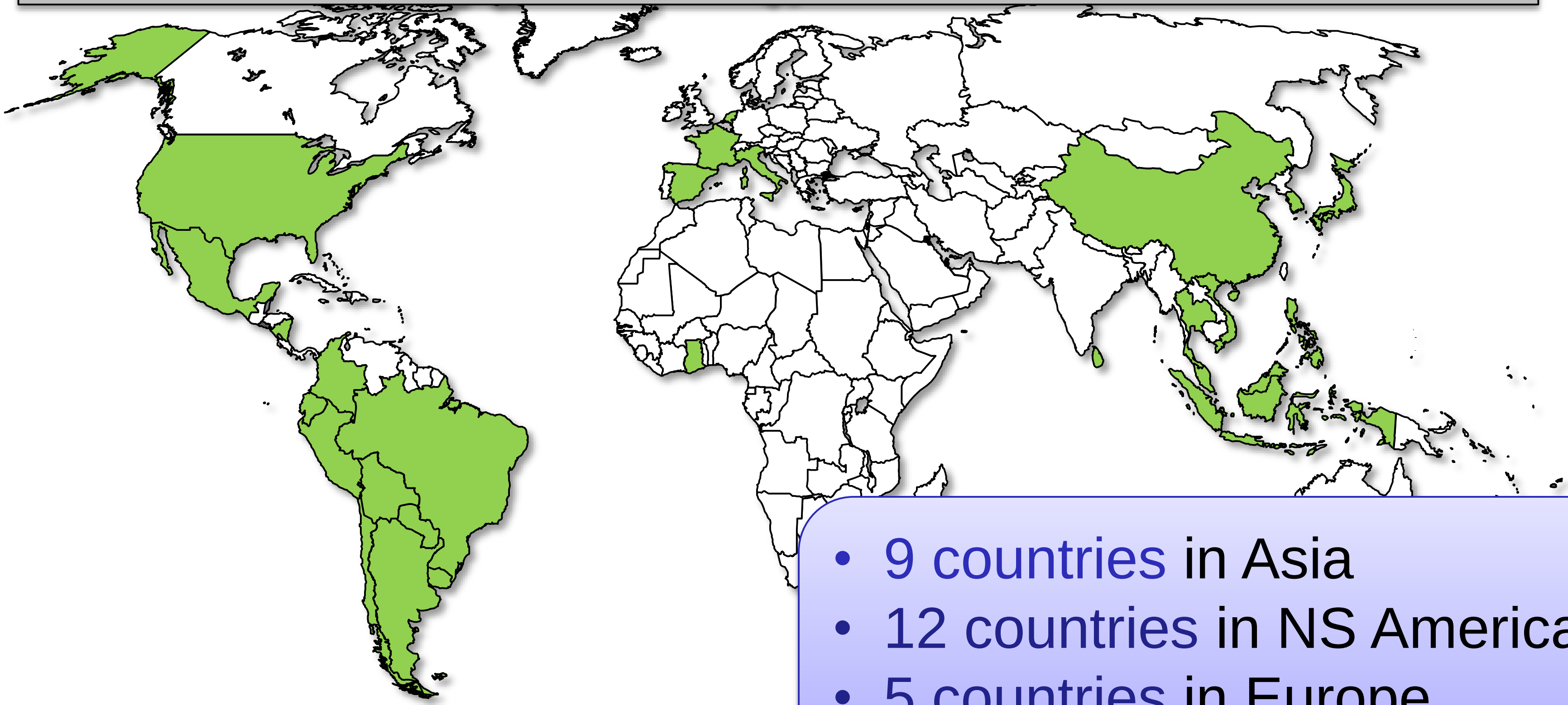
- **27 countries** are members of the paddy rice group



- 9 countries in Asia
- 12 countries in NS America
- 5 countries in Europe
- 1 country in Africa

Paddy Rice Research Group 2014

America Sub-Group Meeting

May 2014, CIAT, Colombia

Asia Sub-Group Meeting

August 2014, IRRI, Philippines

- The Group is structured into two regional sub-Groups: **America** and **Asia,** as a practical way of organizing the Group, in order to ensure meetings can be attended by more member countries.
- However, the Groups will share and agree on **the same workplan**.

Paddy Rice Research Group 2015

America Sub-Group Meeting

February 2015, EMBRAPA, Brazil

- Alongside the XII Latin American and The Caribbean International Rice Conference 2015
- Attended by 6 Alliance member countries and 3 partner institutions.

Asia Sub-Group Meeting

September 2015, Nanjing, China

12th ESAFS
2015
NANJING CHINA

- in conjunction with the 12th International Conference of East and South East Asia Federation of Soil Science Societies (ESAFS2015)
- Expected to be attended by 6 Alliance member countries and 3 observer/partner institutions.

Paddy Rice Research Group – **Partners & Networks**

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- The Group collaborates with **partners** (IRRI, CIAT, CCAFS) and **other international networks** (MARCO, PROCISUR, FluxNet).
- Some **rice experts** from non-member countries are actively participating in the Group's activities.
- The Group endorsed to collaborate with the Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (**CCAC**) to their new agricultural component focusing on mitigating methane emissions from paddy rice.

