Paddy Rice Research Group

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

What is the Global Research Alliance?

Agriculture has a vital role to play in the coming decades with the world's population estimated to reach 9.6 billion by 2050. The sector must find ways to produce additional food and fibre sustainably also contributing to broader development goals.

The Global Research Alliance (GRA) seeks to increase cooperation and investment in research activities to help reduce the emissions intensity of agricultural production systems and increase their potential for soil carbon sequestration, and improve their efficiency, productivity, resilience, and adaptive capacity. This contributes in a sustainable way to overall mitigation efforts but also helps meet food security objectives.

The main work of the GRA occurs in its four research groups. These are focused on key agricultural subsectors (Paddy Rice, Croplands, and Livestock) and issues common to those sub-sectors managed by the Integrative Research Group.

About the Paddy Rice Research Group

The GRA's Paddy Rice Research Group (PRRG) is working together to find ways to reduce the emissions intensity, while improving the overall production efficiency of paddy rice. The Group predominantly focuses on methane (CH_4) because of its significant emissions from paddy rice production in comparison to other cropping systems. Trade-offs with emissions of nitrous oxide (N_2O) and changes of the quantity of carbon stored in paddy soils are also being considered.

The PRRG is focused on helping to provide mitigation options to paddy rice farmers, land managers and policy makers by looking at the impacts of water and soil management, crop rotations, organic matter and fertilisers and cultivar selection.

The PRRG is divided into two regional sub-Groups, Asia and America. Both sub-Groups deliver activities to the same work plan which spans six areas as shown in the diagram.

The sub-Groups allow members to develop activities specifically related to the different rice management options available:

- in the Americas extensive large scale rice farming is dominated by direct seeding cultivation of rice and rotation with pastures or other upland crops.
- in Asia intensive small scale farming is dominated by both direct seeding and transplanting cultivations and widespread multi-cropping of rice.

Key areas of work

1. Understanding the current research landscape

Undertaking a 'stock-take' of activities is valuable to provide an overview of research priorities, understand knowledge gaps and areas for capacity building. For the PRRG which operates sub-Groups, the stock-take was useful to illustrate that while the rice production systems in Latin America and Asia differed, there were opportunities to share experiences and information. The Asia sub-Group has more regional measurement information and research into rice systems and the America sub-Group has more experience with production for markets and flexibility around the crops grown from year to year.

Global stock-take of rice paddy research

A stocktake of research carried out by the PRRG members showed current research focuses on two main areas: GHG accounting and life cycle assessment, and agronomy. The main goals of this research are improving national inventories, investigation and testing of mitigation options, and development of low GHG emitting varieties.

An additional survey across the PRRG members showed the use of a diverse range of inventory methodologies across countries. This was found to make comparison very difficult, especially with regard to measurement period and total gas emission estimates, which will need to be addressed to advance a common understanding and ensure reliable mitigation options.

2. Building capability

The PRRG has a number of members that are new to the area of measuring greenhouse gas (GHG) emissions from paddy fields. Early meetings and workshops of this Group have focussed on sharing methodologies for measurements as well as requirements and possible improvements that will enable each research group to get the best results from the equipment they have.

A Community of Practice has been formed by scientists (Brazil, Argentina, Chile, Colombia and Uruguay) sharing knowledge and techniques, and the first capability building workshop to focus on the group activity in Latin-American countries was held in June 2013, in Montevideo, Uruguay.

The Group organizes international symposia with partner organisations to share best practice and research outcomes on knowledge mitigating GHG emissions from paddy fields.

3. Research networks and databases

Research networks link scientists who share a common interest in a particular area of research, more rapidly advancing the development of solutions through a shared understanding. The PRRG formed a research network to consider synergies between mitigation and adaptation as it relates to paddy rice. Led by Vietnam and Indonesia with the support from other countries, the network undertook a review of current activities underway and identified priority areas for further work:

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

Rice paddies from river deltas in Vietnam.

