External Review Report:
Closing Rice Yield Gaps in Asia with Reduced Ecological Footprint (CORIGAP)

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1. Executive Summary

IRRI is implementing the project "Closing Rice Yield Gaps in Asia with Reduced Ecological Footprint" (CORIGAP). CORIGAP Phase 1 spans 2013 to 2016, and a possible Phase 2 is flagged for 2017 to 2020 if warranted by progress in Phase 1. This review of Phase 1 of the project was conducted by Drs Willett and Barroga in December 2015, nearly three years after the project's implementation. The review started with presentations by IRRI staff and representatives from most participating countries at IRRI Headquarters. The two reviewers then visited project sites in Vietnam and Thailand; Dr Barroga also visited one of the sites in China and Dr Willett one of the sites in Indonesia.

The overall objective of CORIGAP is "*to improve food security and gender equity, and alleviate poverty by optimizing the productivity (resource-use efficiency) and sustainability of irrigated rice production systems, and thereby close rice yield gaps in the major irrigated rice granaries in Asia"*. This is to be achieved through science-based, quantitative tools and participatory methods that:

(1) Generate evidence of increased profitability for smallholder farmers through an integrated approach to crop and natural resource management,
(2) Optimize "integrated sustainable rice production systems", and
(3) Reduce rice yield gaps in lowland rice cropping systems by combining the outputs from (1) and (2).

To meet its objectives, CORIGAP conducts adaptive research involving close linkages and feedback from farmer groups, and learning alliances among farmers, researchers, and staff from both the public and private sectors. Its interventions are based on an integration of needs assessment of smallholder farmers with best management practices for lowland irrigated rice production. The CORIGAP project supports key partners from six major rice producing areas of Asia (Indonesia, Sri Lanka, Vietnam, Thailand, China, and Myanmar).

In brief, we found that the project has made good progress in identifying the causes of yield gaps in each country and has a suite of integrated technologies that can reduce the yield gaps, or maintain current yields, whilst reducing inputs of seed, pesticide, and fertilizer, and by implication, reduce environmental impacts. The project is promoting field-tested interventions that have been demonstrated to result in increased profitability for farmers at sites in Vietnam, Indonesia, Thailand, and China. A particular feature of the project is the integration of in-field technologies with supportive activities, such as postharvest grain protection, learning alliances, and local and national policy support. Integration of systems is strongest in the well-established sites that have strong postharvest components. The project has an approach with a proven track record for gaining farm-level outcomes and impacts, which is very significant because community-level impacts are difficult to achieve when they require changes in in-field farm practices. It has established a wide network of farmer groups (about 65 groups at present) and local partners that are actively converting research results into community benefits. A significant CORIGAP initiative was the development of rice production sustainability indices. The project has also made major contributions to capacity building of researchers and extension specialists in the participating countries. The less advanced countries will benefit from the experience gained in countries in which most of the suite of CORIGAP

interventions has been established. CORIGAP's current structure and organization are proving effective and there is no need for significant changes to the project's structure.

The reviewers' detailed analysis in response to the formal terms of reference are:

The project has developed and tested best management practice interventions and is promoting those that increase *profitability* for rice farmers at sites in Vietnam, Indonesia, Thailand, and China. Increased profitability is largely due to reducing input costs (*i.e*., material and labor for applications) of seed, pesticide and fertilizer, with no or little increases in overall rice yields or total production. There is similar potential for increased profitability for Sri Lanka and Myanmar, with the important exception in Myanmar that some intensification, particularly increased (balanced) fertilizer use will be necessary. In relation to the development of farm-level interventions, we recommend that:

<u>Recommendation 1</u>: More formal and detailed financial information is needed for the interventions trialed and demonstrated at the sites as part of Phase 1.

<u>Recommendation 2</u>: A "sustainable intensification" approach of increasing some inputs, particularly fertilizer, be taken for Myanmar.

Progress in establishing *integration* of systems to support changes to on-farm practices is uneven between the countries. It is most advanced at sites that participated in the preceding project (Irrigated Rice Research Consortium, IRRC) that have strong postharvest components, such as in Vietnam, where opportunities for linking farmers to merchants are being cultivated and developed. These are the sites where good linkages have been forged with the private sector. They represent models that should be applied to the sites in countries where linkages to the private sector are weaker, or depend on *ad hoc* opportunities:

<u>Recommendation 3</u>: The project should intensify its efforts to systematically engage with the private sector at those sites where this is relatively weak (Yogyakarta, Guangdong, all sites in Myanmar, and Thailand).

