



RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
Food Security**



IRRI

2013 technical report

1. Activity Reporting

Activity 570-2013 (Milestone 1.1.1 2015 (2).)

Title: Defining site-specific adaptation programs in major rice-growing areas with specific vulnerabilities in South and Southeast Asia.

Status: Complete. In 2013, climate change adaptation projects (e.g. participatory rice varietal assessments, alternate-wetting-and-drying, heat stress mapping) were further fine-tuned to address site-specific distinctions. This is true especially in the case of emerging biophysical risks arising largely from aggravating climatic conditions which may affect crop production and natural resource management. Farming household analysis remains an integral component of the entire adaptation schema.

Gender component:

This activity addresses the linkage between gender roles and the choice of adaptation strategies and how this affects household risk management and intra-household resource allocation. Females' decisive role for financial matters makes them an effective channel through which conditional benefits, e.g. agricultural subsidies and seeds and fertilizer, could flow. Moreover, owing to their traditional domestic roles, they could be made recipients of awareness and training workshops on climate change and mitigation and adaptation options. These gender-differentiated roles have continued to be incorporated into participatory approaches of selecting rice cultivars and crop management options.

Deliverables:

- Regional action plans for adaptation strategies in rice-based systems in mega deltas of S and SE Asia

None

- Identifying regional/ seasonal hot spots of heat stress and potential adaptation through adjusted cropping calendar.

None

- Capitalizing on gender-specific roles for improved coping strategies for aggravating climate extremes in rice-based farming households.

None

- Capitalizing on gender-specific roles in farm households for defining viable adaptation projects in rice-based production systems.

None

- Identifying synergies of adaptation strategies and technology campaigns for improved resource use efficiencies in rice-based systems.

None

Partners:

CSIRO; KIT; IWMI; AGI; CLRRRI; HUAF; SIWRP; Cantho University

Locations:

Activity 571-2013 (Milestone 1.2.1 2013 (2).) Commissioned

Title: Development of climate smart ideotypes for breeding strategies in rice and sorghum.

Status: Partially complete. The SAMARA model has been further developed in 2013. It was sensitized to ambient CO₂ and water management modules were improved. The adaptation, transformation, and evaluation of various sources of data in relation to the downscaling of key climate scenarios for key sites (new deliverable) are in progress. On the other hand, the methodology for ideotype development by simulation-based selection from virtual populations is just partially completed and still being developed.

Gender component:

Not applicable

Deliverables:

- Further development of SAMARA and other suitable models.

None

- Scientific leadership on the ideotype concept for breeding for a 2030 world.

None

- Phd student to work on Rice with IRRI and CIRAD (ICT).

None

Partners:

Manila Observatory; University of the Philippines Los Baños

Locations:

Global

Activity 572-2013 (Milestone 2.1.1 2015.)

Title: Identifying region-specific options for improved resilience of rice production to cyclones/ typhoons in terms of varietal selection

Status: Partially complete. IRRI has now tested the feasibility of post-hazard mapping of typhoon effects in the Philippines in terms damage to rice production. The approach combines advanced Remote Sensing tools (with images taken right after typhoon occurrence) and GIS-based cropping calendars. The recent experience of the Haiyan typhoon in Eastern Visayas (Philippines) highlighted the need for assessing the magnitude and spatio-temporal patterns of these extreme tropical depressions. The IRRI GIS lab has produced a first set of post-hazard maps specifically mapping damage in rice production.

Gender component:

Not applicable

Deliverables:

- Suitable cultivars/ crop management options identified for different cyclone/ typhoon affected regions.

None

Partners:

Manila Observatory

Locations:

South Asia (SAs), South East Asia (SEA)

Activity 573-2013 (Milestone 2.2.1 2013.) Commissioned

Title: Development of food system-level research and partnerships, including decision support tools for national and international food security and humanitarian response

Status: Complete. In 2013, partnership with the FAO Regional Office for Asia and the Pacific was developed to collaborate on the analysis of Food Security Statistics to establish baselines for indicators, and identify trends. The outputs of these analyses expedite the creation of a FAO / WFP Shock Impact Simulation Model (SISMod) which can be used to model the impacts of climate shocks on food security. Partnership with the Regional Multi-Hazard Early Warning System for Asia and Africa (RIMES) was developed in the area of climate services, including historical data and seasonal forecasts. RIMES and CCAFS evaluated the use of climate information for food security, early warning, and/or disaster risk reduction in the Philippines, Cambodia, Lao PDR, and Myanmar. CCAFS and IRRI jointly organized a workshop on Integrated Food Security Modelling with participants from the CGIAR (CIMMYT, CIAT, and IRRI); the FAO; RIMES; and institutions of the Philippines Government, including the Bureau of Agricultural Statistics, PAGASA (meteorology), and the National Statistics Office.

Gender component:

Not applicable

Deliverables:

- Workshop report highlighting proof-of-concept for integrated modeling tools and a strategy for promoting adoption by food security community.

IMCASE workshop report

- Report(s) documenting the use of climate information for food security early warning and/or disaster risk reduction in at least three countries.

Reports were prepared by RIMES with inputs from CCAFS and IRRI.

- Web portal and multi-center email list for community of practice.

