

## Paddy Rice Research Group Meeting

Sparrow Room, Swaminathan Hall, International Rice Research Institute (IRRI), Los Baños, Laguna, Philippines

22-23 January 2013

# Meeting Report

## OVERVIEW

The fourth meeting of the Paddy Rice Research Group of the Global Research Alliance on Agricultural Greenhouse Gases (“the Alliance”) was held at the International Rice Research Institute (IRRI), Los Baños, Laguna, Philippines as one of three workshops across the week of 21-24 January 2013 dealing with greenhouse gas emissions from paddy rice.

The Alliance meeting was chaired by Japan (Dr Kazuyuki Yagi, NIAES) as Chair of the Paddy Rice Research Group.

This report is a summary of the key discussions and outcomes of the meeting. PDF’s of the presentations are provided separately on the member’s area of the Global Research Alliance website.

## PARTICIPANTS

The meeting was attended by 52 participants, representing 6 Alliance member countries, 1 non-member country, representatives from Paddy Rice Research Group Partner organisations of IRRI, CCAFS and other invited experts.

- **Alliance Members attending:** China, Indonesia, Japan, Malaysia, Philippines, Viet Nam.
- **Alliance Members unable to attend:** Argentina, Colombia, France, Ghana, Mexico, Netherlands, Peru, Republic of Korea, Spain. Uruguay, USA
- **Partner organisations attending:** International Rice Research Institute (IRRI), Climate Change and Food Security (CCAFS),

## **MEETING OUTCOMES**

The meeting achieved the following outcomes:

- Update on research activities in Member Countries.
- Update from the Alliance Secretariat on the latest Council meeting and the agreed Research Group reporting requirements.
- Updates on the other Research Groups of the Alliance.
- Presentations from invited speakers including information about the decision support tool for rice emissions from Tim Searchinger of Princeton University, USA and new trends in crop management and field experiments at IRRI.
- Further discussion on the work areas identified at the last meeting, and development of the identified activities in the Group Workplan.
- Next steps for the Group and discussion about future meetings.

## **SUMMARY OF DISCUSSIONS**

### **OPENING REMARKS**

The meeting was opened by Dr Achim Dobermann, Deputy Director of Research at IRRI who was pleased to welcome the Paddy Rice Research Group and contribute to discussions of the Group relating to greenhouse gas mitigation and measurement. Dr Dobermann outlined some of the important contributions from IRRI's 20 years of history in measuring methane emissions from paddy rice and development of measurement techniques and greenhouse gas emission estimates that are used globally.

Research programmes at IRRI now focus on the global warming potential of rice based crop systems, including measuring all greenhouse gases to capture trade-offs through new technologies such as using eddy co-variance techniques. Research is also ongoing on practical mechanisms such as reducing soil tillage, and crop diversification to reduce global warming potential in rice systems and account for shifts in climate and farming practices 10-15 years in future.

Measurement of gas emissions is important but one component only –we need to find mitigation options that are easy for farmers to adopt, the Group is encouraged to identify these practical solutions and bring to the attention of policy.

### **UPDATE FROM THE SECRETARIAT**

The Secretariat provided a brief overview on the Global Research Alliance on agricultural greenhouse gases including participating member countries and partners, general organisation and structure of the Alliance Research Groups and some examples of current activities underway by the Groups

An update from the most recent meeting of the Alliance Council in Saskatoon, 5-8 June 2012 and the agreed outcome on regular reporting on Research Groups

activities to the Alliance Council. The full presentation is summarised below (refer separate PDF presentation).

### **Council Meeting**

Key outcomes of the Council meeting included:

- Canada takes over Council chairing responsibilities from New Zealand.
- Uruguay confirmed as Vice-Chair of Alliance Council.
- Brazil confirmed as Co-Chair of Croplands Research Group.
- New Zealand confirmed to continue as Alliance Secretariat.
- The Communications plan was agreed and adopted. Points in the adopted Communication policy that directly affect the Groups include:
  - External communication on behalf of a Group about their activities will need to be approved by the Group by consensus of Members' nominated contact points. However, Groups may decide to authorise Co-Chairs to communicate information above on its behalf.
  - A disclaimer needs to be used by Members communicating about activities of the Groups they participate in. The disclaimer can be found in the Communication Policy.
- There will be a teleconference every three months between the Council Chair, Vice-Chair, Secretariat and Group Co-Chairs to improve co-ordination between Groups and provide updates on Group activities.
- Once finalised, action plans of the Groups need to be made available to the Council.
- Six monthly and annual reporting to the Council using a common reporting template is required. The template will be developed with Group Co-Chairs and is based on the workplan template shown in the presentation. It was pointed out that this should not be seen as a burden, rather it is a way for Council members to know what is going on in the Groups which, amongst other things, will help to mobilise research funding.
- Alliance Partners need to be integrated into the Groups' work.

### **Alliance Website**

The Alliance website has been updated to make it easier to use. Some of these updates include; multiple sub-pages for each Group, the ability to feature news and events, increased capability for downloading documents, further functionality to help navigate the website's pages, a new search function, and links to Alliance Partners and Networks.

Member Country participants were encouraged to support the development of country specific Alliance webpages. Member activities in support of the Alliance

may be listed on an existing website, such as that of the lead government department/agency responsible for coordinating involvement in the Alliance and then linked to from the Alliance website. It is also possible for the Member country pages to be hosted on the Alliance website, for more details on this please contact the Alliance Secretariat ([secretariat@globalresearchalliance.org](mailto:secretariat@globalresearchalliance.org)).

## UPDATE ON GROUP ACTIVITIES

Co-Chair Dr Kazuyuki Yagi then provided an overview of the Paddy Rice Research Group; its previous meetings and agreed workplan as well as the current activities being undertaken by Group members. The Group last met in Tsukuba, Japan during November 2011 and at that time agreed to a workplan of activities including:

- Developing guidelines to standardise measurement techniques in paddy rice,
- Establishing databases for both publications and scientific experts,
- Promoting the Alliance and Rice Research Group activities to non-Member countries and within own countries,
- Collaborating in a multi-country experiment

This meeting of the Group is jointly hosted by IRRI and PhilRice as a week of meetings relating to greenhouse gas emissions from paddy rice to explore the synergies and similarities between objectives of the Paddy Rice Research Group and the Greenhouse Gas Mitigation in Irrigated Rice Systems: Guidelines for Measurement Reporting and Verification (MIRSA) project. The main objectives of this meeting are outlined below:

- Reviewing the Alliance and Paddy Rice Research Group activities since its last meeting
- Reviewing the ongoing activities of each member through country reports, which relate to greenhouse gas mitigation efforts from paddy rice production.
- Facilitating information exchange among Group members are IRRI scientists on new trends in crop management and advance field experiments

## INVITED PRESENTATIONS

### **Assessment Group for Rice Emission Decision Support Tool**

Dr Tim Searchinger from Princeton University, USA presented the Group with an overview of the mitigation tool under development for paddy rice. This tool was discussed further during the assessment group meeting (24 January) which was held following this Alliance meeting as the third workshop of IRRI's Workshops on greenhouse gas emissions from rice production.

The tool under development aims to identify ways to further the research on mitigation and put it into action, thereby achieving real mitigation results. It will focus on ways to overcome the obstacles and gaps that are faced when implementing research findings at the farm level. The key points from the presentation are outlined below:

1. Develop a decision support tool for greenhouse gas mitigation options from rice
  - Identify where to focus priorities to have the greatest impact.
  - Consider IPCC guidelines which are outdated and limited, but a main source of information for countries developing their national mitigation plans. Current and updated research needs to be communicated to the IPPC and included in these guidelines.
  - For example, soil type is known to have a large influence on emissions; mitigation activities should focus on soils with the greatest potential for reducing emissions.
2. The current baseline greenhouse gas emissions need to be known before mitigation options can be quantified.
3. Identify the management practices that can reduce emissions per unit of rice
4. What is the degree of confidence in the techniques to achieve emissions mitigation (high/medium/low).
5. Consider the economic factors – the cost of implementing the mitigation activity.
6. Practicality of implementing this activity, how easy or difficult will it be for farmers to achieve.