From Stocktake towards Support

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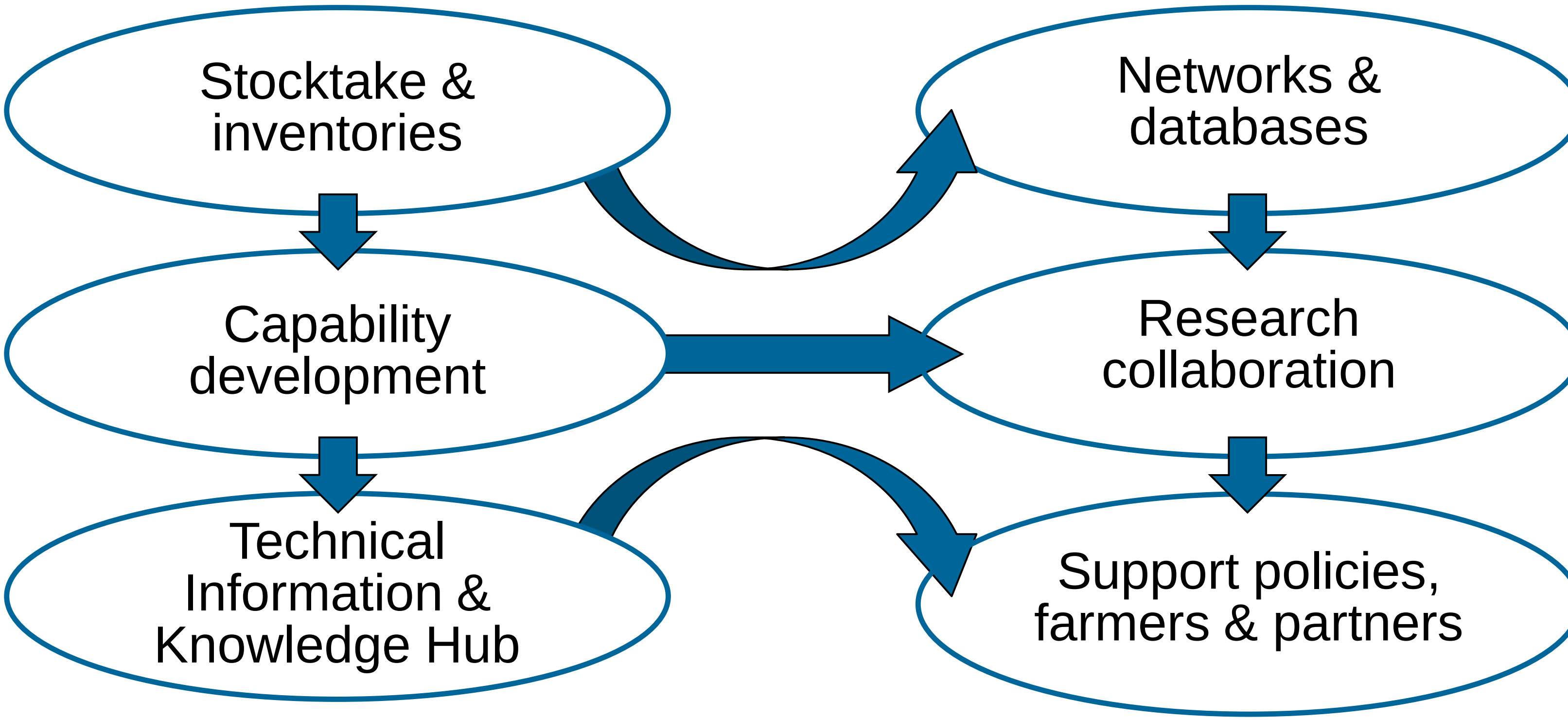

Common understanding **Concerted actions**

Paddy Rice Research Group – **Database**

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- A new proposal to develop **a database (DB) of experimental sites** was endorsed.
- **Spreadsheets** for data input were circulated to member countries in early 2015.
- The DB compiles **metadata** from experimental sites throughout the world where greenhouse gas fluxes are monitored.
- This activity collaborates with the **MAGGnet** activity of the Cropland Research Group.