A pilot project in Vietnam selected measures that could provide both adaption to climate change and mitigate GHG emissions including cultivar selection, fertiliser management and crop/ farm management practices. Other factors considered important are including cost benefit analyses, verification process, scaling up and developing mechanism to support and encourage farmers to take up technologies.

Reducing agricultural emissions in Indonesia

The target to reduce emissions from agriculture in Indonesia is primarily focused on increasing agricultural systems productivity and efficiency and identifying practices that will reduce GHG emissions as a secondary focus. Consequently, Indonesia has an integrated rice and livestock system for sustainable agriculture production which aims to meets multiple outcomes (including the reduction of GHG emissions), but also making use of all parts of the system (e.g. waste products) and considering international carbon schemes. Indonesia has developed a number of programmes to encourage integrated crop management, food diversity, integrated fish and rice crops and reduce emissions from peatlands used to grow oil palm.

Database for experimental sites

A database has been developed in collaboration with the MAGGnet activity of the Cropland Research Group to collect metadata from experimental sites throughout the world where GHG fluxes are monitored. Led by Japan this is an activity supported by both sub-Groups; the Asia sub-Group has more data to share having completed more experimental research measuring GHG emissions. The database is made available to PRRG members through the PRRG website.

http://globalresearchalliance.org/research/paddy-rice/

4. Collaborative research

The PRRG continues to increase in size through country participation and increasing involvement of international organisations and partners. The Americas sub-Group continues to increase its country membership and it is planning to hold its next meeting in the USA. While the European Commission has indicated that it can fund an International Research Consortium to enable EU members to work in the PRRG.

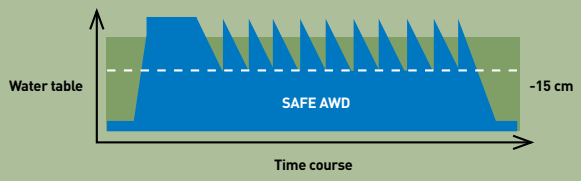
Collaboration among scientists and alignment of research activities and resources is fundamental for the PRRG to achieve its vision and successfully reduce the emissions intensity, while improving the overall production efficiency of paddy rice. Collaborative research allows scientists to achieve results that would not have been achieved working in isolation.

Specific projects may be identified by research networks, or at the annual meetings of the sub-Groups with members then agreeing to source funding for the work. Collaborations with Partners are particularly important to the PRRG as the following examples highlight.

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.

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



Greenhouse gas mitigation in irrigated rice paddies in South East Asia (MIRSA project)

Simultaneous experimental field trials were initiated in Sept 2013 in Jakenan (Indonesia), Nueva Ecija (Philippines), Prachin Buri (Thailand), and Hue (Vietnam), which are continuing for 6 seasons (3 years) to assess the site-specific feasibility of alternate wetting and drying (AWD) as a mitigation option for CH_4 and N_2O emissions from irrigated rice fields. The study aims to develop standardised protocols on the effective implementation of AWD at multiple locations in South east Asia to achieve the emission reduction target of 30% relative to the conventional water management, and to acquire a generalized scientific knowledge about the influence of AWD on GHG emission reduction. The results have shown the effectiveness of AWD to reduce CH_4 and N_2O emissions. Results will be communicated directly to farmers.

Reducing CH_4 emissions in Japan

Midseason drainage (MD) is widely applied to rice cultivation in Japan. In order to attempt further reduction of CH_4 emissions, prolonged MD practices was tested at 9 different sites over the country. The results showed that the seasonal CH_4 emissions was suppressed to about 70% by prolonged MD practices, while maintaining grain yields as high as 96%. Increase in the emissions of N_2O was almost negligible. This alternative water management strategy was adopted as a mitigation option for an environmental subsidy at several regions in the country.