A particular feature of the project is the integration of in-field technologies with supportive activities, such as postharvest grain protection, learning alliances, and local and national policy support. This approach, pioneered and proven in the later phases of IRRC, indicates the project will make significant impacts that are difficult to achieve when they require changes in in-field farm practices (as opposed to research outputs encapsulated in improved seeds). A remarkable achievement of the project was the demonstration that rice yields could be maintained, sometimes with yield increases, even with reduced inputs of seed, water, pesticide, and fertilizer. However, the practices for reducing the yield gaps were not always the most profitable for farmers:

<u>Recommendation 4:</u> The project should focus on the implementation of practices that significantly reduce yield gaps and at the same time are financially attractive to farmers. In the rice exporting countries of Vietnam and Thailand, it should emphasize increasing profitability for improving the livelihoods of small-scale farmers, with reduced environmental impacts. In China, Indonesia, Myanmar, and Sri Lanka, the focus should be on profitably raising yields, also with minimized environmental impacts.

The Field Calculator tool and environmental indicators for considering environmental impacts of rice production are a significant positive development since IRRC, and are an important contributor to IRRI's environmental protection related research. It was unclear exactly to whom the tools are directed. Specification of the users (other than researchers) should be followed by an analysis of how best the information contained in the final outputs is presented.

Recommendation 5: Introduce and apply the Field Calculator and environmental indicator work to all locations. Clarify who the potential users are and how they would like to receive the resulting information.

The project has made major contributions to *capacity building* of researchers in the participating countries, and is continuing to do so even at sites that have already received substantial training by IRRI and other agencies. The integrated approach of the project has improved the research-extension nexus in all countries, and this has been important in China and Thailand that have good research capacity but were relatively weak, or needed better support, in getting research findings out to those who can use them.

The project's *set up* and approaches are effective and have good prospects for impacts as already evident in Vietnam. There is no need for significant changes in the project's set up in terms of its administration and mode of operation. The overall objective should be to bring the entire suite of CORIGAP activities to all countries, recognizing tailoring is required for each country as recommended in this report. Recommendations for particular countries are:

Recommendation 6: In Phase 1, expand the demonstration work in Indonesia with the aim of convincing farmers of the reliability of profitable rice production with small environmental footprints.

Recommendation 7: The work in Thailand and China has started well but additional support and time are needed to further test existing promising interventions leading to imminent large-scale trials that will convince farmers, and to widen the range of stakeholders in a learning alliance.

Recommendation 8: CORIGAP should more firmly establish the Field Calculator and environmental indicator approach in the Thai Rice Department and Land Development Department.

Recommendation 9: In Myanmar and Sri Lanka CORIGAP should steadily expand its activities at most of the sites to the full range of activities operating elsewhere. The arrangements and experience gained in-country to date, and elsewhere, position the project well to deliver impacts within the next few years.

Market integration with farmers is most developed in Vietnam, which demonstrates the potential benefits in terms of driving adoption of improved agronomic practices when there are close linkages between rice producers and the purchasers of the grain.

Mechanization is of increasing importance and when introduced to one part of the crop cycle can have positive consequences for field operations at other times (*e.g.,* alternate wetting and drying is likely to be more feasible with laser leveling):

<u>Recommendation 10</u>: A more integrated and holistic approach be taken in relation to mechanization throughout entire cropping cycles.

The project is consistent and complementary with government *policies* at each site and reflects the frequent and intensive consultations of senior CORIGAP staff with senior agricultural officials in each country. There is evidence of the project influencing policies in Vietnam and China. It appeared the policy related work was rather *ad hoc* or opportunistic, or it may simply have not been well documented. The policy work of the project did not make links with closely related policy issues, such as demand management of irrigation water, subsidization of fertilizer inputs, or regulation of pesticide use.

<u>Recommendation 11:</u> A more systematic approach with formal documentation is needed for the policy advisory and advocacy role of the project.

In general, we consider that the project is making good progress but has not advanced as far as originally planned in some aspects. Nevertheless, the project has good prospects for successfully converting research-based interventions for the benefits of small-scale farmers, and to the environment, of intensive rice-based cropping systems. CORIGAP has successfully developed a means of gaining adoption of farm-level changes in practice that have, in general, been very difficult to obtain, especially in less-developed countries. It has developed an approach, currently most advanced in Vietnam, which can, with some adjustments for particular sites, be applied in the other five countries and elsewhere.

