GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

## Paddy Rice Research Group Meeting

## No. 2 Meeting Room, Institute of Soil Science, Chinese Academy of Sciences, Nanjing, China

18 September 2015

# Meeting Report

# OVERVIEW

The 2015 meeting of the Paddy Rice Research Group's (PRRG) Asia sub-Group of the Global Research Alliance on Agricultural Greenhouse Gases ("the Alliance") was held at the Institute of Soil Science, Chinese Academy of Sciences, Nanjing, China on 18 September 2015 alongside the 12th International Conference of the East and Southeast Asia Federation of Soil Science Societies (ESAFS). The Alliance meeting was chaired by Japan (Dr Kazuyuki Yagi, NIAES) as Co-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 Alliance's website.

## PARTICIPANTS

The meeting was attended by 16 participants, representing five Member countries and partners of the Group. Several scientists from the host institute also attended the meeting.

- **Alliance Members attending:** China, Japan, Republic of Korea, Viet Nam and Uruguay.
- **Invited Organisations**: International Rice Research Institute (IRRI), Environmental Defence Fund, and Climate Clean Air Coalition (CCAC) Bangladesh

## MEETING OUTCOMES

The meeting achieved the following outcomes:

- Update from the Alliance Secretariat including outcomes from the latest Council meeting.
- An update on the activities of the America sub-Group.
- Announcement of the publication of the measurement standardisation guidelines.

- Decision to develop a PRRG brochure and sub-Group case studies.
- Next steps for the Group and a discussion about the next meeting.

# SUMMARY OF DICUSSIONS

## OPENING REMARKS

1. The meeting of the Paddy Rice Research Group (PRRG) Asia sub-Group was opened by Dr Renfang Shen, Director of the Institute of Soil Science, who welcomed participants to Nanjing. Dr Shen hoped that the meeting would extend and strengthen the collaborations between the PRRG and the Institute of Soil Science in China.

## UPDATE FROM THE SECRETARIAT

2. The Secretariat provided an update of the outcomes of the Alliance Council meeting, which took place 8-11 September 2015 in Des Moines, Iowa. The meeting was hosted by the US who also took on the role of Council Chair from the Netherlands. The Secretariat announced that Mexico has become the Council Vice-Chair and will host the 2016 Council meeting.

3. The Alliance now has 46 member countries participating in its activities, with the most recent members Dominican Republic, Egypt, Lithuania and Tunisia all having joined due to participation in regional projects and workshops of the Alliance.

4. The Secretariat introduced the new-look Alliance website, which was developed in response to the Council's request to raise the profile of the Alliance. The Alliance website has been designed to make sure that the large amount of information it holds is able to be easily navigated and so the Research and Cross-Cutting Groups are more able to promote their work.

## GROUP OVERVIEW

5. Dr Kazuyuki Yagi, Co-Chair of the PRRG, provided an overview of the Group to date and the outcomes from previous meetings of the Group. Although the PRRG is the smallest Research Group active membership have increased following the development of regional sub-Groups. The sub-Groups have reduced travel costs for Members through the organisation of local meetings and allowed members to develop activities specifically related to the different rice management options available in America and Asia.

6. Partner organisations of the PRRG are key contributors to the workplan and joint collaborations are underway with several international organisations including the International Rice Research Institute (IRRI) and the Climate and Clean Air Coalition (CCAC). A representative from the Environmental Defence Fund was invited to attend the meeting and speak about their activities and the opportunities for Partnership with this organisation.

7. The Group discussed opportunities to increase participation from rice producing countries in Africa. Although AfricaRice has not previously been interested in mitigation activities, the Council has agreed to promote the Alliance in Africa by communicating outcomes for food security and increased production that lead to mitigation co-benefits, and there may be opportunities to collaborate in these areas.

## AMERICA SUB-GROUP UPDATE

8. Mr Gonzalo Zorrilla, Co-Chair of the PRRG provided an overview of the America sub-Group and the rice production system in America. Most countries in Latin and Central America are

members of the Alliance, although not all the countries participate in the PRRG. The sub-Group hopes to increase participation from some important rice producers in the region, such as the Dominican Republic, and invite representatives from the US and Europe to attend the next meeting.

9. Most of the greenhouse gas emissions measurement research in South America focuses on extensive rice production systems of large farms using mechanised production and dry direct seeding. The emissions profile is different from rice produced in Asia, with higher $N_2O$ emissions as a result of the direct seeding phase and the rotational livestock-crop system. Research to reduce greenhouse gas emissions of American rice production needs to consider the different phases of the rotation: rice – pastures/livestock – other crops. Specifically during rice crop water management and alternate wetting and drying (AWD) techniques are one of the mitigation options available.

