

GRA Flagship on Reducing GHG Intensity of Rice Systems

Context and problem definition

Rice cultivation systems act as one of the major sources of atmospheric methane (CH₄), a potent greenhouse gas and the second largest contributor to historical global warming after CO₂. Although 90% of the world's rice paddies are located in Asia, they are a globally important CH₄ source. Estimates based on IPCC guidelines indicate that CH₄ emissions from rice paddies total 33–40 Tg year⁻¹, or 11% of total anthropogenic emissions. Rice production is expected to increase at least in next several decades in order to meet increasing demand for rice in the world, which possibly increase CH₄ emissions from rice cultivation further.

Due to the importance of CH₄ emissions from rice cultivation, a number of research has been conducted to find practical measures that reduce emission intensity of the systems, while sustaining or improving its overall production efficiency. One of the promising options is water management in irrigation systems, such as alternate wetting and drying (AWD) management. The effectiveness of ADW is being evaluated in some research projects mainly in Asia, while fewer activities have been carried out in Latin American and African countries where rice cultivation systems are largely different from those in Asia. In addition, there are still large uncertainties in trade-offs of AWD, including the effects on nitrous oxide emissions, soil carbon sequestration, and crop production. Other proposed mitigation options, such as organic matter management and rice cultivar selection, are also expected to be tested in multi countries/regions.

Another challenge for reducing GHG intensity of rice systems is to find ways of adopting mitigation options to local rice cultivation. It is necessary to quantify both emission intensity and reduction possibility by analysing existing observation data by model calculation for supporting policy choice in domestic and international schemes. Developing measurement, reporting, and verification (MRV) guidelines and maps indicating optimum areas for adopting mitigation options are useful as supporting tools for the implementation. Capability building of experts and other stakeholders are expected to be included in the flagship.

Finally, it is pointed out that some actions in this Rice Flagship are overlapping with those in other flagships and have potentials of synergies when the actions are operated collaboratively.

Fundamental principles underlying the Rice Flagship

- Unique GRA added value – utilise knowledge & expertise of 32 member countries and partners
- Inclusive – must give opportunities for all members to be engaged in some way, availability of \$ should not be a barrier to participation
- Relevant – all Members need to have benefit from some or all of the Flagship, i.e. something in it for everyone
- Solution focussed – clear link to the development and implementation of mitigation practices/technologies
- Multifaceted – address greenhouse gas mitigation and/or soil carbon sequestration along with co-benefits and synergies for livelihoods & adaptation; supportive of policy needs
- Increase capacity/capability of member countries
- Supplement and support existing efforts by Member countries and Partners

The components of the flagship

Developing <i>solutions</i>	Improving <i>quantification</i>	<i>Adopting</i> solutions	Building <i>capabilities</i>
<ul style="list-style-type: none"> • Water management – conducting multi-country experiments on commercial size farms to assess the effects of AWD as a mitigation solution • Organic matter management – identification, testing & quantification of improved management of crop residue and manure as a mitigation solution • Cultivar selection – identification, testing & quantification of high yielding rice cultivars with low CH₄ emission 	<ul style="list-style-type: none"> • Database compilation – sharing experimental information and emission data among members • Improved emission factors' – improving emission and scaling factors for CH₄/N₂O emissions and soil C stock changes in country/region by analysing emission monitoring data • Modelling – development and inter-comparison of process-based models to simulate CH₄/N₂O emissions soil C stock changes 	<ul style="list-style-type: none"> • Identification – of areas where AWD can be applied and optimized to reduce yield loss risks, water and carbon footprints of rice systems • MRV guidelines – measurement, reporting, and verification (MRV) guidelines for implementing the solutions to GHG mitigation actions • Promotion of solutions – by communication of tested mitigation solutions with stakeholders to support NAMAs and NDC 	<ul style="list-style-type: none"> • Workshops – to enhance the technical and institutional capacity to conduct relevant GHG research in the Group • Coordinated networks – of scientists and extensionists, private-sector, and farmers for accelerating the wide-scale adoption of best-fit management options

Shared characteristics – developing the detail

- Utilise existing data – no individual country may have enough data but collectively we may.
- Build on existing databases and/or develop databases – collation and examination of existing and new data.
- Build on existing projects – projects already exist in all of the priority areas. How can we extend these to add value to GRA Members and Partners?
- Strong need to be realistic – prioritise projects that can deliver tangible benefits in the short & medium term.
- Projects need to demonstrate concrete ‘product’s that are beneficial to Members.
- Development of a ‘long list’ of priority projects under each component with a ‘short list’ for immediate action i.e. those that can commence in the 2017 calendar year. Minimum of one project under each component.
- Leadership is critical – prioritised projects need to have a committed leader(s) who is resourced.
- Development of resourcing mechanisms – so far we have tended to expound the benefits of collaboration but not always put in place mechanisms that facilitate collaboration in practice. Any project on the ‘short list’ needs to have a resourcing plan.

