Overview of the Paddy Rice Research Group

3rd Meeting of the Americas Sub-Group

13 July 2016

Dale Bumpers National Rice Research Center (DBNRRC) , Stuttgart, Arkansas, USA

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Paddy Rice Research Group – Vision

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

- 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 – **Overview**

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- The Group's work is focused on **helping provide knowledge** of source/sink extents and mitigation options to paddy rice farmers, land managers and policy makers by looking at the impacts of water management, organic matter and fertilizers, cultivation systems and cultivar selection.
- It will also improve countries' **national inventories** of greenhouse gas emissions from paddy rice cultivation systems.

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Paddy Rice Research Group

- **Co-chairs**

  Kazuyuki Yagi, NIAES, Japan

  Gonzalo Zorrilla, INIA, Uruguay

- **Action plan:**

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

Paddy Rice Research Group: 2010-2013

1st Group Meeting
September 2010, Tsukuba, Japan


2nd Group Meeting
March 2011, Versailles, France


3rd Group Meeting
November 2011, Tsukuba, Japan


4th Group Meeting
January 2013, Los Baños, Philippines


Paddy Rice Research Group

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Paddy Rice Research Group 2013

Latin-American Regional Workshop

by GRA-PRRG & PROCISUR

June 2013, Montevideo, Uruguay

5th Group Meeting (Asia)

October 2013, Bogor, Indonesia

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

- in conjunction with the 12th International Conference of East and South East Asia Federation of Soil Science Societies (ESAFS2015)
- Attended by 5 Alliance member countries and 3 observer/partner institutions.

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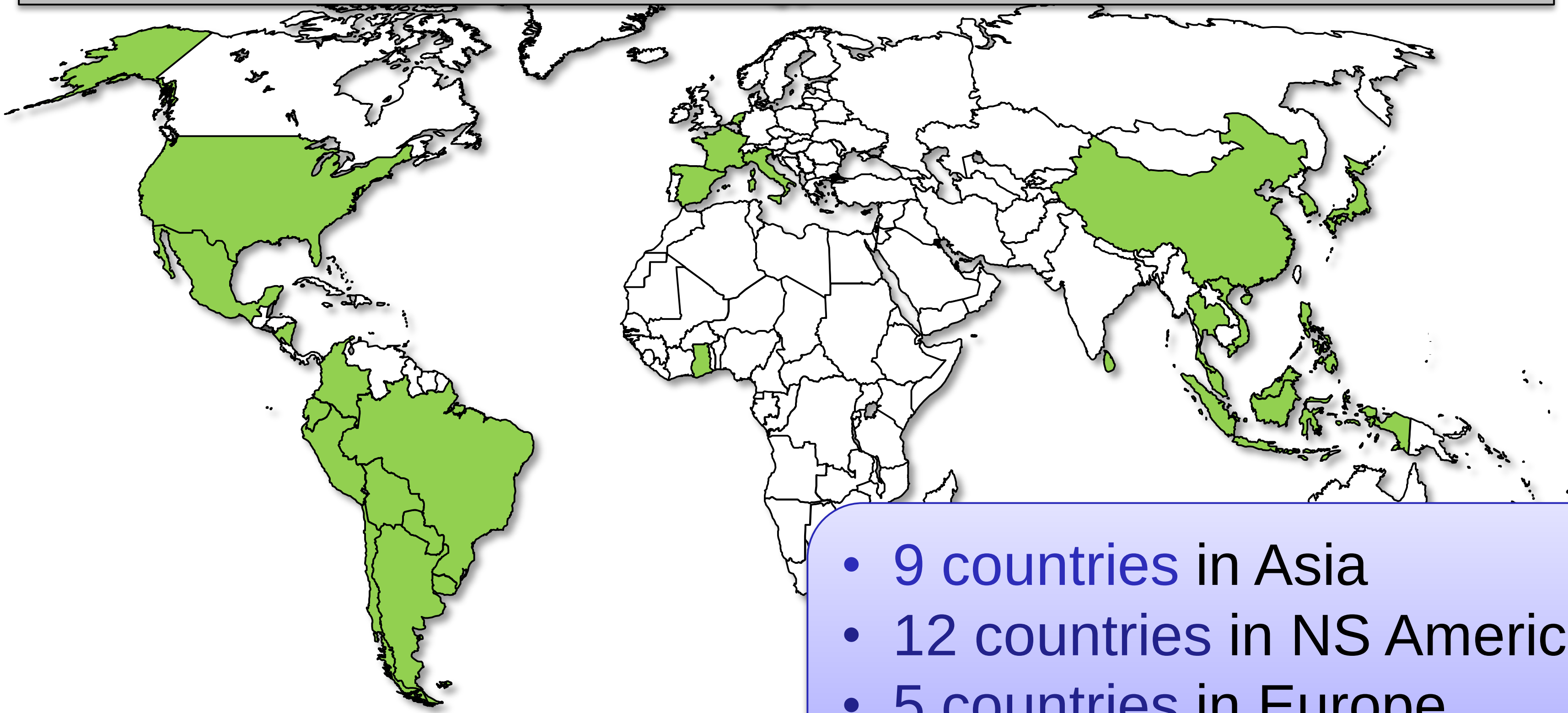
Paddy Rice Members