Community of Practice email list established and updated regularly. COP (CGIAR and partners) encouraged to register with Food Security Information Network (<http://www.fsincop.net>) instead of establishing new web portal.

Partners:

WFP; RIMES; FAO GIEWS; FAORAP

Locations:

Global

Activity 574-2013 (Milestone 3.3.1 2015 (1).)

Title: Promoting mitigation projects in rice-based production systems in South and Southeast Asia (planning phase).

Status: Partially complete. Most of IRRI-CCAFS deliverables for 2013 have been completed. The development of reporting and verification guidelines (as part of the MRV guidelines is still in progress. Also, several technical improvements were made in the design and operation of the smoke collection device which necessitate the revision of measurement protocol.

Gender component:

Gender-specific distinctions can be incorporated into participatory approaches for changing farming practices whose immediate impact would be observed in intra-household resource allocation in terms of income, workload, and food availability. Albeit not generally visible and involved in physical farm production, females may still exert considerable influence on decision making for some activities, namely: purchase of farm inputs and machinery required for mitigation and adaptation and crop residue management. This activity examines how to strengthen female engagement into mitigation projects through their involvement in the irrigators' association on the one hand and attendance in training workshops on the other.

Deliverables:

- Testing MRV-guidelines in different rice growing regions.

Measurement guidelines have been developed (to be published) and have been tested in the Philippines and Vietnam. The development of reporting and verification guidelines is still in progress.

- Identifying strategies to strengthen female engagement into mitigation projects in rice-based production systems.

None

- Devising protocols on the use of innovative approaches and instrumentation for recording emission rates as a means to ease future MRV requirements.

None

- Fine-tuning of rice mitigation strategies in SE Asia in suitable regions and production systems.

None

- Facilitating a CDM methodology for preventing straw burning: formalizing and submitting a methodology approach to UNFCCC.

None

- Improving the mechanistic understanding of mitigation effects in rice-based systems in terms of element cycles and ecosystem functions: continued field experiments and model development.

None

Partners:

PhilRice; IAERI; ILRI; ICRAF; HUAF; KIT; JLU

Locations:

South Asia (SAs), South East Asia (SEA)

Activity 575-2013 (Milestone 4.1.2 2015.)

Title: Integrating validated simulation models into a decision support system on mitigation projects rice production systems.

Status: Complete. The Technical Coefficient Generator spreadsheet model is now ready to compile GIS-maps on land use and derive parameters, namely yields and GHG emissions, under different planning purposes. These maps will be summarized in a 'road map' for desirable development rice production technologies in Quang Nam Province.

Gender component:

Not applicable

Deliverables:

- Developing a generic spreadsheet model (Technical Coefficient Generator) for assessing technological and socio economic viability of adaptation and mitigation projects in rice-based production systems.

None

Partners:

AgMIP; IFPRI

Locations:

South Asia (SAs), South East Asia (SEA)

Activity 576-2013 (Milestone 4.3.3 2013.) Commissioned

Title: CGIAR Center support to include climate change research in the "Global Futures for Agriculture" project.

Status: Complete. The Global Future for Agriculture project of IRRI has the following activities: -Evaluation of drought tolerant virtual cultivar in South Asia using Mirca 2000 rainfed rice pixels and AR4 (coarse resolution) future weather scenarios with ORYZA 2000 (specialized rice simulation model) in South Asia-Development and application of crop simulation tools for C4 Rice, by incorporating C4 photosynthetic routines into ORYZA 2000. Preliminary application of the model in South Asia was made after calibration and validation of the simulation model. Further procedural refinement is under process.-Ex-ante assessment of drought tolerant virtual cultivar done for South Asia. Analysis indicates that the development and release of this new variety in South Asia would provide net economic benefits in light of global climate change. -Integration of ORYZA 2000 into DSSAT (decision support system for agrotechnology transfer) framework

Gender component:

Not applicable

Deliverables:

- Advanced simulation analyses of virtual cultivars of rice.

None

- Contribution to dissemination report to partners, donors, researchers, and policymakers providing details on



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modeling, impacts of different scenarios and preliminary conclusions and recommendations on effective policy interventions.

None

- Participation in one or more final/transition workshops.

None

Partners:

Locations:

Global

2. Succinct summary of activities and deliverables by Output level

Output: 1.1.1

Summary:

- Regional action plans for adaptation strategies in rice-based systems in mega deltas of S and SE Asia

Several IRRI-CCAFS activities in 2013 were tied into the climate change adaptation projects in the Mekong Delta (under CLUES = Climate Change affecting Land Use in the Mekong Delta: Adaptation of Rice-based Cropping Systems). Analysis of the farming systems and livelihoods and adaptive capacity of rice households was carried out towards understanding institutional and policy gaps related to farming households' adaptation. The fine-tuning of participatory rice varietal assessments (as a promising adaptation technology) was also undertaken. With regard to resource management for resilient rice-based systems, four provinces in Vietnam have been selected to develop solutions for future environmental challenges in each of the agro-hydrological zones within the Mekong Delta. The available results indicated that AWD could be a good solution to overcome water scarcity under current and future conditions. The use of this technology by farmers will potentially increase resilience to water scarcity in the rice production systems of the Mekong Delta. In the future changed, climatic conditions could exacerbate acid sulphate soils and generate further acidity. This aggravating soil quality will affect a whole range of management factors including crop residue recycling.