The decision support tool will be a matrix that considers all possible mitigation factors, including some that have already been identified:

- a. Increase crop yield
- b. Changes to soil chemistry
- c. Water level management
- d. Rice variety
- e. Straw management, timing and composting
- f. Fertiliser management
- g. Trade-offs between greenhouse gases
- h. Changes in soil management practices

This tool is under development as a global research project, as part of a broader initiative; the Agricultural Synergies Project which is a series of practical guidance (pasture improvement, intensification with forests, agroforestry). The rice guidance project is not funded currently, but the aim is to produce agricultural guidance in all systems including tools for estimating emission reductions.

### **Effect of iron-materials to reduce methane emissions and promote rice growth in tropical paddy soils**

Dr Kazuyuki Inubushi of Chiba University, Japan presented research on the addition of iron to paddy rice soils as a way of reducing methane emissions and improving yield. Experiment sites across South-East Asia were compared (Indonesia, Thailand, Vietnam, Philippines) and the main outcomes are listed below:

- Addition of amorphous iron can reduce methane emissions.
- This effect is significant in low iron soils, with high iron soils showing less effect.
- If iron is used to reduce methane emissions an increase is also seen in crop yield, although the fertiliser used contained other beneficial nutrients as well as iron.

- Additional iron should not be added to soils with known heavy metal toxicity.
- Methane production potentials were positively correlated with balance of mineralized N content and available Fe content.
- Methane / CO<sub>2</sub> production was also positively correlated with the ratio of mineralized N content and ferrous content.
- This indicated that Takai theory (Takai, 1980) is also useful and soil Fe is important to estimate methane production in South-East Asian paddy soils.
- Methane emission decreased in 11 of 17 crop seasons in Vietnamese paddy fields with the addition of iron containing fertilizer and yield increased in 14 of 17 crop seasons.
- Therefore iron-fertilizer could be effective on yield increase and methane suppression in South-East Asian paddy fields.

### **A feasible option to reduce CH<sub>4</sub> and N<sub>2</sub>O emissions in South Sulawesi, Indonesia by water management**

Dr Kazuyuki Inubushi of Chiba University, Japan also presented an experiment on water management in Indonesia. Two varieties of rice Ciheran and Cigulis were compared in an experiment that also looked at water management options in Indonesia. The management practices compared the local farmers' traditional water management with a reduced water mitigation option.

1. Farmers maintain water at same level, groundwater is kept at approximately 6cm and rice plants are always submerged.
2. The experimental mitigation option keeps the groundwater at 3cm, some parts of the field may be drained.

The experiment found significant reduction in methane emissions by reducing the water level, with no change observed in yield, and no effect on N<sub>2</sub>O emissions. Final conclusions from the project:

- Water management affected the greenhouse gas flux emitted from paddy fields in South Sulawesi, Indonesia; farmers could reduce methane emissions by 37 % with no effect on yield with maximum water level across the field at no more than 6 cm.
- A further 24% of methane reduction could be achieved if farmers were using the rice variety Ciheran and 4% for the Cigulis variety if the maximum water level was reduced to 3 cm.
- No significant changes in N<sub>2</sub>O flux were seen.

### **Effect of water saving and the use of by product in rice paddies of the Mekong Delta**

Dr Yas Hosen of MAFF, Japan presented the results of a mitigation option for rice paddies in the Mekong river delta, Vietnam. Paddy Rice crops in the Mekong delta are almost constantly grown under flood conditions, so this experiment looked at the mitigation effect that could be achieved through alternative water management and organic matter management through treatments of crop residues.

The experiment looked at the following management options for Paddy Rice Crops:

1. Divide field into two water management practices

- Continuous flood conditions
  - Irrigation management using the alternate wetting and drying method (AWD).
2. Three organic matter treatments
- Rice straw remains in the field
  - Rice straw burned and the ash returned to the field
  - Rice straw removed from the field completely.

The experiment found that water management using AWD significantly reduced the global warming potential (GWP) by reducing both CH<sub>4</sub> and N<sub>2</sub>O emissions. The same crop yield could be achieved with AWD water management as from the continuously flooded fields and there was a potential to increase yield with the addition of organic matter in the form of rice straw or straw ash.