Paddy Rice Research Group – **Research Collaboration**

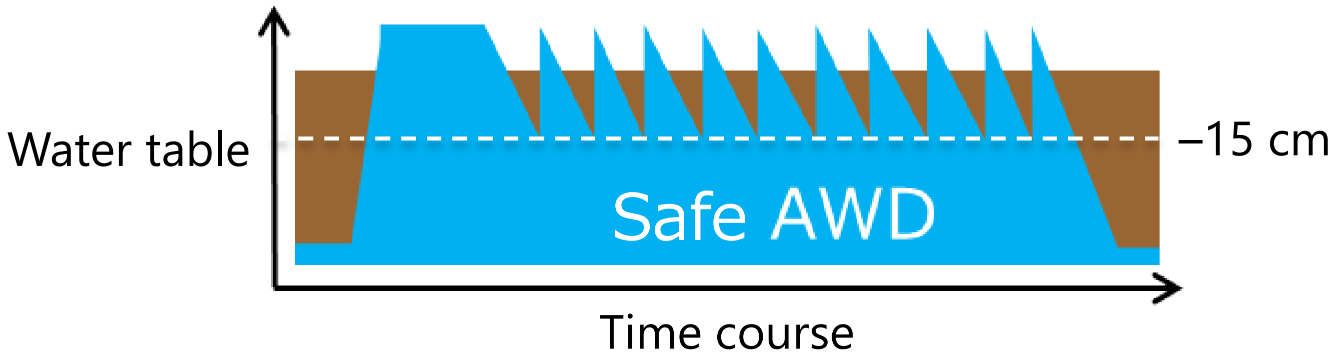
- A multi-country research project for Southeast Asia, **MIRSA**, was launched in 2013.
- A concept note for similar multi-country project in NS America was prepared.

AWD: Alternate Wetting and Drying

The term "AWD" is now used as a common term that denotes "water management practice during rice growing period."

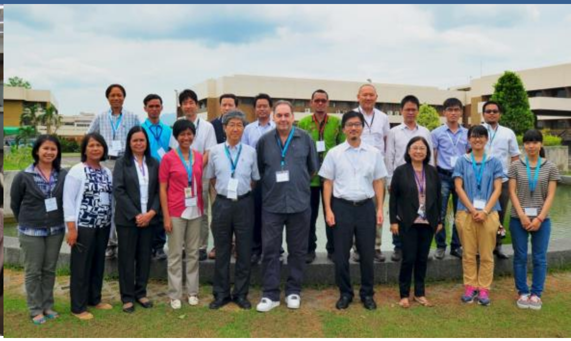
In the MIRSA project, 3 practices are shared and tested at all the sites.

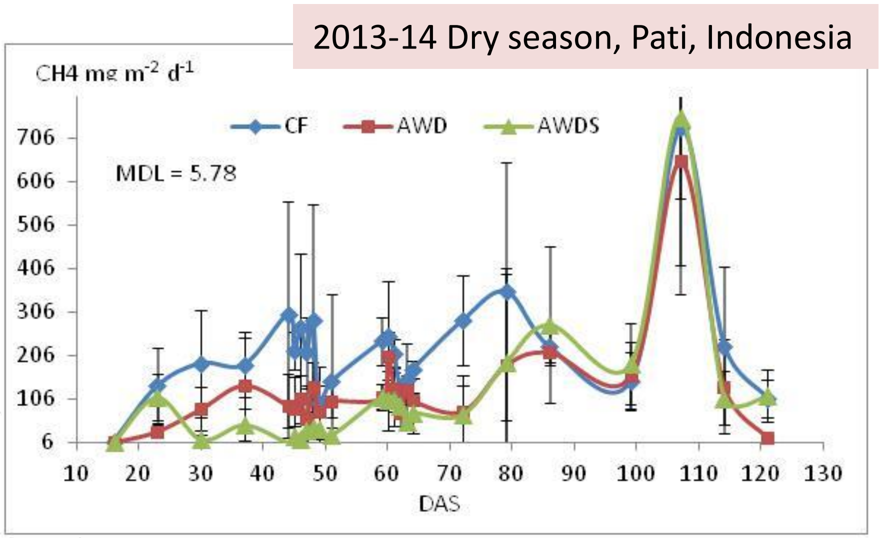
1. **Continuous flooding**: as the reference practice
2. **Safe AWD**: naturally drained until the surface water table reached –15 cm; and then irrigated…
3. **Site-specific AWD**: established based on scientific experience of each monitoring site (i.e., can differ in the practice among the sites)



MIRSA Project

(Greenhouse Gas Mitigation in Irrigated Rice Paddies in Southeast Asia)





- A research project funded by MAFF, Japan, from 2013 to 2018
- Aiming at assessing the feasibility of GHG mitigation through water saving techniques (AWD) in irrigated rice fields
- Results shows effectiveness of AWD to reduce CH_4+N_2O emissions