- Identifying regional/ seasonal hot spots of heat stress and potential adaptation through adjusted cropping calendar.

We identified hotspots for daytime and nighttime heat stress using daily maximum and minimum temperatures during critical rice growth stages. Our preliminary analysis shows that many rice areas in mainland Asia and parts of western Africa have been experiencing frequent heat stress events over the past three decades (Fig). We are currently refining our model to take into account the effect of relative humidity by using panicle temperature instead of air temperature. These spatial assessments of rice areas that are vulnerable to heat stress are important for planning and targeting appropriate adaptation and mitigation strategies to ensure food security. As a next step, we will simulate the effect of adoption of shorter duration varieties and shifted cropping patterns in rice areas prone to heat stress.

- Capitalizing on gender-specific roles for improved coping strategies for aggravating climate extremes in rice-based farming households

The IRRI-CCAFS Theme 1 activities in the Philippines make use of a gender-sensitive stakeholder analysis. In the context of climate change adaptation in smallholder rice farming systems, this analysis is key to understand the interplay between gender roles and gender-differentiated risk perceptions toward climate change/ variability and their impacts. In 2013 (phase 1: consultation or needs assessment), IRRI in collaboration with the Municipal

Agriculture Office (MAO) and National Irrigation Administration (NIA) conducted household surveys with women and men farmers separately from two villages where floods are a common occurrence.

The results of the surveys showed that very few women are directly involved with rice cultivation. They are directly involved only during seed selection and post-harvest activities and replanting when rice plants are damaged; yet they seem to be more affected by rice crop loss and low yields than the men due to direct reduction of expendable household budgets. In 2013, most farmers in the villages have adjusted their cropping calendar to avert typhoon and flooding shocks that in the past have detrimentally affected their income. The project is looking at the impacts of these developments, namely how the farmers' adaptive capacity and intra-household allocation of resources are affected.

- Capitalizing on gender-specific roles in farm households for defining viable adaptation projects in rice-based production systems

Several risk-coping strategies were identified from the household surveys conducted in 2013. But these strategies should be transformed into concrete long-term adaptation projects in order to create an impact to the farming households. Since the farmers experience several flooding events every year, it was considered that the farmers: (i) shift the cropping calendar and (ii) get involved in initiating non-farm and off-farm livelihood programs offered by other institutes such as MAO. We will follow up in 2014 how these developments will affect farmers' adaptive capacity and intra-household allocation of resources.

- Identifying synergies of adaptation strategies and technology campaigns for improved resource use efficiencies in rice-based systems

The activities in 2013 focused on decision making on adaptation and mitigation options for rice farmers through Mobile Phone applications. An existing mobile phone app on resource-efficient crop management has been expanded to a Climate-Informed Rice Crop and Low Emission Manager (CIRCLE). While IRRI has received funds from the Regional CCAFS office in Hanoi to develop a new mobile phone app jointly with the Vietnamese Academy of Agricultural Sciences, such mobile phone apps have also been used in other CCAFS activities, e.g. in Central Luzon (Philippines). The new beta-version available for Vietnam contains various generic algorithms to compute real-time nutrient demand based on 'target yield' levels alongside with the GHG footprint of a given management practice.

Output: 1.2.1

Summary:

This output was not yet achieved in 2013, owing to difficulties in obtaining suitable down-scaled GCM data. But much of the technical base to generate the output was put in place in 2013 including an improved SAMARA crop model; multi-environment field data for 12 diverse high yielding rice varieties for model calibration and

validation; new experimental data to calibrate models for ambient CO₂ effects on rice canopy photosynthesis, transpiration and growth; and a prototype methodology for scenario downscaling and evaluation in collaboration with a new partner, Manila Observatory. The output will be achieved but with a 1-1.5 year delay due to data availability.

Output: 2.1.1

Summary:

IRRI has been actively involved in compiling GIS datasets for mapping rice areas and cropping calendars of rice-growing regions. These have been particularly useful in IRRI-CCAFS activity of identifying region-specific crop management options for improved resilience to cyclone/ typhoons. The recent experience of the Haiyan typhoon in Eastern Visayas (Philippines) highlighted the need for assessing the magnitude and spatio-temporal patterns of tropical depressions affecting rice production in Southeast Asia via GIS technology. The expertise of GIS lab will be tapped to provide maps which will be used to develop regional action plans for management climate risks.

Output: 2.2.1

Summary:

In 2013, partnership with the FAO Regional Office for Asia and the Pacific was developed to collaborate on the analysis of Food Security Statistics to establish baselines for indicators, and identify trends. The outputs of these analyses expedite the creation of a FAO / WFP Shock Impact Simulation Model (SISMod) which can be used to model the impacts of climate shocks on food security.

Partnership with the Regional Multi-Hazard Early Warning System for Asia and Africa (RIMES) was developed in the area of climate services, including historical data and seasonal forecasts. RIMES and CCAFS evaluated the use of climate information for food security, early warning, and/or disaster risk reduction in the Philippines, Cambodia, Lao PDR, and Myanmar. CCAFS and IRRI jointly organized a workshop on Integrated Food Security Modelling with participants from the CGIAR (CIMMYT, CIAT, and IRRI); the FAO; RIMES; and institutions of the Philippines Government, including the Bureau of Agricultural Statistics, PAGASA (meteorology), and the National Statistics Office.