10. Local projects on AWD practices are underway in Brazil and Uruguay while Colombia is engaged in a CCAC international project. However, farmers are reluctant to change water management practices given the difficulty of maintaining a consistent level of soil moisture across the large fields that are common for the region. Other research projects underway to reduce emissions from different management practices include the comparison of emissions from different crops and rotations, soil tillage to incorporate residues directly after harvest, and the comparison of no-tillage and conventional tillage methods.

11. America sub-Group action plan activities

1. Standardisation guidelines: The America sub-Group will review the guidelines and provide input into later versions, especially for areas specific to America's conditions.
2. Database of experimental sites: Few publications from Latin America, but identifying those that can be included.
3. Increasing participation in the Group: inviting representatives from the US and Europe to attend the next meeting and exploring the possibility of holding the 2016 meeting in the US.
4. Multi-country projects: The Group has developed a proposal for a multi-country project and are looking for funding.
5. Participation in the mitigation and adaptation synergies network: would like to identify participants from Latin America.

## ACTION PLAN DISCUSSION

12. Updates were provided to the Group on outcomes and next steps for the PRRG action plan activities.

Standardisation of Measurement Techniques

13. Dr Yagi presented on the publication of the standardisation of measurement technique guidelines. The guidelines have been developed as a part of the MIRSA project and were written by experts from Japan and IRRI as well as others. The guidelines are available to be downloaded from http://www.niaes.affrc.go.jp/techdoc/mirsa_guidelines.pdf. The guidelines provide a list of minimum requirements for measuring greenhouse gas emissions ($CH_4$ and $N_2O$) from paddy rice. A list of recommendations is provided at the start of the guidelines followed by a clear description of the practical and experimental methods. The guidelines also identify a number of evolving issues that are currently under discussion in the literature and unsolved problems that may be resolved in future versions.

14. The Guidelines will be regularly updated to accommodate future research, it is expected that the next version will be published 2016 or 2017 and all members of the Group are welcome to contribute to or lead this revision. The next stage of the activity is the development of guidelines for implementing monitoring reporting and verifying (MRV) of mitigation options.

Databases for Experimental Sites

15. Dr Shigeto Sudo from NIAES, Japan provided an update of the spreadsheet database that has been developed to collect metadata from experimental sites. The excel based spreadsheet has been adapted from the Managing Agricultural Greenhouse Gas Network (MAGGnet) activity of the Croplands Research Group and allows users to share the metadata from their experiment sites and link to the published paper.

16. The Group was asked to consider the design of the spreadsheet and the terms and conditions for version 1. The Group has previously reviewed the information to be provided when adding a site to the database, including the list of categories and items that have been added specifically to reflect rice management practices. The metadata sharing agreement that was developed for MAGGnet and outlines the conditions of sharing data for the data providers and data users was also discussed.

17. The Group suggested minor changes to the template which will be now be revised. The revised spreadsheet will be sent out in October to PRRG members, partners and resource persons. Any final changes to the template should be provided by November and the final version of the template will be distributed in December for **completion by March 2016**. A first set of data will be presented to the Group next year.

18. The Co-Chair reminded the group that adding information to the database is a voluntary activity, and if you are able to share your data then you will have access to the experimental site data provided by others also. The database is based on the MAGGnet template, but it is up to the PRRG to decide how to collaborate with this activity.

Multi-Site/Country Experiment

19. An update on the multi-country project 'Greenhouse Gas Mitigation in Irrigated Rice Paddies in Southeast Asia' (MIRSA) was given by Dr Yagi. The MIRSA project is funded by the government of Japan for five years over 2013-2018. The experiment compares continuous water management in paddy fields with two alternative water management options, safe AWD, and a site specific AWD management. The experimental sites are located in Vietnam, Thailand, Indonesia and the Philippines with all sites using a standardised measurement protocol, although the chamber equipment used is different at each location.

20. Results from each site so far were presented, including a reduction of emissions by as much as 47% from the site in Vietnam, with reductions also achieved in both Indonesia and Thailand. The Philippines site has not recorded a reduction in emissions across any treatment, primarily due to a season of very heavy rain which did not allow the fields to drain. The experiment will continue for another three seasons, for a total of six seasons.

Mitigation and Adaptation Synergies

21. Dr Ha Pham Quang from the Vietnamese Academy of Agricultural Sciences (VAAS) led a discussion to develop activities on mitigation and adaptation synergies in the PRRG and the lessons learned from projects in Vietnam that had considered both of these aspects. A pilot project for rice paddies from river deltas in Vietnam selected measures that could provide both adaption to climate change and mitigate greenhouse gas emissions including cultivar selection, fertiliser management and crop/ farm management practices. Other considerations that are important are including cost

benefit analyses, verification process, scaling up and developing mechanism to support and encourage farmers to take up technologies.