It was also shown that continuous flooding means soil is highly reduced, and levels of SO<sub>4</sub> increases under AWD.

## COUNTRY REPORTS

Member countries were asked to provide a brief update on the mitigation research activities they were undertaking, research priorities and focus of future research.

### Japan

Research priorities:

- Developing feasible mitigation options, particularly by water and straw management
- Evaluating mitigation potentials of those options at national scale
- Improving national inventories with using the DNDC-rice model
- Promoting international collaboration to find the possibility of applying agricultural CDM

Current and planned research:

- Mitigation options
  - prolonged mid-summer drainage (completed)
  - improvement of soil drainage
  - straw management
  - minimum or shallow tillage
- Modeling
  - further revisions of the DNDC-rice model
  - Tier 3 calculation of national inventory
- LCA and implementation to carbon trading schemes
- Greenhouse gas emissions under future atmospheric CO<sub>2</sub> and temperature
- International collaborations
  - MIRSA
  - Thailand, China, Philippines, Vietnam, Indonesia, Bangladesh, ...

### Philippines

Mitigation activities

- Assessment of methane emission potential of rice cultivars in varying agroecosystems, ensuring that yield is not reduced.
- Develop mitigation options for methane emissions from paddy rice.
- Inventory of greenhouse gas emissions in rice and rice based farming systems.

Current research:

- Collaborative projects ongoing between IRRI and PhilRice.
- Greenhouse gas emission mitigation using the alternate wetting and drying method
- Trials set up for comparison in different regions under different irrigation schemes.

## **Indonesia**

Current research:

- Rice intensification programme
  - Expansion of rice crops into marginal cropping land (peat)
  - Intensify production and yield by increasing to four rice crops in one year.
  - Effect on greenhouse gas emissions in intensive cropping systems, including comparison of water management, seedling age at transplant, and planting practices (skip row).

## **Vietnam**

Current research:

- Optimising efficient use of fertilizers
- Understanding the effects of plant age, soil type, season, water management and fertilizer use on methane emissions

Research activities and priorities:

- Technical support tools to provide on-farm mitigation options
- Measurement and assessment of options (rice husk, bio char etc)
- Crop yield predictions as affected by climate change
- Carbon cycle in whole of farm system
- Identify best options for farmers –e.g. reduce water without compromising yield

## **Thailand**

Current Research:

- Stocktake of paddy rice management and methane emissions from various management practices.
- Identifying options to reduce methane emissions in collaboration with IRRI
  - Rice straw management
  - Water management and optimal drainage period
  - The effect of soil type and season
- Developing carbon footprints different rice systems, cultivars and management practices
- Rice adaptation



- Exploring new rice varieties
- adjustment of management practices
- effect of climate change on irrigation practices and current zones of rice production

Research needs:

- Mitigation technologies and transfer
- Development of local emission factors for inventory
- Collaboration and information sharing with domestic and international organisations.

## China

- 5 year national programme on carbon sequestration and mitigation technology assessment in paddy rice.
- Several chamber measurement sites/experiment stations across China
  - Experiment comparing water management options to reduce methane and nitrous oxide
  - Fertilisers and methane emissions.
  - comparison of chamber designs, and effect on plants
- New automatic sampling system can analyse 300 samples

New mitigation options:

- Comparison of N<sub>2</sub>O emissions from organic sources (biochar, rice straw)
- Comparison of emissions from rice varieties
- Experiments with coated fertilisers and nitrogen inhibitors, and organic additives to the field (straw and dung)

Future focus:

- Mitigation options to decrease emissions
- Models (Daycent, RothC, DNDC)
- Effect of emissions under climate change predictions
- New monitoring techniques
- International cooperation

## India

Current Research:

- Emissions across a variety of water management practices
- Compare methane and nitrous oxide emissions from fertilisers (urea, urea and rice straw)
- DNDC model to calibrate seasonal variation of methane

Mitigation options:

- Manage organic input
- Improve nitrogen fertiliser use

- Modify irrigation management
- Improve crop variety

## **ACTION PLAN DISCUSSION**

Session two of the meeting included discussion of the Paddy Rice Research Group action plan, activities underway and future activities for the Groups consideration. The Group Chair encouraged close collaboration between the MIRSA project and the Paddy Rice Research Group. The Group recognized that the MIRSA project was planned to actualize the action plan of the Paddy Rice Research Group.