Output: 3.3.1

Summary:

- Testing MRV-guidelines in different rice growing regions.

An IRRI-CCAFS workshop on greenhouse gas measurement and analysis guidelines with attendees from 5 Asian rice producing countries was held in December 2013. A conjoint project (MIRSA-2) was started. Field experiments on GHG emission reduction techniques in 4 countries will be conducted in 2014 and 2015. In all 4

countries the same measurement guidelines will be executed.

The annual GRA rice paddy group meeting with attendees from 8 rice producing countries was held at IRRI in January 2013. Greenhouse gas measurement guidelines were an important topic of the meeting and the members agreed to use a common measurement protocol.

On the IRRI research station, GHG measurement guidelines have been tested in view of their adequacy regarding spatial variation of emissions. On two 1-ha plots, systematic GHG sampling on different spots has been done to assess the variation of methane and nitrous oxide emissions on different spatial scales.

- Identifying strategies to strengthen female engagement into mitigation projects in rice-based production systems.

With the aim of engaging women into mitigation projects such as alternate wetting and drying (AWD), several household interviews were held in 2013. These interviews were seconded by other extension activities such as training and workshops to determine and address the factors enabling and constraining the adoption of AWD. Most women – as well as some men -- in the study area were generally unaware of the merits of AWD. So AWD posters and flyers written in the local language were distributed to irrigators' association and farmers. A de-briefing workshop was organized to allow them to share their experiences and difficulties in practicing AWD. However, women's participation in the study has remained wanting and also the suggestion to farmer women to monitor and collect water level data (as a field scout) throughout the crop growth stage in compliance with the AWD water management practice has had limited success. We observed that the acceptance of AWD was more prominent among the households with both the husband and wife working together on the farm. As this behaviour results from the women's own decision, this can be seen as a form of empowerment within the family.

- Devising protocols on the use of innovative approaches and instrumentation for recording emission rates as a means to ease future MRV requirements.

The principal objective in terms of MRV development in 2013 was the determination of diurnal cycles as a means of assessing uncertainties implied in manual sampling taken only once or twice a day. For this purpose, we used results from automated chamber systems that recorded emission rates over 24-h cycles coming from the research project ICON (Introducing non-flooded crops in rice-dominated landscapes: Impact on CarbOn, Nitrogen and water budgets). The results clearly showed the temporal variability is superseded by spatial variability which impedes a clear-cut definition of diurnal patterns. However, the results may be affected by the specific conditions during the dry season as well as the relatively poor time resolution of approx. 4-h intervals.

Moreover, a protocol was developed using a semi-automated photo-acoustic gas (PAS) monitor - INNOVA1412j, for measuring GHG emissions in rice fields, as a possible alternative to the manual gas sampling and analysis by gas chromatography (GC). A highly significant correlation between GC- and PAS-measured CH₄ fluxes was obtained in a continuously flooded rice field at the IRRI farm during the wet season. Similarly, a high correlation between GC- and PAS-measured N₂O fluxes was obtained in aerobic rice fields. No significant N₂O and CH₄

fluxes were observed under flooded and aerobic conditions, respectively, by both PAS and GC methods. Recently, a portable dew point generator (DPG) - LI-COR model LI-610 placed between the chamber and the PAS has been tested and verified to reduce and maintain a stable water vapor during GHG measurements. The DPG is now being used together with the PAS for GHG measurements during the dry season. A comparison of the GC, PAS and the eddy covariance system for measuring CH₄ fluxes is ongoing at the IRRI experimental rice fields.

- Fine-tuning of rice mitigation strategies in SE Asia in suitable regions and production systems.

In 2013, IRRI conducted greenhouse gas (GHG) measurements in the Philippines in collaboration with PhilRice (embedded in the SAMPLES project). In the dry season, the mitigation potential of the AWD technology has been assessed in 4 different types of irrigation systems on farmers' fields with great success at all sites. In the wet season 2013, the mitigation effect of AWD was also tested under rainy conditions in the Philippines. Even then, a significant methane reduction could be achieved at the two test sites.

In Vietnam, extensive diurnal GHG measurements were conducted in two seasons of 2013. Furthermore, field experiments assessing the mitigation potential of AWD with and without salinity stress were conducted in central Vietnam. In the Mekong Delta, different combinations of straw-, water- and fertilizer management practices have been analyzed for their mitigation potential.

In collaboration with the IRRI GIS lab, a suitability map for AWD dissemination has been generated for the Philippines. Climate and soil data have been linked with the rice calendar to identify high and low priority areas for the dissemination of the AWD technology in the different cropping seasons. The Philippine case study has also served for developing the methodology of the suitability assessment that will now be extended to entire Southeast Asia in 2014.

- Facilitating a CDM methodology for preventing straw burning: formalizing and submitting a methodology approach to UNFCCC.