The project has made sufficient progress to show that it has very good prospects of achieving key impacts of improved livelihoods for small-scale farmers, with reduced environmental impacts. This is shown by its impacts at its most advanced sites in Vietnam and South Sumatra in Indonesia, and is underpinned by formal external economic assessment of the closely related previous programs of IRRC. However, much remains to be done to clearly demonstrate financial and environmental benefits, and completion of the Field Calculator tool and environmental indicator work is required for this purpose, particularly for the newer project sites. The objectives as originally envisaged cannot be achieved at all project sites in the remaining 12 months of the project but sufficient progress has been made to make the recommendation:

<u>Recommendation 12</u>: That an early decision be made to continue CORIGAP in a Phase 2. Revisions and tuning should be made in accordance with the recommendations of this review.

We endorse and congratulate participants on the successful approach and mode of operation of the project, which has proven robust when applied to sites with varying operating environments. However, we do not mean continuation without some real change or "carrying on as is", but that the recommendations made here be adopted. In particular, there should be emphasis on practices that significantly reduce the yield gaps and increase farm profitability with minimal environmental impact. Increasing farmers' profits may encourage more farmers to continue farming and improve their practices to increase yield and quality and may also encourage younger farmers to engage in farming. The monitoring tools should be completed in Phase 1 and applied to larger scale demonstrations of integrated interventions that will convince farmers.

Acronyms and Abbreviations

1M5R:	1 must do, 5 reductions (in Vietnam)
ACP:	Agriculture Competitiveness Project (in Vietnam)
AC:	Advisory Committee
AWD:	Alternate wetting and drying (water saving irrigation)
CORIGAP:	Closing Rice Yield Gaps in Asia with Reduced Ecological Footprint
BPTP:	Bahasa Indonesia for Assessment Institute for Agricultural Technology
CROP:	Cost Reduction Operating Principles (in Thailand)
CU:	Coordination Unit team (CORIGAP project)
CURE:	Consortium for Unfavorable Rice Environments
DARD:	(Provincial) Department of Agriculture and Development (in Vietnam)
FGD:	focus group discussions
GAP:	Good Agricultural Practice
GDRRI:	Guangdong Rice Research Institute
GP-PTT:	large scaling out program in Indonesia based on ICM
GRiSP:	Global Rice Science Partnership
ICM:	integrated crop management
IRRC:	Irrigated Rice Research Consortium
IRRI:	International Rice Research Institute
LDD:	Land Development Department (in Thailand)
MARD:	Ministry of Agriculture and Rural Development (in Vietnam)
NARES:	national agricultural research and extension systems
NGO:	non-government organization
NRM:	natural resource management
PTT:	Bahasa Indonesia for ICM
RCM:	Rice Crop Manager
RD&E:	Research, Development and Extension
RRDI:	Rice Research and Development Institute (in Sri Lanka)
SDC:	Swiss Agency for Development and Cooperation
SFLF:	Small Farmer-Large Fields (in Vietnam)
SRP:	Sustainable Rice Platform
SSNM:	Site-specific nutrient management
UPSUS:	*Upaya Khusus Pencapaian Swansembada Pangan* Special Efforts for Self Sufficiency Achievement (in Indonesia).

2. Introduction

IRRI is implementing the project "Closing Rice Yield Gaps in Asia with Reduced Ecological Footprint" (CORIGAP) with funding from the Swiss Agency for Development and Cooperation (SDC). CORIGAP Phase 1 spans 2013 to 2016. A possible Phase 2 is flagged for 2017 to 2020 if warranted by progress in Phase 1. This review of Phase 1 of the project was conducted in December 2015, nearly three years after the project's implementation.

CORIGAP builds on a very substantial predecessor, the Irrigated Rice Research Consortium (IRRC) that spanned 1997 to 2013. The IRRC developed practical and affordable technologies and practices for smallholders to increase rice production in several Asian countries. Technologies developed by IRRC, including SSNM, AWD, drum seeding, improved post-harvest practices, and ecologically-based pest management have been widely adopted by farmers in Asia with benefits to farmers' livelihoods and potential to reduce the environmental footprint of intensive irrigated rice production. Integration and adaptation of IRRC technologies for particular rice agro-ecosystems take the form of "Good Agricultural Practices" (GAP). CORIGAP builds on GAP approaches and applies integrated practices aimed to reduce the gap between practical achievable rice yields and current yields, whilst reducing environmental impacts of rice production systems.