### **Standardisation of measurement techniques**

Dr Kazunoro Minamikawa of the National Institute of Agro-Environmental Sciences in Japan provided an overview of the completed activities for the standardisation of measurement techniques in paddy Rice which included a survey of measurement techniques used by member countries and the analysis from the automated chamber measurement experiment in Japan. Following these activities a paper has been published :: *Kazunori Minamikawa, Kazuyuki Yagi, Takeshi Tokida, Bjoern Ole Sander & Reiner Wassmann (2012): Appropriate frequency and time of day to measure methane emissions from an irrigated rice paddy in Japan using the manual closed chamber method, Greenhouse Gas Measurement and Management, 2:2-3, 118-128.*

The published article will form a scientific basis for the closed chamber methodology manual that is that next step in this workplan activity. The manual will cover methane measurements only, but could be expanded later to cover N<sub>2</sub>O and Soil Carbon. The manual will be available for any one to download freely from the Alliance website, and will be updated and revised as required.

Dr Minamikawa proposed the contents of the manual would provide a step by step approach for practical and setup and usage including detailing the required equipment, measurements and analysis. The six chapters outlined for the proposed handbook are listed below:

1. Introduction
2. Experimental design
3. Preparation of instruments
4. Works during gas sampling
5. Gas analysis and calculation
6. Relevant measurements

The Group then discussed how the protocol would be developed, for example it should build on knowledge and protocols that were already used in member countries. It was agreed that there would be several measurement protocols tested, as related to the range of climates that paddy rice is grown in. Member countries need to provide the protocols that they use or that work best for their climates and the MIRSA project will test each protocol over several sites and see how they compare. IRRI has experimental sites across South-East Asia which each have

different measurement equipment available, but would still allow for comparison between climates.

The Group agreed that all countries would make the measurement protocols and guidelines that they use available for comparison at the next meeting. The comparison would then look at elements of the protocols could be standardised and which methods are best for specific conditions and climates. At this stage the Group is asked to collect information on methane measurements from manual chambers only, including any information on the best time of day to take measurements. A worksheet template will be circulated to Group participants which will outline the basic information required e.g. type of equipment, measurement protocol and calculations for analysis.

### **The future of the stocktake**

One of the first activities of the Alliance was for all members to undertake a stocktake of agricultural greenhouse gas mitigation research underway in their countries. The Alliance as a whole has decided that they will not repeat the exercise again collectively, although each Research Group may agree to complete a separate stocktake of its particular agricultural system.

The Chairs of the Paddy Rice research Group would like to propose that the Group undertake another stocktake of mitigation activities. The template would be revised to make the categories of greater relevance to paddy rice management practices and research.

The Group will aim to undertake this stocktake activity in 2013 and the results will be discussed at the next meeting of the Group in 2014.

### **Databases for publications and experts**

During the third meeting of the Group in Tsukuba, November 2011 a draft literature database of paddy rice mitigation research was discussed. However, following the distribution of this draft database to the Group there has been no response or input to support developing this any further. The Group was asked to consider if this activity is still considered to be a priority in the workplan.

There was agreement from the participants that this database will be an important asset for the Group and that the information should still be collected. The Group decided to continue developing both database, but they will not be listed as high priority actions.

### **Communication and Collaboration**

The Paddy Rice Research Group has already established partnerships with several international organisations, and is collaborating with IRRI on the MIRSA research project as discussed above. The Group also communicates with Africa Rice and the international Centre for Tropical Agriculture (CIAT) who were invited but unable to attend this meeting.

The Group then discussed the AsiaFlux network as possible partner for the Group or the Alliance more generally. The network brings together research scientists using

eddy-covariance measurement towers and are the regional network under the FLUXNET that run training courses and undertake data sharing and comparison. Although most measurement sites are set up in croplands or agro-forestry systems they could be a potential collaborator.

The Group also acknowledged the Climate Change and Food Security (CCAFS) programme, particularly theme 3 - pro-poor climate change mitigation, the aims and objectives of which had been presented during the first workshop earlier in the week. The Group will maintain communications and deepen linkages with the programme.