The smoke collection device constructed in 2012 has been used in 2013 for analyzing GHG emissions from rice straw burning have been done in IRRI fields. These measurements focused on the impacts of different moisture levels on the composition of the smoke, namely the concentrations of CH₄ and N₂O. Moreover, we made several technical improvements in the design and operation of the smoke collection device in 2013. These modification required to revise the measurement protocol which is now much more efficient and facilitating a fast and reliable through-put of straw samples.

Improving the mechanistic understanding of mitigation effects in rice-based systems in terms of element cycles and ecosystem functions: continued field experiments and model development.

The long-term goal of the IRRI-CCAFS activities on process understanding is to establish a Knowledge Hub on GHG Mitigation in Rice Production Systems. The required increase in rice production must be achieved with less water, less labor, and less land in more efficient, environment-friendly production systems that are resilient to climate change and contribute less to greenhouse gas emissions. An important component of this work is the

development and use of performance indicators that provide quantifiable targets through which management practices can be identified to optimize among multiple goals of high productivity, high profitability, and sustainability while meeting the standards of environmental quality. An extensive field experiment on a total of 12-ha is designed as a long-term, production-scale experimental system in which modern technologies are dynamically explored and adapted to the needs for different intensification and diversification options (Ecological Intensification Platform). Three eddy covariance flux towers were installed to directly measure fluxes and budgets of CO₂, CH₄, energy, heat, and evapotranspiration within the different cropping systems. The field experiment also included overhead centre pivot sprinkler irrigation systems to improve water-use efficiencies. The innovations arising from the research platform will contribute to future transformation of existing double and triple rice-cropping systems in Southeast and East Asia. In 2013, comparative CH₄ measurements between the Eddy Covariance system and the common manual static chamber approach have been conducted. The differences of the results of the two approaches were bigger than expected. In 2014, comparative PAS measurements will be added to the experiment.

Output: 4.1.2

Summary:

- Developing a generic spreadsheet model (Technical Coefficient Generator) for assessing technological and socio economic viability of adaptation and mitigation projects in rice-based production systems.

A spreadsheet model (Technical Coefficient Generator = TCG) has been compiled for Quang Nam Province in Central Vietnam. The input data was generated by extensive surveys of farmers and other stakeholders. The computations are based on models (ORYZA2000, DNDC) as well empirical response functions, e.g. for salinity effects. In the current version, the TCG calculates

- Potential yield,
- Limited yield (water and nitrogen limitations),
- GHG fluxes as a function of drainage periods,
- Yield losses as a function of salinity stress, and
- Yield losses as a function of climate change scenarios.

The TCG will now be used to compile GIS-maps on land use and derive parameters, namely yields and GHG emissions, under different planning purposes. These maps will be summarized in a 'road map' for desirable development rice production technologies in Quang Nam Province.

Output: 4.3.3

Summary:

The Global Future for Agriculture project of IRRI has the following activities:

- Evaluation of drought tolerant virtual cultivar in South Asia using Mirca 2000 rainfed rice pixels and AR4 (coarse resolution) future weather scenarios with ORYZA 2000 (specialized rice simulation model) in South Asia
- Development and application of crop simulation tools for C4 Rice, by incorporating C4 photosynthetic routines into ORYZA 2000. Preliminary application of the model in South

Asia was made after calibration and validation of the simulation model. Further procedural refinement is under process.

- Ex-ante assessment of drought tolerant virtual cultivar done for South Asia. Analysis indicates that the development and release of this new variety in South Asia would provide net economic benefits in light of global climate change.
- Integration of ORYZA 2000 into DSSAT (decision support system for agrotechnology transfer) framework

3. Publications

Publication #1

Type: Journal papers

CCAFS Themes: Theme 3

Citation: Gaihre, YK, Wassmann R, Villegas-Pangga G. 2013. Impact of elevated temperatures on greenhouse gas emissions in rice systems: interaction with straw incorporation studies in a growth chamber experiment. *Plant and Soil* 373: 857-875.

Publication #2

Type: Other

CCAFS Themes: Theme 4.3

Citation: Mohanty S, Wassmann R, Nelson A, Moya P, and Jagadish SVK. 2013. Rice and climate change: significance for food security and vulnerability. IRRI Discussion Paper Series No. 49. Los Baños (Philippines): International Rice Research Institute. 14 p.

Publication #3

Type: Journal papers

CCAFS Themes: Theme 3

Citation: Tirol-Padre A, Rai M, Gathala M, Sharma S, Kumar V, Sharma PC, Sharma DK, Wassmann R, and Ladha JK. 2014. Assessing the performance of the photo-acoustic infrared gas monitor for measuring CO₂, N₂O, and CH₄ fluxes in two major cereal rotations. *Global Change Biology* 20: 287–299.

Publication #4

Type: Other

CCAFS Themes: Theme 3

Citation: Siopongco JDLC, Wassmann R, Sander BO. 2013. Alternate wetting and drying in Philippine rice production: feasibility study for a clean development mechanism. IRRI Technical Bulletin No. 17. Los Baños (Philippines): International Rice Research Institute.