Projects under the Flagship

Project 1

Title: On farm assessment of multi-beneficial improved water management techniques, reducing costs, water use and gas emissions in America's rice systems

Leader: Gonzalo Zorrilla, Uruguay

Technical Coordinator: Ngonidzashe Chirinda, CIAT - Colombia

Countries: Any in the Americas with interest and some funds available for local research. (to be consulted)

Partners: CIAT, FLAR, CCAFS

Brief description: Alternate wetting and drying (AWD) is a known and proven approach for reducing methane (CH₄) emissions and water inputs for irrigated rice. Yet, the adoption of AWD face numerous barriers including, feasibility at different scales, lack of incentives, limited awareness, low farmer confidence due to limited validation of economic benefits in specific systems, risk perceptions on the impacts this could have on yields. This flagship aims at identifying areas where AWD can be applied and optimized to reduce yield loss risks, water and carbon footprints of rice systems. Flagship activities will be conducted in first mover countries in South and North America. Focus will be on on-farm validation and optimization (to avoid yield penalties and/or promote yield increases) on commercial size farms.

Key partners and existing resources/projects: CIAT will be main partner and international technical coordinator of the project, while FLAR and CCAFS will be implemental for the dissemination of results to the whole region. Research projects on AWD are on-going in several of the candidate countries, so some funding is already available.

Benefits and contribution to flagship: results of the validation in different countries will support a regional effort for massive adoption of improved water management techniques.

Resourcing needs: Funding for an international technical coordinator, who will be the articulator of validation efforts in each country and then will be implemental on the dissemination component. Some resources will be needed for each country local coordinator, and for the implementation of validation plots in farmer's fields.

Resourcing mechanisms: Regional funding agents like FONTAGRO or IDB should be contacted for funding, which should be mainly directed to cover international coordinator and some seed funds for each country. In-kind contributions by participant countries will be critical to support most of the costs of validation plots.

Projects under the Flagship

Project 2

Title: Multi-country on-farm assessment of multi-beneficial integrated management techniques in the rice sector of Asia

Leader: Kazuyuki Yagi, Japan

Countries involved: All GRA countries in Asia

Brief description: The effectiveness of alternate wetting and drying (AWD) water management on reducing GHG emissions from ADW is being evaluated in south-east Asian countries. The project aims to evaluate additional potentials of management techniques on multi-benefits of rice cultivation by combining fertilizer and organic matter management with water management. The targeting benefits include soil conservation by increasing fertility and sustainability of rice production, in addition to reducing GHG intensity and water saving. Field experiments will be conducted at paddy fields in different countries and effects of irrigation schemes, water management, application of chemical and organic fertilizer on GHG emissions, soil carbon stock change, and rice production will be tested. Simulation models will be applied to evaluate long-term effects of the management. The results will be outreached to communities of rice producers, policy makers, and other stakeholders.

Key partners and existing resources/projects: Relevant CGIAR centres and projects (IRRI, CCAFS), private sectors, and government. Japanese government will financially support by on-going MIRSA project.

Benefits and contribution to flagship: Develops a direction of integrated management options as a 'solution' in rice systems; modelling approach can provide long-term quantified indices of the benefits, that contribute to adopting the options to future rice management; develops capability; relevant to multiple countries in the region; also can be extended to other regions (Americas, Africa); contributes to other international processes (IPCC).

Resourcing needs: Resources for coordinating the project, conducting field experiments, project meetings, publication and outreach.

Resourcing mechanisms: An international project fund, plus in-kind contributions by countries involved to support dedicated country contact points.

Linkages: This project is planned as the next phase of on-going MIRSA project. A strong link with the relevant activities of IRRI and CCAFS is expected in terms of sharing of resources, knowledge, data, and/or delivery of output.

Projects under the Flagship

Project 3

Title: Identification of high yielding rice cultivars as related to low methane (CH₄) emissions

Leader: Kazuyuki Yagi, Japan; Prihasto Setyanto, Indonesia

Countries involved: All GRA countries

Brief description: The project aims to support the selection of high yielding rice cultivars with low methane (CH₄) emissions around the world. For that, the rice plant controlling factors affecting CH₄ emissions will be assessed by meta-analysis of published data and new experiments. The mechanisms causing different emission intensity among rice cultivars will be investigated. Also, CH₄ emissions from newly released cultivars will be quantified. The results will be exchanged in GRA member countries and its partners for developing high yielding rice cultivars with low CH₄ emissions.

Key partners and existing resources/projects: Relevant CGIAR centres and projects (IRRI, CCAFS), private sectors. No existing resources/projects.

Benefits and contribution to flagship: Develops a new option as a 'solution' in rice systems; easy to adopt the solution in local rice farming, although it is relatively a long-term focus.

Resourcing needs: Resources for coordinating the project, literature survey, conducting field experiments, project meetings, publication and outreach.

Resourcing mechanisms: An international project fund, plus in-kind contributions by countries involved to support dedicated country contact points.

Linkages: A strong link with the relevant activities of IRRI, CIAT, AfricaRice, and other research institutions is expected in terms of sharing of resources, knowledge, data, and/or delivery of output.