"The vision of CORIGAP is to co-develop science-based tools to close yield gaps while protecting the environment, leading to improved production systems that improve the livelihoods of smallholder rice farmers and meet the increases in rice production required to maintain food security in Asia."

The overall objective of CORIGAP has been stated as "*to improve food security and gender equity, and alleviate poverty by optimizing the productivity (resource-use efficiency) and sustainability of irrigated rice production systems, and thereby close rice yield gaps in the major irrigated rice granaries in Asia"*. This is to be achieved through science-based, quantitative tools and participatory methods that:

(1) Generate evidence of increased profitability for smallholder farmers through an integrated approach to crop and natural resource management,
(2) Optimize "integrated sustainable rice production systems", and,
(3) Reduce rice yield gaps in lowland rice cropping systems by combining the outputs from (1) and (2).

CORIGAP conducts adaptive research involving close linkages and feedback from farmer groups, and learning alliances among farmers, researchers, and staff from both the public and private sector. Its interventions are based on an integration of needs assessment of smallholder farmers with best management practices for lowland irrigated rice production. It is developing a tool, the "Field Calculator", to assess productivity, profitability, and environmental impacts of management practices of rice cropping systems.

Additional expected outcomes of CORIGAP Phase I are:

1. Outputs are expected to be adopted at national policy level.

2. The private sector and NGOs are incorporated in the project through their involvement in targeted country management teams and the development of learning alliances, and,
3. Adopted technologies provide environmental benefits that are gender positive through reducing the drudgery of women and providing them with better opportunities.

The CORIGAP project supports key partners from six major rice producing areas of Asia (Indonesia, Sri Lanka, Vietnam, Thailand, China, and Myanmar). The irrigated rice-growing areas of these countries have some common issues in rice production as well as some distinct differences. All the countries are experiencing shortages of, and an aging of, agricultural labor and a corresponding increased interest and need for mechanization; have objectives of improving farming families' livelihoods; and recognize the need to reduce environmental impacts of rice production. However, significant differences are apparent: variation in the emphasis on raising rice yields *per se* and overall production in countries aiming for self-sufficiency (occasional importing countries: Indonesia, China, Sri Lanka), and those emphasizing improved quality (exporting countries: Vietnam, Thailand, Myanmar). Some of the countries have fertilizer subsidies to promote its use, and none has volumetric charges for water use, which can work against the efficient use of these inputs, and corresponding reductions in potential environmental impacts. The countries have variable capacity to implement the project; some had extensive experience from the preceding IRRC and others are newcomers. There is also wide variation in existing relevant in-country development out-scaling activities that can pick up RD&E outputs from CORIGAP for immediate implementation. Accordingly, the expected outcomes and impacts of CORIGAP vary between countries. The reviewers have therefore largely taken a country-by-country approach in assessing the project's outputs and outcomes, with a focus on integrated technologies, market development, and environment impacts, rather than a focus on the assessment of individual technologies and practices.

3. Methodology

The reviewers were provided with detailed terms of reference and a guide to the methodologies to be used for this review. The terms of reference are shown in Section 4 (below; a small amount of repetition has been removed). Documentation provided in advance of the review period included the Project Document with its original logframe, Annual Reports for 2013 and 2014, up-to-date reports from each country, three reports on cross-cutting issues, and a recent report on each outcome, output, and activity as specified in the logframe. The material was supplemented by several reports provided during visits to IRRI and its partners and cooperators in Vietnam, Indonesia, China, and Thailand (Appendix 1a), and copies of the project's newsletter "Ripple". The review started with presentations by IRRI staff and representatives from most participating countries at IRRI Headquarters and national representatives made presentations for Sri Lanka and Myanmar which were not visited by the reviewers (Appendix 1b). The context of CORIGAP in relation to IRRI's current research position was discussed with Director General Dr Mathew Morell and in relation to GRiSP with Dr Bas Bouman.

The two reviewers visited Vietnam accompanied by IRRI post-doc Dr Alexander Stuart as a resource person. Dr Barroga visited China (Guangdong Province) with Dr Pieter Rutsaert whilst Dr Willett

visited Indonesia (Yogyakarta) with Dr Stuart. Both reviewers visited Thailand together with Drs Stuart and Rutsaert (Appendix 1a).