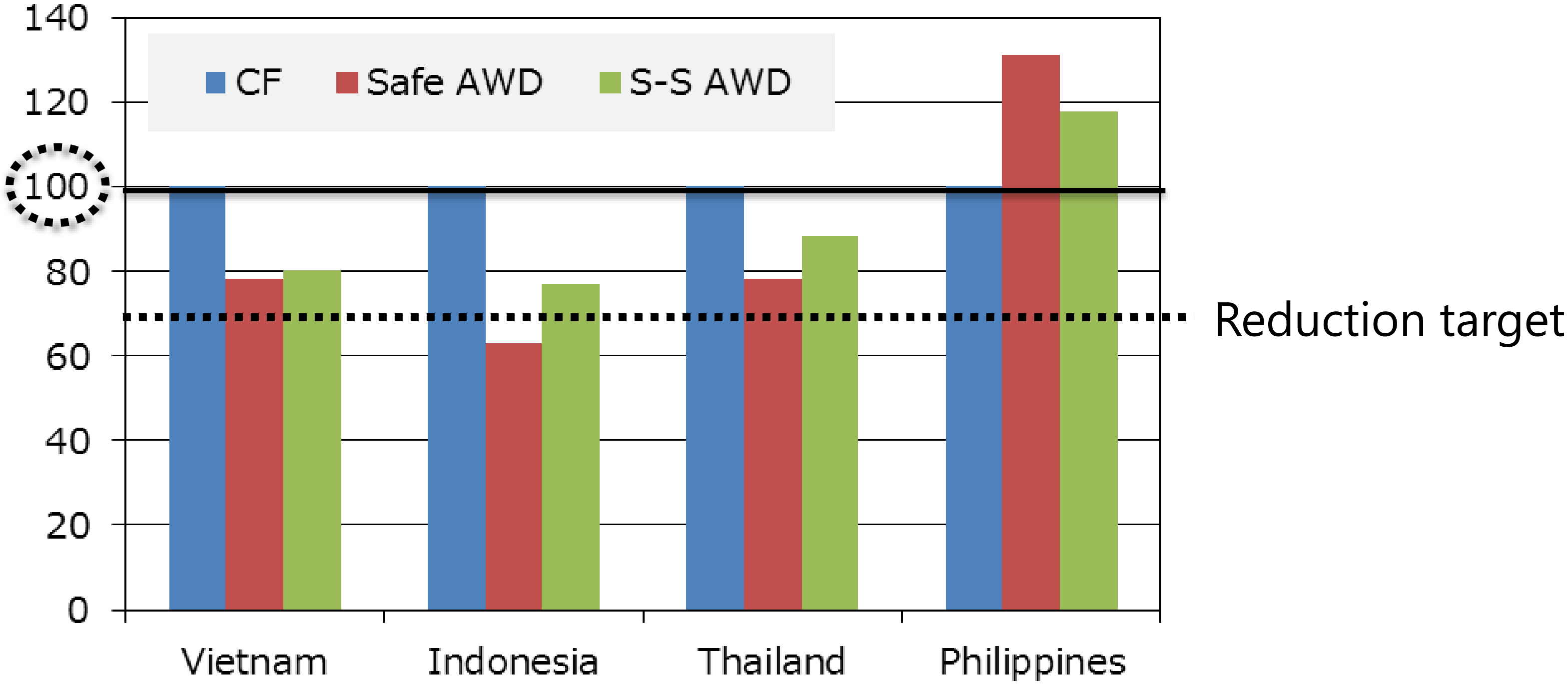

Indonesia


Thailand


Philippines


Vietnam

Research Progress: Field Monitoring



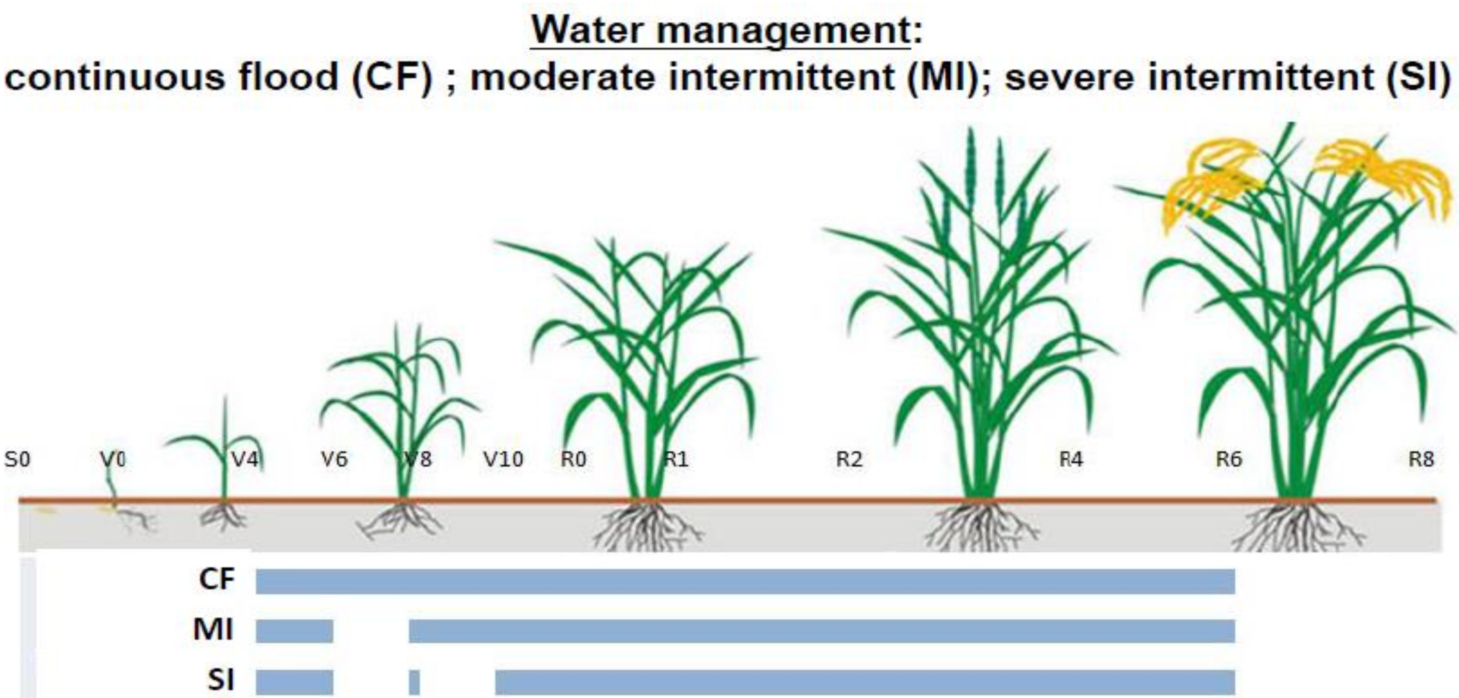
AWD's reduction potential of CO_2-equivalent CH_4+N_2O emission in the first year (the first two seasons) at the four sites.