Publication #5

Type: Book chapters

CCAFS Themes: Theme 3

Citation: Sander BO, Wassmann R and Siopongco JDLC. () Water-saving techniques: potential, adoption and empirical evidence for mitigating greenhouse gas emissions from rice production. In: Hoanh CT, Smakhtin V, Johnston, T. (Eds). *Climate change and agricultural water management in developing countries*. CABI Climate Change Series. CABI Publishing, UK (in print)

4. Communications

Media campaigns:

None

Blogs:

Climate change mitigation through alternate-wetting and drying in Central Luzon, Philippines (funded by SAMPLES)

<http://ccafs.cgiar.org/blog/step-step-strategies-low-emission-cultivation-are-being-explored#.UtjO19Jxzcs>

Websites:

Technical bulletin on Alternate wetting and drying in Philippine rice production: feasibility study for a Clean Development Mechanism

<http://www.irri.org/resources/publications/serials/technical-bulletins/item/alternate-wetting-and-drying-in-philippine-rice-production-feasibility-study-for-a-clean-development-mechanism>

Social media campaigns:

None

Newsletters:

None

Events:

1) Regional workshop on gender and climate-smart agriculture in ASEAN in Bangkok on 11-12 December 2013.

<http://www.wocan.org/news/regional-workshop-gender-climate-smart-agriculture-asean-11-12-dec-2013-organized-fao-giz-wocan>

2) Seminar on IRRI's greenhouse gas mitigation work under CCAFS by BO Sander on 19 November 2013.

<http://irriseminars.blogspot.com/2013/11/irris-greenhouse-gas-mitigation-work.html>

3) IRRI holds workshops on greenhouse gas emissions from rice production on 21-24 January 2013. [http://irri-](http://irri-news.blogspot.com/2013/01/philippines-irri-holds-workshops-on.html)

[news.blogspot.com/2013/01/philippines-irri-holds-workshops-on.html](http://irri-news.blogspot.com/2013/01/philippines-irri-holds-workshops-on.html)

4) Hands-on training and coordination workshop on greenhouse gas emission measurements in rice fields in

December 2013. <http://irri-news.blogspot.se/2014/01/irri-and-ccafs-regional-program-office.html>

Videos and other multimedia:

Presentation titled “Prospects of mitigation in rice fields and possible policy support: Examples from Asia” at the CCAFS Workshop on Institutions and Policies to Scale out Climate Smart Agriculture on 2-5 December 2013, in Colombo, Sri Lanka

<http://www.slideshare.net/cgiarclimate/r-wassmann-29133073>

Other communications and outreach:

1) Several stand-up posters of CCAFS-funded climate change research have been set up in IRRI headquarters. Each poster represents a certain topic that follows IRRI’s new climate change framework. CCAFS topics include: (i) Climate-informed crop management, (ii) Region-specific assessments, and (iii) Training, media and policies.

2) Poster titled “Climate Change Activities of the International Rice Research Institute in Southeast Asia” by Wassmann R, Sander BO, Basconcillo JA. Climate Change Agriculture and Food Security Scientific Meeting, 19-21 March 2013, University of California Davis, USA.

5. Case studies

Case Study #1

Title: Mitigation potential of AWD in different irrigation systems and socio-economic aspects of water saving

Author: B.O. Sander

Type: Social differentiation and gender, Participatory action research, Food security

Project description:

This case study is embedded in the SAMPLES project. In one region of the Philippines (Central Luzon), an intensive analysis of the mitigation potential of AWD (a water-saving technology) in four different irrigation systems in the dry and wet seasons has been conducted. The research was carried out directly on the fields of the farmers who take some measurements themselves. This study is strongly related to food security because water shortage particularly in dry years has in the past led to harvest loss. Water saving can be an important measure to impede this yield loss. As in any technology dissemination efforts, site-specific distinctions have been observed. Thus, the assessment of farming households' attitude toward AWD adoption has been integrated into the SAMPLES project. This attitude is influenced by a number of agro-ecological, institutional, and socio-economic (including gender) factors. The Philippines Rice Research Institute is a research partner in this study while the National Irrigation Administration oversees the implementation and monitoring of AWD adoption level

Introduction / objectives:

1) To quantify the mitigation potential of AWD under four different irrigation systems
 2) To assess the feasibility of AWD in the wet season
 3) To identify socio-economic factors that benefit or hinder the implementation of AWD (with emphasis on gender factors)

Project results:

In all four irrigation systems (communal pump, governmental pump, near-source gravity irrigation and far-source gravity irrigation) methane emissions could be greatly reduced by more than 60% with the AWD technology as compared to continuously flooded fields while yields did not significantly differ. Nitrous oxide emissions only slightly increased or did not at all. Even in the rainy season (June-October), methane reductions of more than 30% could be achieved. The socioeconomic studies showed that yield losses remained the utmost concern of farmers in view of the possible AWD adoption followed by increasing rats due to lesser flooding time. Thus, water-saving techniques should be integrated into best farming practices (e.g. on nutrient, weed, and soil) to help farmers obtain higher yield. Women's participation to monitor and collect water level data (as field scout) in compliance with the AWD practice has had limited success. Yet, the acceptance of AWD seemed more prominent among households with both spouses working together on the farm. Women-focused info drive will be promoted.