The reviewers developed a set of questions that would be posed in each of the countries visited (Appendix 2). These questions formed a core or minimum set to be asked in an appropriate style in each country. The questions were designed to assist the reviewers to be consistent across countries and to address specific terms of reference, and were aimed at national policy level, provincial or district level, and village or individual farmer levels. The reviewers recorded their main findings in reports for each country visited (Appendix 3), which also contained details of the people consulted, and places visited.

At the end of the review travel period the reviewers met to discuss the content and format of this review report, which was then completed by exchange of drafts. As noted above, there are significant differences in the rice industries between countries, and there are also differences in the outcomes and outputs expected for each country. Therefore, where appropriate, the reviewers have responded to the terms of reference country-by-country. The terms of reference were addressed on the basis of the written materials, oral presentations and briefings at IRRI and during country visits, and by interviews and discussions with national, provincial, and village agricultural officials, and directly with farmers in Vietnam, China, Indonesia, and Thailand.

The reviewers participated in the 3rd Annual CORIGAP Review and Planning meeting held in Yogyakarta, Indonesia, on 23-25 February 2016. They participated in discussions on the project presentations, and observations of the project's advisory committee, senior IRRI managers, and Dr Carmen Thönnissen of the Swiss Development Corporation. This report was finalized after feedback from that meeting.

4. Responses to the Terms of Reference

TOR 1. Achievement of project objectives

1(a) CORIGAP has generated evidence of increased <u>profitability</u> for smallholder farmers through an integrated approach to crop and natural resource management

Vietnam: The main project sites are in Can Tho and Long An provinces, (an additional location in An Giang serves as a satellite site), in the Mekong Delta region, which is largely a smallholder economy. Rice here is cultivated three times per year on about 4.3 M ha with a relatively high output of about 25 M tonnes (*i.e.*, 52% of the country's production). Key issues for increasing farm profitability are rice quality improvement and the need for farmers to be rewarded for improved quality, largely through development of contract farming systems. With signs of environmental stress starting, there is also a need to strengthen sustainable production.

Evidence of increased profitability has been generated by the project in two seasons of field trials. The trials on integrated NRM technologies using the "1 must do, 5 reductions"[1] platform in three management approaches (i.e., GAP, Small Farmer-Large Fields (SFLF), and conventional practice) versus farmers' practice have each indicated considerable increase in net profit (*i.e.*, for GAP, 4.35%; for SFLF, 14.7%; for conventional, 13%), but not in yield (*i.e.*, for GAP, -1%; for SFLF, 1.8%; for conventional, 1%)[2]. Net profit ranged from USD 60-210/ha. DARD partners and farmers interviewed affirmed reduction of production costs with a resulting similar yield leading to greater profitability. However, farmers expressed some difficulty with implementation, particularly on reducing seeding rate to the recommended 80 kg/ha. Specific recommendations for reduced fertilizer use have yet to be trialed. Some details of increased profitability of 1M5R implementation were also available from the last phase of IRRC. Benefits arising from using quality seed and reduced inputs of seed and agrichemicals were estimated at USD 160/crop, even without yield increases.

Increasing participation in the SFLF program, including contract farming for exporters, in which only farmers trained in the IRRC-developed 1M5R practices can join, is also providing evidence of increased profitability. Reports suggest farmers receive a premium of 100-150 VND/kg rice when produced by SFLF practices than by current farmers' practices. There is likely to be more opportunities of increased profitability and productivity from the project's introduction of machinery and postharvest technologies (*e.g.*, laser leveler, dryer, straw baler), including the DARD-initiated mushroom production to address rice straw management. There is great interest among the farmers in these technologies that support the use of integrated NRM technologies and that work well under the SFLF approach, but there are insufficient field data as yet to conclude that they increase profitability.

Overall, we conclude that in Vietnam, CORIGAP has generated good evidence of increased profitability for smallholder farmers through an integrated approach to crop production and NRM. This is due mainly to reduced input costs and from a slightly higher market price. Farmers have become aware of these economic benefits, as well as environmental advantages, but may need new additional learning strategies to facilitate behavior change given the shift to specific recommendations.