Represented as the relative value to that from Continuous Flooding treatment within each site (100).

Research Activities in South America

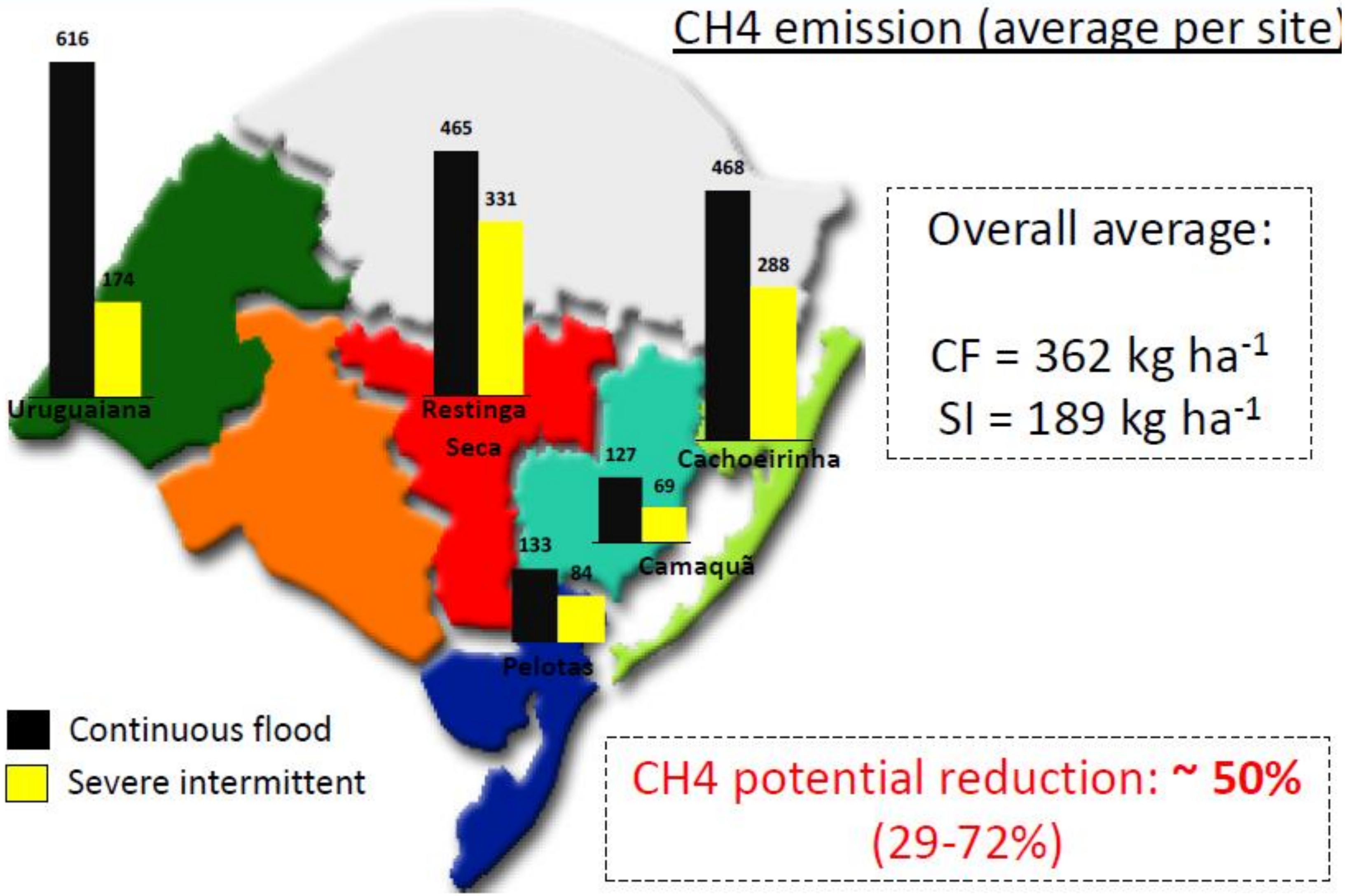
AWD Brazil

T. Zschornack - UFRGS



Significant reductions in CH4 emissions and no yield penalty

Results



Overall average:

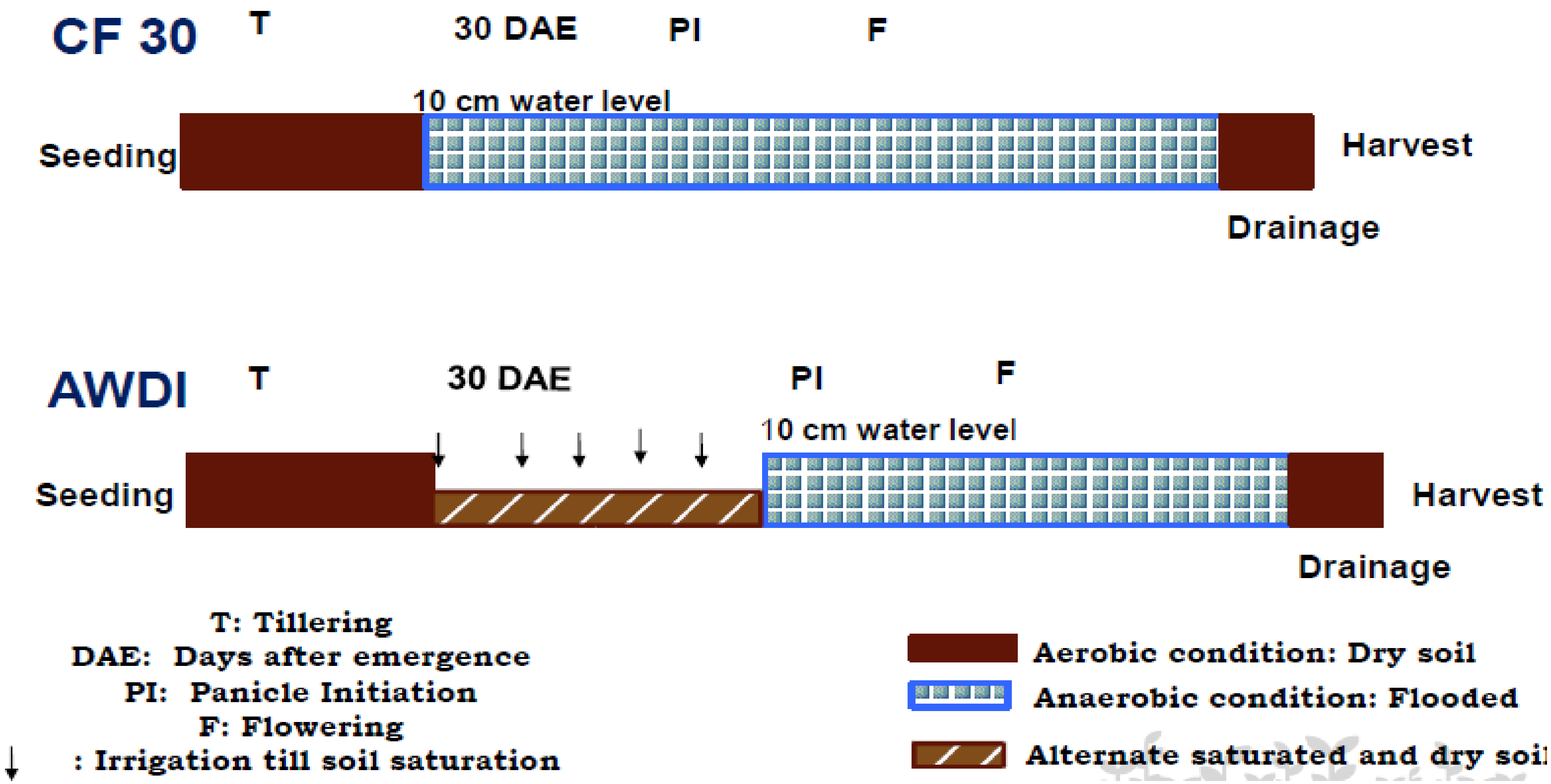
CF = 362 kg ha^{-1}

SI = 189 kg ha^{-1}

CH4 potential reduction: ~ **50%**
(29-72%)

AWD Uruguay

S. Tarlera, P. Irizarri , A. Roel – UDELAR, INIA



Mean seasonal Scaled GWP down from 0,58 to 0,31 kg of CO2 eq per kg of rice produced (47%)

10 % yield penalty

AWD Colombia

Proposed focus technology: Alternate Wetting and Drying (AWD)

- Periodic drying and re-flooding of rice fields



- Safe AWD = Irrigate when water depth ~ -15 cm
- Reduces methane emission ~40-50%
- Saves irrigation water ~15-35%