- **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 – **Partners & Networks**

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- The Group collaborates with **partners** (IRRI, CIAT, CCAFS) and **other international networks** (PROCISUR, FluxNet).
- Some **rice experts** from non-member countries (India, Pakistan, etc.) 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.
- The Group invited the Environmental Defence Fund (**EDF**) to the Asia sub-group meeting 2015 for collaboration.

From Stocktake towards Support

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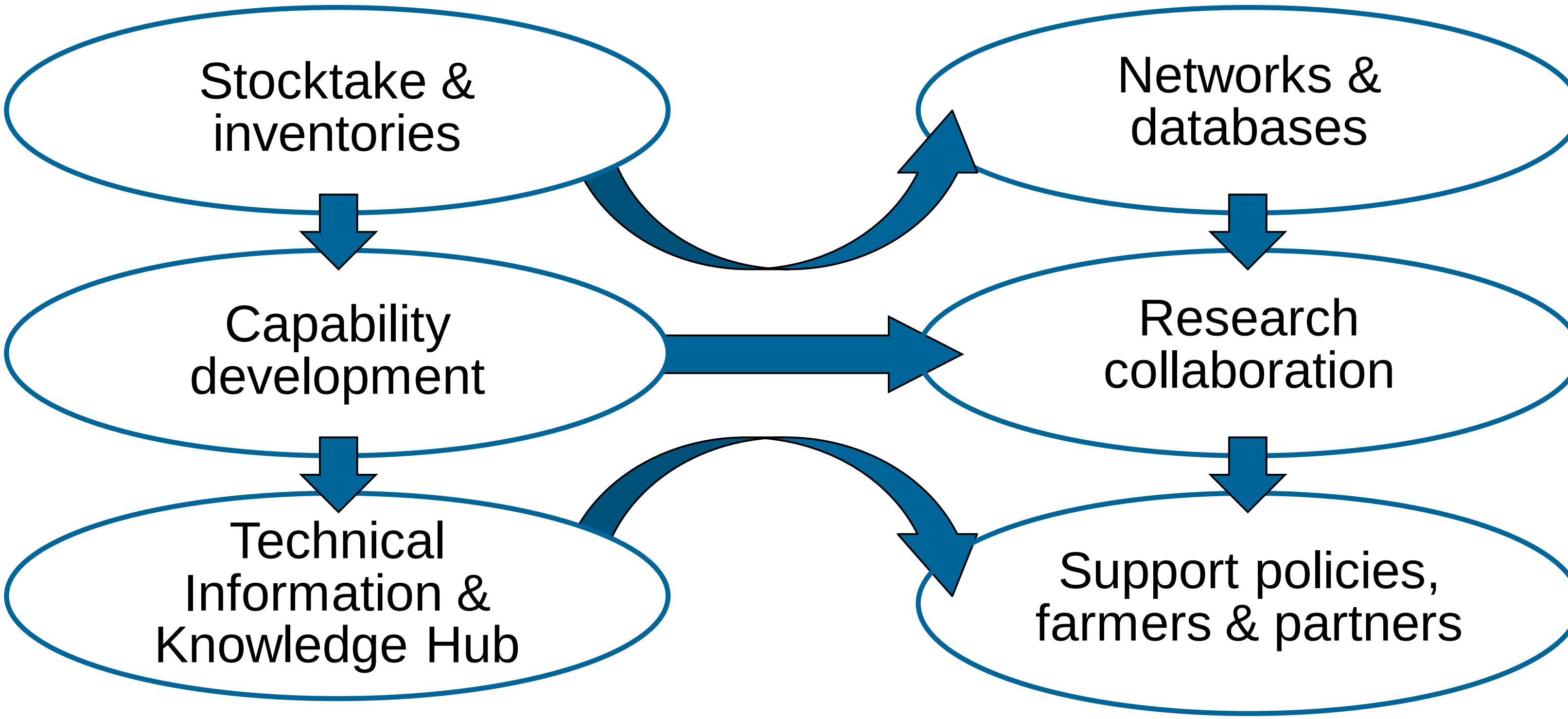