### **Capacity Building workshop**

The Chair would like to ask all members of the Group to identify opportunities to support Group activities through capacity building workshops. There is a possibility of holding a paddy rice capacity building workshop in Latin America to involve the Group members who were unable to attend this meeting, including Uruguay as Co-Chair of the Group. This could be held alongside the next Alliance Council meeting which is planned for mid-2013, but financial support to hold this event would need to be identified.

Developing the manual to standardise chamber measurements may also provide a workshop opportunity, each country could present their protocols and measurement guidelines and discuss the next steps for developing the manual.

There was some interest in a training workshop covering DNDC modelling. The Group would need to support in identifying a budget and experts to do this. However, it was mentioned that Shanghai University holds regular courses on this topic. The representative from China agreed to circulate this information to the Group.

### **Greenhouse Gas Mitigation in Irrigated Rice Systems: Guidelines for Measurement, Reporting and Verification (MIRSA)**

The MIRSA project, as discussed in the workshop (21-22 January 2013) preceding the Alliance Meeting, is a consortium of partners lead through IRRI and funded by the Government of Japan. The project aims to identify mitigation opportunities through water saving techniques in irrigated rice paddies and inform future mitigation projects in tropical regions. As a project to assess water management options was agreed to by the Group during the second meeting held in Versailles, France (March 2011) and was noted to be of high priority again in the third meeting at Tsukuba (November 2011) the decision to fund this project was based on support from members of the Group.

MIRSA aims to provide scientific validation to the measurements that are being taken. The project will identify how many measurements are needed to get an accurate result, what time of the day is best to take measurements and the number of sampling sites required for accurate results. The project aims to make recommendations about possible approaches depending on the conditions, it is not intended that these guidelines proscribe one approach but rather examines the errors and trade-offs associated with all methods.

At this time the MIRSA project is funded for 1 year through MAFF, Japan. The next stage of the project is being considered and would involve a five year consortium project. The proposal would establish a competitive fund, with participating institutes carrying out the research. Other future activities for this project could include:

- Undertaking another pilot project of measurement standardisation in North-South America, based on the MIRSA project.
- Include information about other crops that are grown in rotation with rice, include the Croplands Research Group in this work.
- Inform and collaborate with the CCAFS SAMPLES project.

### **Activities on policy support**

The Group currently has no workplan activities in the area of policy support. The Alliance Council does not require that the Group undertake activities under every heading, but the Group is asked to consider how it might approach policy support to provide a real contribution in the area.

## **NEXT STEPS AND UPCOMING MILESTONES**

In the final session of the meeting the Group were asked for their views on the date for the fifth meeting of the Group. Relevant international meetings that the Group could meet alongside included:

- 11th International Conference of the East and Southeast Asia Federation of Soil Science Societies (EAAFS11), Bogor - West Java, Indonesia on 21-24 October 2013. Even if the Group does not meet at this time all participants are encouraged to attend and submit papers to the session on land use and climate change by 31 March. (<http://www.esafs11ina.org/>)
- 20<sup>th</sup> World Congress of Soil Science (WCSS) Jeju, Korea, 8-14 June 2014. There is a possibility of holding a joint meeting with the Croplands Research group at this event. (<http://www.20wcsc.org/>)
- Next meeting of the MIRSA project, this would be held at IRRI at the projects conclusion, end of 2013.
- Alliance Council meeting July 2013 in Uruguay. Possibly a Group meeting or workshop to include members from Latin-America alongside the Council meeting.

The Co-Chair then noted that six monthly reports to the Alliance Council from all Groups will be discussed at an upcoming teleconference of the Co-Chairs. This meeting will provide opportunities for the Research Group to identify collaborations and ensure the Alliance is coordinated in its work. Possible areas of collaboration that have been discussed today will be mentioned by the Co-Chairs on behalf of this Group.

Dr Kazuyuki Yagi then brought the meeting to a close and thanked all participants for their attendance and input over the two days of this meeting. In particular invited guests and participants from IRRI were thanked for their support and expert advice.

# APPENDIX 1: Participants List

Country	Attendees
<b>Alliance Member Countries</b>	
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