Include other mitigation options,
e.g. altered straw management

Other approachs to reduce emissions

- Rotations with other crops reduce emissions and increase land productivity
- Anticipated tillage (not in winter)
- No-till systems reduce emissions compared with conventional tillage

Summary of America´s Sub–Group Actions

- Created less than two years ago
- Substantially increased country participation in the region
- Community of practice formed by scientists (Brazil, Argentina, Chile, Colombia and Uruguay) sharing knowledge and techniques
- Several member countries do not have conditions to start research yet (Paraguay, Bolivia, Perú, Ecuador)
- Multi-country project is difficult to fund

Paddy Rice Research Group – **Technology Transfer**

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- The Group made a comparison of **the measurement protocols** at different countries.
- Experts have analyzed **automated measurement data** for the closed chamber technique.
- From these exercises, experts in the MIRSA Project published the 1st version of the Guidelines for measurement techniques at the website of the NIAES, Japan, in August 2015.
- The Group further plan to develop a standardized methodology of MRV for rice GHG emissions.

Measurement Guidelines just published

Guidelines for Measuring CH_4 and N_2O Emissions from Rice Paddies by a Manually Operated Closed Chamber Method

NIAES

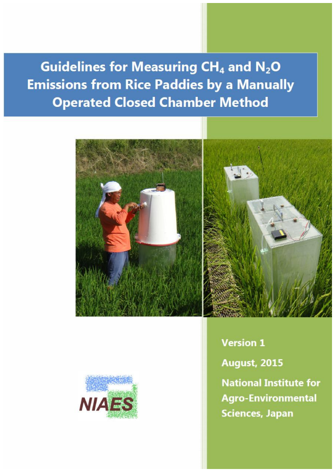
Version 1

August, 2015

National Institute for Agro-Environmental Sciences, Japan

Officially published online on 11 Aug.
Available from NIAES's webpage:
http://www.niaes.affrc.go.jp/techdoc/mirsa_guidelines.pdf

Measurement Guidelines: Contents


Guidelines for Measuring CH_4 and N_2O Emissions from Rice Paddies by a Manually Operated Closed Chamber Method

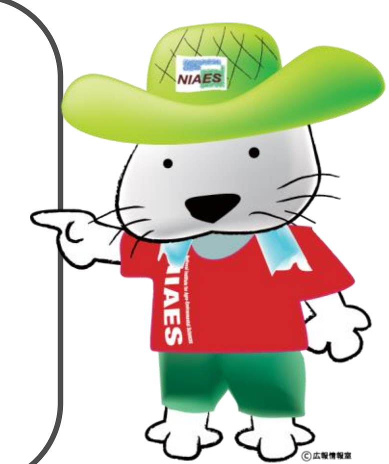
Version 1

August, 2015

National Institute for Agro-Environmental Sciences, Japan

NIAES

- Totally 76 pages,
- Minimum requirements are summarized as "Recommendations" at the beginning,
- Practical and technical methods for each step of measurements are described with photos/illustrations and scientific bases,
- Some unsolved problems are discussed as "evolving issues".



Recommendations

Gas sampling

Category	Minimum requirements and *recommendations*
Period	✓ Determine the measuring period according to the research objectives. ✓ The measurement period should encompass the entire rice growing period for the estimation of seasonal emissions of CH_4 and N_2O. · *In accordance with IPCC recommendations, to calculate the N_2O emission factor, measurements should be obtained throughout a year.*
Time of day	✓ Mid-morning during flooded rice-growing periods (measure once daily to obtain the daily mean CH_4 flux). ✓ Measure all treatments at the same timing. · *Daytime during temporary drainage events during the rice growing period.* · *Late morning during dry fallow periods.* · *Measure the N_2O flux concurrently with the CH_4 flux.*
Frequency	✓ At least weekly during flooded rice-growing periods. ✓ More frequently during agricultural management events (e.g., irrigation, drainage, and N fertilization) and some natural events (e.g., heavy rainfall). · *Weekly or biweekly during dry fallow periods.*