Common understanding **Concerted actions**

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 published

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

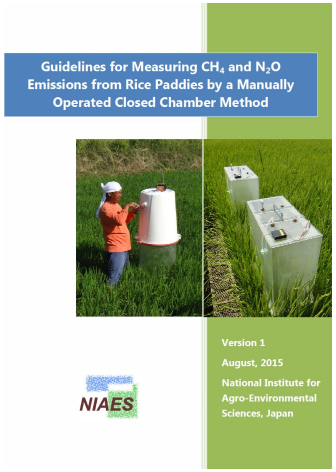
Preface
Table of contents
Recommendations
- Experimental design
- Chamber design
- Gas sampling
- Gas analysis
- Data processing
- Auxiliary measurements

Evolving issues
1. Experimental design
2. Chamber design
3. Gas sampling
4. Gas analysis
5. Data processing
6. Auxiliary measurements

References
Appendices

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

Measurement Guidelines: Contents



- 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.*

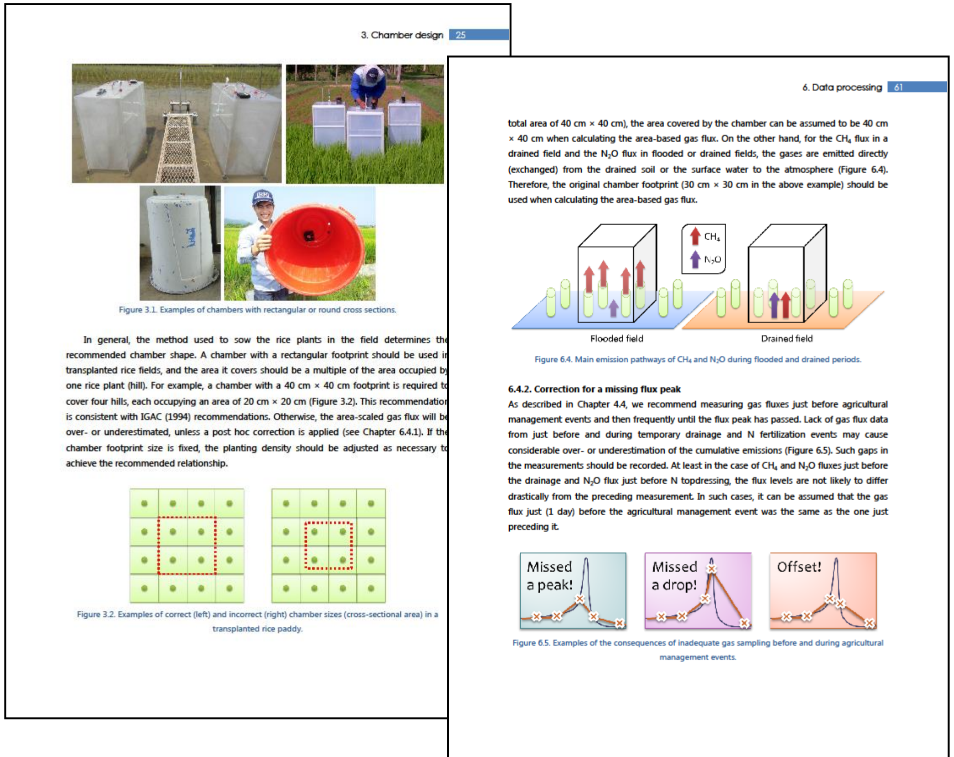

3. Chamber design 25

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 th[illegible] recommended chamber shape. A chamber with a rectangular footprint should be used i[illegible] transplanted rice fields, and the area it covers should be a multiple of the area occupied b[illegible] one rice plant (hill). For example, a chamber with a 40 cm × 40 cm footprint is required t[illegible] cover four hills, each occupying an area of 20 cm × 20 cm (Figure 3.2). This recommendatio[illegible] is consistent with IGAC (1994) recommendations. Otherwise, the area-scaled gas flux will b[illegible] over- or underestimated, unless a post hoc correction is applied (see Chapter 6.4.1). If th[illegible] chamber footprint size is fixed, the planting density should be adjusted as necessary t[illegible] 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 – 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 for designing DB.
- 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**