Partners:

Philippines Rice Research Institute (PhilRice), National Irrigation Administration (NIA)

Links/sources for further information:

For more information about the case study area:

<http://www.irri.org/resources/publications/serials/technical-bulletins/item/alternate-wetting-and-drying-in-philippine-rice-production-feasibility-study-for-a-clean-development-mechanism> For more information about the SAMPLES project: <http://www.worldagroforestry.org/project/samples>



Case Study #2

Title: Dissemination of AWD in coastal areas of Mekong Delta

Author: Ngo Dang Phong, Reiner Wassmann, Vo Thanh Danh, Nguyen Thi Thanh Phuong, and Banh Thuy An

Type: Policy engagement, Participatory action research, Food security

Project description:

AWD was introduced to farmers in the Bac Lieu Province, Vietnam during the implementation of IRRI’s CLUES project (Climate Change affecting Land Use in the Mekong Delta: Adaptation of Rice-based Cropping systems) in 2011. The AWD dissemination of AWD was carried out by the Bac Lieu Department of Agriculture and Rural Development (DARD) with the support of GIZ Bac Lieu. AWD was integrated in DARD’s “1 Must-5 Reductions”

farming technique. The “safe” AWD principle was applied but with modifications: irrigation was made whenever water level dropped to 10 cm below soil surface during certain rice growth stages. This was to avoid the oxidation of acid and saline soils when soil dried up. AWD demonstration sites in 21 rice fields had been conducted and 21 technical training classes were given to 840 farmers from 5 districts of Bac Lieu. A survey was carried out to evaluate their willingness to adopt AWD. Results showed some great potential for designing new training programs on farming techniques in the area. The descriptive statistical and ANOVA analysis were used in this study.

Introduction / objectives:

The project aims to help farmers in the coastal area of Mekong River Delta (Bac Lieu province) achieve stable rice production by implementing a water-saving technique such as AWD. Climate change manifested through more frequent droughts in rainy season, prolonged dry season and higher saline water intrusion to fresh water areas have adversely affected the availability of water for rice farmers.

Project results:

The results showed that AWD technology was applied effectively for rice fields in the winter-spring seasons 2011-2012 and 2012-2013. Reduced pumping (by 3 times) and lower water input (by 30%) allowed the farmers to save about VND 2-4 million (or US\$ 96-192) per hectare on energy without yield penalty. Furthermore, lesser incidence of lodging for AWD fields compared with continuously flooded fields was also seen during harvest stage. As a technique within “1 Must-5 Reductions”, AWD brought more income to farmers through less frequent watering and reduced fertilizer and insecticide application. Most of farmers believed that AWD was an appropriate measure to cope with the aggravating impacts of changing climate. The assessment of the suitability of AWD differed by agro-ecological areas (severe, medium, brackish and fresh water areas) in Bac Lieu. While AWD was used safely on moderate acid sulfate soils, it was less effective in areas with severe conditions such as elevated fields, severe acid sulphate or saline soils.

Partners:

Can Tho University, GIZ Bac Lieu, and Bac Lieu Plan Protection Sub Department - Bac Lieu DARD

Links/sources for further information:

Paper titled “Farmers’ willingness-to-adopt on the alternate wetting and drying technology in Bac Lieu Province. Presented in November 2013 in a faculty workshop in Can Tho University, Vietnam: http://seba.ctu.edu.vn/HOITHAO/2013/Ky%20Yeu%20HT%20Khoa%20KT_2013.pdf. Pages 202-2017. <http://snn.baclieu.gov.vn/hoatdongnganh/Lists/Posts/Post.aspx?List=2b295da8-079c-42d3-bbaf-2d161ad8d5ac&ID=126>

6. Outcomes

Title:

Integration of AWD into Vietnam's climate change mitigation campaign (e.g. 20-20-20 strategy)

What is the outcome of the research (i.e. use of research results by non-research partners)?

Farmers will be applying AWD technology as a means to 1) save irrigation water and 2) reduce GHG emissions in rice fields

What outputs produced in the three preceding years resulted in this outcome?

- 1) Field measurements conducted jointly with NARES
- 2) Trained NARES partners
- 3) Several meetings with stakeholders in different parts of the country

What partners helped in producing the outcome?

NARES from Vietnam:

- 1) Hue University of Agriculture and Forestry
- 2) Can Tho University
- 3) Cuu Long Delta Rice Research Institute (CLRRI)

Who used the output?

- 1) Policymakers at the national level (Prime Minister)
- 2) Ministry of Agriculture and Rural Development (MARD)
- 3) Provincial governments
- 4) Vietnamese farmers

How was the output used?

Large-scale adoption of AWD in Vietnam will be promoted. Through the 20-20-20 decision Vietnam committed to reduce emissions from the agricultural sector by 18.87 Mt CO₂-eq in 2020. AWD is the most important technique for mitigation in rice production. It is directly mentioned in the MARD's decision number 3119..

What is the evidence for this outcome? Specifically, what kind of study was conducted to show the connection between the research and the outcome? Who conducted it? Please provide a reference or source.

1) Methodology has been approved and published by UNFCCC.