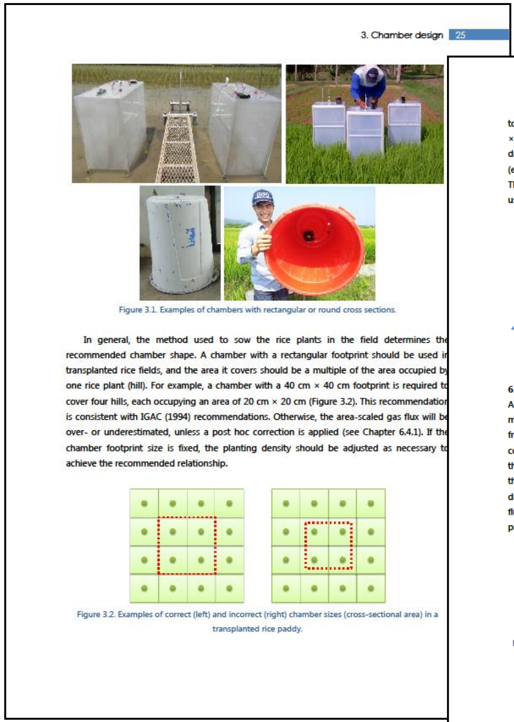
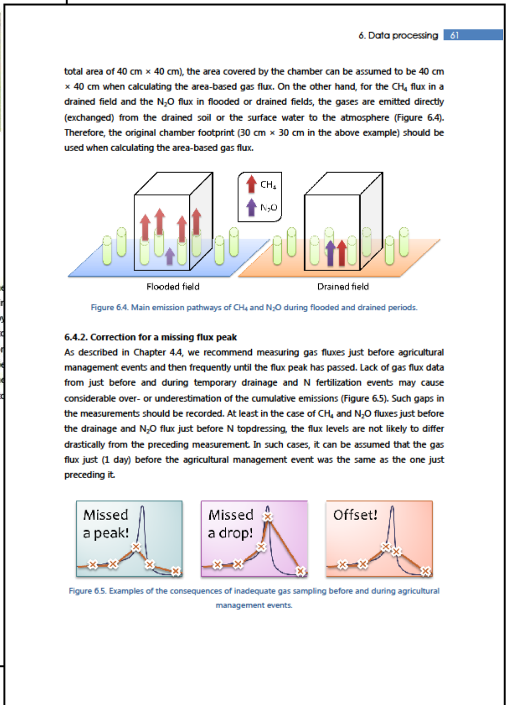

3. Chamber design 25

Figure 3.1. Examples of chambers with rectangular or round cross sections.

In general, the method used to sow the rice plants in the field determines the recommended chamber shape. A chamber with a rectangular footprint should be used in transplanted rice fields, and the area it covers should be a multiple of the area occupied by one rice plant (hill). For example, a chamber with a 40 cm × 40 cm footprint is required to cover four hills, each occupying an area of 20 cm × 20 cm (Figure 3.2). This recommendation is consistent with IGAC (1994) recommendations. Otherwise, the area-scaled gas flux will be over- or underestimated, unless a post hoc correction is applied (see Chapter 6.4.1). If the chamber footprint size is fixed, the planting density should be adjusted as necessary to achieve the recommended relationship.

Figure 3.2. Examples of correct (left) and incorrect (right) chamber sizes (cross-sectional area) in a transplanted rice paddy.


6. Data processing 61

total area of 40 cm × 40 cm), the area covered by the chamber can be assumed to be 40 cm × 40 cm when calculating the area-based gas flux. On the other hand, for the CH_4 flux in a drained field and the N_2O flux in flooded or drained fields, the gases are emitted directly (exchanged) from the drained soil or the surface water to the atmosphere (Figure 6.4). Therefore, the original chamber footprint (30 cm × 30 cm in the above example) should be used when calculating the area-based gas flux.

Figure 6.4. Main emission pathways of CH_4 and N_2O during flooded and drained periods.

6.4.2. Correction for a missing flux peak

As described in Chapter 4.4, we recommend measuring gas fluxes just before agricultural management events and then frequently until the flux peak has passed. Lack of gas flux data from just before and during temporary drainage and N fertilization events may cause considerable over- or underestimation of the cumulative emissions (Figure 6.5). Such gaps in the measurements should be recorded. At least in the case of CH_4 and N_2O fluxes just before the drainage and N_2O flux just before N topdressing, the flux levels are not likely to differ drastically from the preceding measurement. In such cases, it can be assumed that the gas flux just (1 day) before the agricultural management event was the same as the one just preceding it.

Figure 6.5. Examples of the consequences of inadequate gas sampling before and during agricultural management events.

Paddy Rice Research Group – Mit. & Adapt. Synergies

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- **Possible options** for mitigation and adaptation synergies relate to paddy rice were Identified.
- The Group agreed to consider the discussion of the synergy activities and the review of current activities underway in the work plan within the **Network** created.
- Vietnam, with the support of Indonesia and other experts coordinate the development of this framework.

Paddy Rice Research Group – Goals

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Short-term goals:

1. The **database** of experimental sites is compiled and shared in the Group.
2. A network for **mitigation and adaptation synergies** is developed.
3. A multi-country mitigation-adaptation **project in north-south America** is launched.

Paddy Rice Research Group – **Goals**

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ON AGRICULTURAL GREENHOUSE GASES

Long-term goals:

1. **A standardized methodology of MRV** for rice GHG is developed.
2. Several **international research projects** and **capacity building activities** for local experts are carried out by promotion and collaboration of the Group members.
3. All countries with relevant rice production come to have **involvement** in the activities of the Group.

Paddy Rice Research Group – **Message to the Council**

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- Greater **mobilization of resources** (experts and funds) is requested to the member countries in order to support the workplan activities
  - *At least*, support to attend Group meetings
- Strengthening the two PRRG **Sub-groups**:
  - Americas: S America + N&C America + Europe
  - Asia: inclusion of big rice countries (India, Bangladesh, Cambodia, Australia, …, + Europe)
- Links to the projects of **CCAFS and other partners** with similar objectives
- Capability building activities in **Africa**?