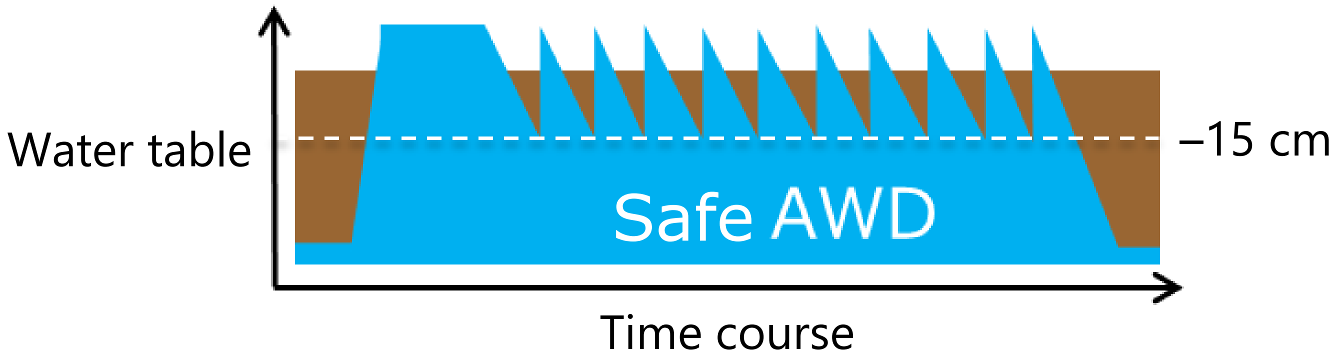
- A multi-country research project for Southeast Asia, **MIRSA**, was launched in 2013.
- A concept note for similar multi-country project in NS America was prepared.

AWD: Alternate Wetting and Drying

As far as I know, the term "AWD" is now used as a common term that denotes "water management practice during rice growing period."

In our project, the three practices are shared and tested at all the sites.

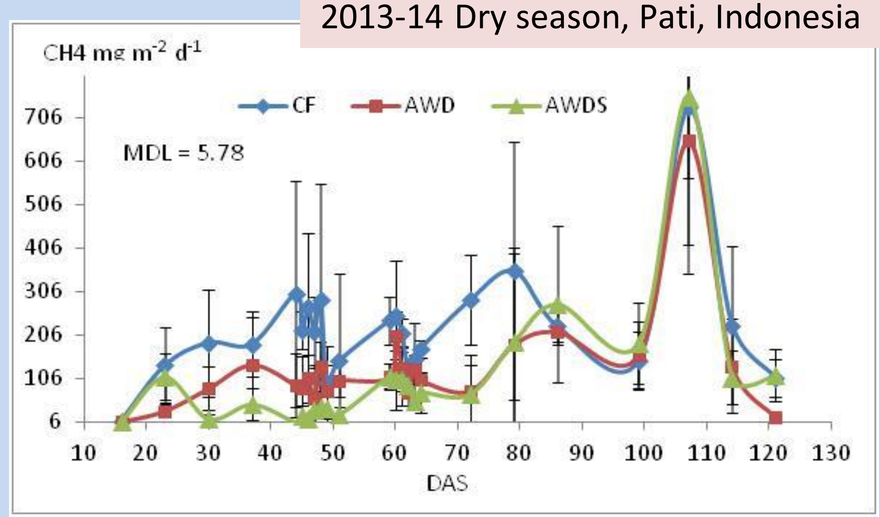
1. **Continuous flooding**: as reference practice
2. **Safe AWD**: naturally drained until the surface water table reaches –15 cm; and then irrigated...
3. **Site-specific AWD**: established based on scientific experience of each monitoring site (i.e., can differ in the practice among the sites)