<http://cdm.unfccc.int/methodologies/DB/D6MRRHNNU5RUHJXWKHN87IUXW5F5N0>

2) AWD is promoted in the IRRI website to generate multiple benefits in terms of mitigation, water saving, productivity, and food security. <http://irri.org/our-impact/tackling-climate-change/addressing-water-scarcity-through-awd>

7. Outcome indicators

Outcome indicator #1

Outcome indicator:

One to five flagship technical and/or institutional approaches identified and developed with farmers, key development and funding agencies (national and international), civil society organizations and private sector in three regions, which would directly enhance the adaptive capacity of the farming systems to the climate change conditions

Achievements:

- Participatory variety selection was consistently used in all adaptation activities aiming at climate-resilient rice production systems. NARES partners have intensively been trained in this approach.

Evidence:

- New rice varieties have been introduced in the coastal area of the Mekong Delta in close collaboration with farmers. NARES partners show high familiarity with this approach.

Outcome indicator #2

Outcome indicator:

Breeding strategies of regional and national crop breeding institutions in three target regions are coordinated, informed by CCAFS-led crop modeling approaches that are developed and evaluated for biotic and abiotic constraints for the period 2020 to 2050

Achievements:

- Breeding institutes of Vietnam have been guided to develop multi-trait rice varieties coping stresses of both salinity and flooding
- Mapping of heat stress in Asia as a basis for identifying priority regions for disseminating heat-tolerant varieties

Evidence:

- New rice lines for field testing are available in the Mekong and Red River Deltas.
- GIS maps on heat stress overlaying region-specific temperature patterns and crop calendars

Outcome indicator #3

Outcome indicator:

Integrated adaptation strategies for agricultural and food systems inserted into policy and institutional frameworks at regional, national or sub-national level in 2 target regions. Policy makers and key stakeholders use CCAFS research outputs - guidelines, tools and methods- to support the development of NAPAS, sector specific adaptation plans, or germplasm benefit sharing policies.

Achievements:

- In the Philippines and Vietnam, IRRI decision tools based on mobile apps with optional setting of climate-adjusted yield targets (work in progress)

Evidence:

- Beta-versions of the mobile phone apps for the Philippines and South/ North Vietnam available (e.g. <http://webapps.irri.org/ph/rcm/> <http://webapps.irri.org/vn/rcm/>)

Outcome indicator #5

Outcome indicator:

Three food crisis response, post-crisis recovery, and food trade and delivery strategies tested and evaluated with partner crisis response organizations at benchmark locations in three regions

Achievements:

A new methodology for post-hazard mapping has conceptually been laid out and tested. Pending on more methodological development this pioneering approach could become a standard methodology for post-hazard mapping of yield losses, e.g. after extreme tropical depressions (typhoons and cyclones).

Evidence:

First set of post-hazard maps specifically mapping damage in rice production available (see <http://irri.org/news/media-releases/satellite-images-map-rice-damage-from-typhoon>).

Outcome indicator #7

Outcome indicator:

Findings and evaluation tools on mitigation and livelihoods benefits of alternative agricultural development pathways used by global agencies and decision-makers in two countries in each of the three regions

Achievements:

- In Vietnam and the Philippines, awareness of AWD has greatly increased among different stakeholders, namely farmers and irrigation authorities in selected target regions. AWD was integrated into the Vietnamese mitigation strategy 20-20-20 and is directly mentioned in brochures from Vietnamese extension services

Evidence:

- Recent Decision No.1775 of Prime Minister aims at promoting AWD for mitigating GHG emissions (see attached an unofficial translation)
- Recent MARD Decisions No.543 and No.3119 specify AWD implementation. These MARD Decisions are now being translated into action at provincial level, one example for Quang Nam Prov. in Central Vietnam

Outcome indicator #8

Outcome indicator:

Decision-makers in three regions better informed re options and policy choices for incentivizing and rewarding smallholders for GHG emission reductions

Achievements:

- National Irrigation Association (NIA) in Bulacan/ Philippines turned over big water pump to electricity company that now runs it with interval (instead of continuous running as before). Therefore, farmers in the regions pay lower electricity fee.
- In Vietnam, AWD became integral part of rice technology campaigns to increase farmers' incomes (e.g. "3 Reductions -- 3 Gains" and "1 Must Do -- 5 Reductions").

Evidence:

- Pump in target area of the Philippines operating according to AWD schedule
- Posters and brochures on "1 Must Do -- 5 Reductions" campaigns distributed in the Mekong Delta

Outcome indicator #9

Outcome indicator:

Project design and monitoring guidelines for smallholder agriculture in developing countries produced and contributing to global standards

Achievements:

- Provided advice to developers of standardized baseline for low emission rice production in the Philippines. Previously developed CDM methodology will form basis for this baseline.

Evidence:

Standardized baseline for low emission rice production in the Philippines will be submitted to UNFCCC in 2014.
<http://cdm.unfccc.int/methodologies/DB/D6MRRHNNU5RUHJXWKHN87IUXW5F5N0>

Outcome indicator #12

Outcome indicator:

New knowledge on how alternative policy and program options impact agriculture and food security under climate change incorporated into strategy development by at least 3 national agencies, and 3 key international and regional agencies

Achievements:

The specific outcome of this activity is policy support for the new 20-20-20 policy of the Vietnamese government that has now been passed on to the provincial governments for implementation.

Evidence:

The current version of the Technical Coefficient Generator targets one province (Quang Nam), but can now easily be adjusted to other provinces in Vietnamese Delta regions.