Indonesia: CORIGAP is being implemented at South Sumatra and at a new site near Yogyakarta. Rice in South Sumatra is produced in lowland coastal swamps with peaty soils and acid sulfate subsoils (0.5 to 2 m amsl). The wet season yield is in the order of 4 t/ha and yield gaps are about 33% (5.88 *vs* 3.96 t/ha). With good water management to control flooding and salinity, it is expected that 6 t/ha is readily achievable in the short term. In S. Sumatra, implementation of drum seeding, rat control, variety selection, leaf color chart and a soil test kit (SSNM under ICM is not yet fully implemented) has been achieved. Grain drying is widespread in S. Sumatra with more than 50 husk furnace units being produced. Dry season cropping was unproductive and unprofitable but the project's introduction of better varieties, drum seeder, rodent trap barrier system, and postharvest

[1] Also known as 1M5R or *Mot Phai, Nam Giam,* this is Vietnam's platform for best management practices developed under IRRC and consisting of the following: (1) must use good quality seeds, and reduce (2) seed rate; use of (3) pesticide, (4) fertilizer, and (4) water; and (5) postharvest losses. For improved use of 1M5R, the project recommended drum seeding at 80kg seeds/ha, AWD, SSNM, and clear limits for pesticide use (i.e., no more than 2 applications per target pest group).
[2] Percentage increase derived from data of the Vietnam report during presentation to external reviewers, 1 Dec 2015 at IRRI, Los Baños.

drying with assistance from the national agricultural development project *GP-PTT* has resulted in rapid expansion (about 20,000 ha - 10,000 each in the Telang and Seleh deltas). Benefits from increased yields and reduced input costs were said to be about USD 400/ha but financial information for wet season cropping was not presented.

The rice yields are higher in the Yogyakarta area, which is in the favorable growing areas of Java, where it is usually possible to produce three rice crops each year. However, a very large yield gap was identified in the initial farm surveys – 45% (5.3 t/ha: mean, 9.6 t/ha for top 10% of farmers). This may be an unusually large gap resulting from the sampling in the survey as field trials indicate smaller gaps in reality. Integrated interventions based on integrated crop management (ICM), ICM+drum seeder, ICM+AWD have already resulted in closing the gap in trials by 0.5 to 1.5 t/ha. ICM has reduced fertilizer and pesticide applications, with no yield penalties, suggesting that there are financial savings from the materials and the labor costs for applications, and corresponding possible environmental benefits. The latter have not yet been yet been estimated as the Field Calculator has not yet been applied in Indonesia.

Little financial information was provided for the trials in Indonesia but it is likely that at least some of the combinations will be profitable as there were reduced inputs cost with similar or slightly greater yields than current practices. Voluntary participation by neighboring farmers also suggest the interventions are financially attractive. Formal financial information is needed as part of Phase 1.

Thailand: There are two field sites in the Central Plain granary of Thailand, in Nakhon Sawan and Chainat provinces (*changwat*) that only started in 2013 or later. CORIGAP interventions build on the existing Thai program "Cost Reduction Operating Principles" (CROP), particularly by introducing AWD and drum seeding. The practices address the policy priority for Thailand of cutting the costs of production at a time when rice prices are flat or depressed and labor costs are rising. Focus group discussions and surveys of farmers by the project confirmed the farmers need to reduce production costs, and mechanization is widely practiced. Existing rice yields are around 4.8 t/ha and the best farmers achieve 6.2 t/ha, suggesting a yield gap of 23%. Survey data suggest that the best farmers already use nitrogen efficiently by using smaller rates than farmers who obtain only average yields. Therefore, there appears to be good prospects of raising yields whilst cutting down on nitrogen fertilizer use. Drum seeding (pulled by machine) and AWD were combined with CROP practices and compared with CROP-only practices ("3 must do" – 2 crops maximum per year, use of quality seed, keeping of diaries by farmers, "3 reductions" – seed rate, fertilizer rate, pesticide applications). Over three seasons of testing, rice yields in the treatments were similar, or slightly below farmers' existing yields, but were obtained with significantly smaller input costs, approx. USD 100/ha, because of reductions in seed cost (60%), insecticide (50%), and fertilizer (as a result of following recommendations obtained by soil analysis). AWD does not seem financially attractive from an individual farmer's point of view, although the water-saving was appreciated as the test periods coincided with a dry weather. Although much of the success in reducing inputs, and therefore increasing profitability and reducing environmental footprints, may be attributed to the core CROP treatments, it is clear that CORIGAP has provided the means of turning the *ideas* of input reductions of CROP into ways of implementing new practices on farms.