22. The Group discussed how they could take forward the list of technologies that benefit both mitigation and adaptation synergies that has been developed at previous meetings. Ideas identified included:

- Thinking about adaptation in terms of resilience, and sustainable practices that can help soil quality and build resilience;
- Identifying the co-benefits (adaptation benefits) within the current activities of the Group;
- Development of tools that can work out the cost-benefit analysis or socio-economic benefits; and
- Calculation of water use efficiency at MIRSA experiment sites.

23. The Group agreed to continue discussing this topic and new ideas or actions should be brought forward to the activity leaders and Co-Chairs.

## RESEARCH ACTIVITY REPORTS

Methane Mitigation Research in China

24. Dr Xiaoyuan Yan from the Institute of Soil Sciences, Chinese Academy of Sciences provided an overview of the two national projects, funded by the Ministry of Agriculture and the Ministry of Science and Technology, which considered mitigation options for rice production. The mitigation options were chosen because of their environmental and economic synergies, which would increase the likelihood of uptake by farmers. The mitigation options that were included in the experiments were:

- **Residue management:** The experiment measured the effect of rice straw on emissions and soil carbon sequestration. No increase in soil carbon was seen from incorporating straw into the field and emissions were increased, instead the straw was turned into biochar, which did show a reduction in emissions when applied.
- **Water-saving cultivation:** The use of a recyclable plastic film as a mulch over the soil reduced the effects from spring drought in some areas and increased early growth. The plastic did show a reduction in $CH_4$ emissions, although may increase $N_2O$ emissions.
- **Water-saving rice variety:** Drought resistant rice varieties were compared with conventional varieties. However, so far the drought resistant varieties have shown a much higher level of greenhouse gas emissions, probably due to the larger root system.
- **Rice-duck cultivation:** the practice of raising ducks in rice paddy fields has shown an improvement of yield and seems to reduce $CH_4$ emissions by increasing the oxygen content in the water.
- **Multiple technology integration:** Experiments on crop rotation have compared the common rice-wheat with a rice- green bean rotation. The bean residues are fermented and used to increase the $CO_2$ levels in greenhouses increasing production of greenhouse crops. The rice-green bean rotation also reduced $CH_4$ emissions and increased yield.

Mitigation Options from Double Rice

25. Dr Xiaobo Qin from the Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences presented the results of a project to compare mitigation options for double-cropping rice systems in China.

26. The mitigation options considered were biochar application, comparison of rice cultivars and the use of nitrogen inhibitors. The use of biochar with a high application rate on the paddy fields demonstrated the greatest reduction in greenhouse gas emissions and a higher yield than traditional fertiliser application. The use of nitrogen inhibitors with the nitrogen fertiliser reduced $N_2O$ emissions after application and produced a higher yield than was seen when applying fertiliser only.

IRRI Initiatives for Mitigating GHG Emissions from Rice Cultivation

27. Dr Agnes Padre from the International Rice Research institute (IRRI) provided an overview of greenhouse gas and climate-smart agriculture activities underway in the CGIAR Climate Change, Agriculture and Food Security (CCAFS) programme. IRRI is also involved in the PRRG MIRSA project, a project supported by the CCAC to upscale AWD management practices in Vietnam, Bangladesh and Colombia, and a mobile phone based decision support tool- CIRCLE manager - which provides farmers with site specific management options, including to reduce greenhouse gas emissions. CCAFS have three projects funded under the low emissions agriculture theme that are related to the work of the PRRG.

- **No-Regret mitigation strategies for rice production:** By assessing the incentives for uptake of mitigation options the project aims to overcome a lack of motivation among smallholder farmers to practice AWD. The project considers additional and economic benefits, if water availability is not a concern for the farmer, and how AWD practices can be integrated into a farming strategy. Local demonstration farms are established to show that AWD can reduce lodging and fungal diseases in rice plants as well as provide a better soil condition for mechanization.

- **Standard Assessment of Agricultural Mitigation Potential and Livelihoods (SAMPLES):** The project is now active in four regions: Latin America, East Africa, West Africa and South East Asia and SAMPLES aims to identify regional emission factors for specific management practices that are applicable to tropical agriculture systems. A web-based database has been developed for researchers to share data and access a network of contacts. To upload published research data to the database a data worksheet can be completed and sent to Meryl Richards (meryl.richards@uvm.edu). This activity is similar to the PRRG collaboration with the MAGGnet database and CCAFS is inviting the Alliance to collaborate in this work area, the data can be labelled as collected from Alliance Members. The database goes beyond metadata and is collecting emission factor information also.

- **CLIFF:** An international capacity building programme that links PhD students from developing countries to the SAMPLES project.