Experiences of measuring GHG emissions from rice systems

The PRRG are collaborating with National Institute for Agro-Environmental Sciences (NIAES) researchers in Japan to identify the best time of day to sample GHG emissions from chambers and achieve a representative value. Researchers have found that diurnal measurements of emissions peaked at midday and the time that most consistently provided average values was 10am. However, when IRRI researchers repeated this experiment in a tropical climate in the Philippines an obvious diurnal variation was not always detectable, and manual sampling showed that the representative time would be between 9-11am. The programme is also trialling AWD methods to reduce emissions from paddy rice systems. The results showed that N_2O emissions increased using AWD protocols, where the fertiliser was applied just before drainage. However, there is still the potential to reduce CH_4 emissions using this method as N_2O remains a minor contribution to overall emissions even with the increase shown in this experiment.

The PRRG are also collaborating with CCAFS in a project called the Standard Assessment of Mitigation Potential and Livelihoods in Smallholder Systems (SAMPLES). This project will develop low cost protocols for GHG emissions measurement, defining minimum data requirements and guidelines for analysis of trade-offs.

5. Providing policy support and links to international initiatives

Partner organizations of the Group are key contributors to the work plan and joint collaborations are underway with several international organizations including the International Rice Research Institute (IRRI), International Center for Tropical Agriculture (CIAT), Climate Change, Agriculture and Food Security (CCAFS) and the Climate and Clean Air Coalition (CCAC). The Group has held International Workshops and Symposia jointly with the Monsoon Asia Agro-Environmental Research Consortium (MARCO) and the Cooperative Program for the Development of Agricultural Technology in the Southern Cone (PROCISUR).

Climate and Clean Air Coalition funded project on up scaling AWD practices

The Agriculture Initiative of the Climate and Clean Air Coalition (CCAC), hosted by the United Nations Environment Programme (UNEP), aims to implement the alternate wetting and drying (AWD) technology on large scale in Vietnam, Bangladesh, and Colombia to significantly reduce methane emissions from rice fields. With support from CCAFS, IRRI coordinates the activities of this component in Vietnam and Bangladesh, while CIAT covers the work in Colombia.

The Paddy Rice workstream of the initiative addresses major constraints to mitigation in paddy rice by identifying (1) best management practices that achieve mitigation and food security and (2) incentives, technical support mechanisms, and enabling conditions to overcome the barriers that men and women farmers face in using new practices.

Current activities of the workstream focus on: 1) Improved information for decision-making, 2) suitability maps for AWD, and 3) national networks and capacity. Multi-stakeholder working groups in each country identify barriers to adopting AWD and approaches on how to overcome them. National policy networks are being created to raise awareness of paddy rice mitigation options. IRRI and CIAT work with policy makers to build needed capacity and support national initiatives and international development programs.

6. Good practice guidance and technical methodologies

Experts in the PRRG have identified the need to work together to produce good practice guidelines and technical manuals in the following areas:

- Guidelines for measuring CH_4 and N_2O emissions from rice paddies by a manually operated closed chamber method.
- Guidelines for implementing monitoring reporting and verifying (MRV) of mitigation options.

Publishing information in this way allows scientists to easily compare measurement protocols in different countries and facilitates collaboration in research projects across the sub-Groups. The PRRG will use these publications in future capability building projects.

Led by the National Institute for Agro-Environmental Sciences (NIAES) in Japan, experts from the PRRG have worked together with IRRI to publish guidelines for the "Measuring CH_4 and N_2O emissions from Rice Paddies by a manually operate closed chamber method". The guidelines were developed as a part of the MIRSA project.

The guidelines provide a list of minimum requirements for measuring 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 version.

The guidelines can be downloaded from **http://www.niaes.affrc.go.jp/techdoc/mirsa_guidelines.pdf**

Further Information

For more information and contact details for the PRRG Co-Chairs and research network coordinators, please visit the PRRG's area of the GRA website:

http://globalresearchalliance.org/research/paddy-rice/

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