MIRSA Project

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

2013-14 Dry season, Pati, Indonesia



- 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

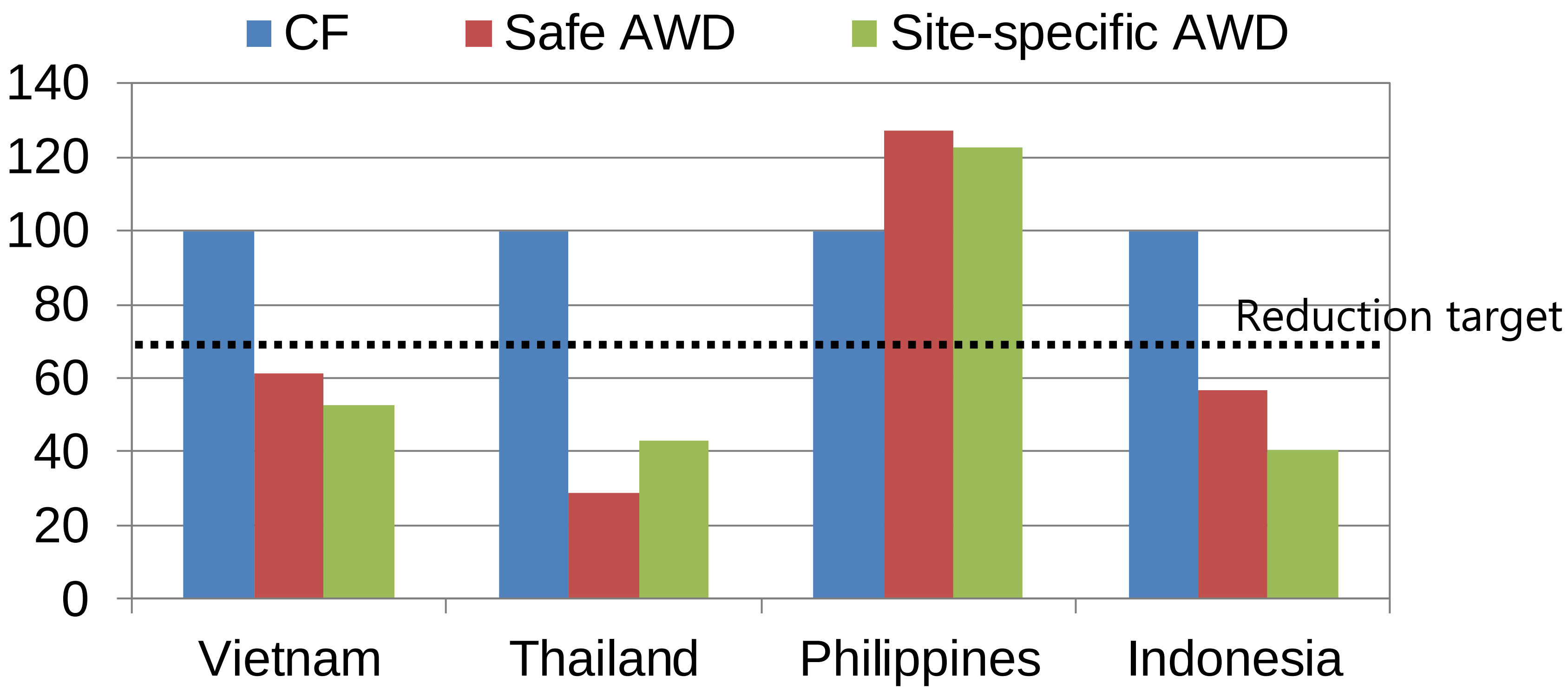

Indonesia


Thailand


Philippines


Vietnam

Research Progress: Field Monitoring



- CH_4 + N_2O emissions from the three practices in 3rd experimental season (2015 dry season) of the four countries.
- Represented as the relative value to that from Continuous Flooding treatment within each site (100).

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

GLOBAL RESEARCH ALLIANCE 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 to rice production come to have **involvement** in the activities of the Group.

Paddy Rice Research Group – Next meetings/milestones

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- **Asia sub-Group Meeting 2016** is planed, but not fixed yet, possibly in Thailand.
- In **2017**, some activities alongside the GRA Council Meeting and GRA International Conferences (venue TBD)?
- **A special issue** for rice GHG mitigation in the scientific journal, *Soil Science and Plant Nutrition*, is planed to publish in early 2018.
    - Call for paper in 2016
- **A scientific session** for rice GHG mitigation is proposed at the 21st World Congress Soil Science (WCSS21) in Rio de Janeiro, Brasil, August 12–17, 2018.