Activities of the Climate and Clean Air Coalition Rice Component in Bangladesh

28. Dr Saidur Rahman was invited to present the CCAC project on upscaling AWD practices in Bangladesh. The past ten years have seen more farmers taking on AWD practices in Bangladesh as water availability has decreased and the use of herbicides to control weeds, a problem in unflooded fields, has become more common. The CCAC rice project started in January 2015 and focuses on upscaling AWD practices nationally. A national planning workshop was held to bring together

stakeholders and farmers and develop a set of case studies from Bangladesh. The second stage of this project is now under development.

29. A nationally suitability assessment has been completed for Bangladesh, indicating that AWD can be practiced in 12 of the 13 zones across the country. Farmers report that AWD has increased yields, which they believe is because of an increase in tiller numbers.

Methane and Nitrous Oxide Emissions Data from Indian Rice Paddies

30. Dr Kritee of the Environmental Defence Fund (EDF), was invited to present on their research activities in South India. The EDF is a non-profit organisation based in the US with 12 offices worldwide. Agriculture is not a specific focus area for the organisation but is relevant to the climate and eco-systems work areas.

31. In India EDF work with work with other non-profit organisations providing guidelines and the science based knowledge for others to undertake implementation activities with farmers. EDF fund research projects and labs in India to measure greenhouse gas emissions from rice, and other crops, with an aim to recommend packages of management practices that provide the triple win of increased yield, increased income and environmental benefit. The labs are based in rural areas near to the farm plots where the experiments are set up. The research presented is from paddy fields in South India, an area with typically low yields.

32. The research presented showed that $N_2O$ emissions from aerobic irrigated paddy fields may be higher than previously recorded, especially in the sandy soils of South India. The experiment has recorded very high $N_2O$ emissions fluxes that are not always predicable – often occurring several days after rainfall or fertiliser application. The key factor to consider is that $N_2O$ emissions can be quite high and are not only caused by drainage events, but can occur after harvest. Experimental designs need to give more consideration to measuring $N_2O$ emissions from paddy fields alongside $CH_4$ measurements.

## NEXT STEPS AND OTHER ISSUES

33. **Next steps to implement the action plan**

1. Standardisation of measurement technique. The Group approved the guidelines developed and a link will now be created from the Alliance website to promote these as a product of the PRRG. The guidelines will be revised in the next two years and the Group will consider developing MRV guidelines.
2. Members are asked to complete the database template with experimental metadata. This activity will discuss the next steps to collaborate with the CCAFS SAMPLES activity.
3. New proposals/ results of projects similar to the multi-site/country project should be shared with the Group so more projects can be developed.

34. The group discussed activities to communicate the achievements of the PRRG. The Co-Chair shared the brochures and case studies that have been developed by the Livestock Research Group and proposed that the PRRG develop similar products. The PRRG will develop a brochure that combines the activities of both sub-Groups which will initially be developed by the Co-Chairs. Separate regional or country case studies could then be developed by members to share examples with the group and more widely.

35. The Group did not finalise the time and location for the 2016 meeting, although the possibility of meeting alongside the next MIRSA meeting in Thailand will be explored.

# APPENDIX 1: Participants List

| Country | Attendees |
|---|---|
| **Alliance Member Countries** | |
| China | Xiabo Qin: Institute of Environment and Sustainable Development in Agriculture (chinayrh@gmail.com)<br>Yufan Wan: Institute of Environment and Sustainable Development in Agriculture (wanyunfan@ami.ac.cn)<br>Xiaoyuan Yan: Institute of Soil Science, Chinese Academy of Sciences (yanxy@issas.ac.cn) |
| Japan | Kazuyuki Yagi: NIAES (kyagi@affrc.go.jp)<br>Shigeto Sudo: NIAES (ssudo@affrc.go.jp)<br>Kazuyuki Inubushi: Chiba University (inubushi@faculty.chiba-u.jp) |
| Korea | Hyuncheol Jeong: National Academy of Agricultural Sciences (Taiji152@korea.kr) |
| Uruguay | Gonzalo Zorrilla: National Institute of Agricultural Research (gzorrilla@inia.org.uy) |
| Viet Nam | Ha Pham Quang: IAE-VAAS (haphamquang@fpt.vn) |
| **Secretariat**: Deborah Knox, New Zealand Ministry for Primary Industries (deborah.knox@mpi.govt.nz) | |
| **Invited Participants** | |
| Dr Kritee, Environmental Defence Fund, USA (Kritee@edf.org)<br>Dr Mhammad Saidur Rahman, Bangladesh Agricultural University (saidurbau@yahoo.com)<br>Dr. Agnes Padre, IRRI (a.padre@irri.org)<br><br>Observers attending from the Institute of Soil Sciences, Nanjing Normal University, Chiba University, Akita Prefecture University, and NARO Tohoku Agricultural Research Center. | |