China: The CORIGAP site in China is in Guangdong province (in Yangxi, Gaoyao, Renhua, and Meizhou counties), where rice production is small-scale (*i.e.*, average of 0.2ha) and yields are 16% lower than the national average. The province, with almost 110 M population, imports rice from other provinces of China. Younger people are leaving farming for better incomes in factories and this compounds the problems of raising rice production. Focus group discussions identified the following constraints to profitable and productive rice production: rat and bird damages, lodging, lack of storage facilities, limited labor, and high input and labor costs.

CORIGAP interventions here build on the IRRC-developed three controls technology (3CT)[3]. Some 40% of farmers in Guangdong are reported to have adopted the technology since its introduction in 2007 and surveys of adopters showed they obtained higher yields compared with non-adopters, even with reduced fertilizer use. The 3CT package is further improved with the addition of AWD because there is currently no criterion yet for reducing irrigation cost. Results of participatory field trials on 3CT + AWD showed that, in general, yields were better than 3CT alone and farmers' practice, and have higher economic returns of 13% on average. The Gaoyao farmers who were interviewed attested to higher yield and estimated 20-30% increase in their income owing to efficient use of N, water, and pesticide. On-station field experiments on AWD, on the other hand, indicated that AWD15 (*i.e.*, irrigation when the water level has fallen to 15 cm below the surface) can save water by 20%, increase water productivity by 46%, and reduce greenhouse gas emission by 30%, while maintaining yield levels, as compared to farmers' practice. All this points to a growing evidence and awareness of increased profitability through reduced input costs and increased yield. However, further adaptive studies may still be needed because the intervention has not yet translated into significantly higher yield.

Sri Lanka: The CORIGAP sites here are in Polonnaruwa, a major rice bowl; and in Kilinochchi, an area affected by civil unrest in the 1990s. Rice in Sri Lanka supports the livelihood of more than 1.8 M farmers, who produce 4.3 M tonnes of rice from 1.2 M ha, where approximately 75% are irrigated. Rice self-sufficiency was achieved in 2010 but there is still a considerable yield gap of 24% or 1.5 t/ha (in Polonnaruwa, in particular).

The specific field sites in Polonnaruwa (*i.e*., Kalingaela) and Kilinochchi (*i.e.*, Paranthan) are different in terms of farm size and crop establishment methods (*i.e*., a mean of 0.81 ha and wet direct seeding for Kalingaela and a range from 2 to 15 ha and dry direct seeding for Paranthan). Average yield per hectare is higher at Polonnaruwa than in Kilinochchi (5.5 t/ha vs 3.9 t/ha).

There have been no previous IRRC activities in this country and there is no integrated crop and NRM platform yet. The project activities dealt more with preparations toward integration by adapting and validating at local field conditions component technologies that address FGD-identified production constraints (*i.e.*, crop establishment, and fertilizer, water, and weed management). Initial results are generally promising. Sri Lanka, however, could start taking and applying lessons from Vietnam and China on how to communicate and promote the technologies.

[3] This consists of controlling (1) N fertilizer; (2) unproductive tillers; and (3) pests and diseases. It became a nationally recommended technology in 2008.

Myanmar: CORIGAP currently focuses on rice in the Ayeyarwady delta, Myanmar's most productive area of its most important crop. To date, it has added learning alliances and gender and livelihood studies to projects funded by other agencies but this is about the change as CORIGAP is establishing stand-alone sites. It builds on the national policy of Good Agricultural Practice (GAP). In general, rice yields are smaller in Myanmar than the other countries of the project, due to the varieties being grown and small applications of fertilizer. It differs from the sites in the other five countries in that there may be a need to increase inputs of fertilizer to close yield gaps, and raise rice production generally, rather than reductions in fertilizer use that are feasible in the other countries.

Little information on rice yields was presented to the reviewers (this may have been attributed and reported to projects funded by others). In the Bago Division, farm surveys in the wet season of 2012 showed a gap of 36% (2.6 *cf* 4.1 t/ha) indicating good potential to reduce yield gaps. Better yielding crops were associated with soil type and the use of fertilizer. There was no information presented on profitability but it can be expected from IRRC results that profitable practices are being developed.

We conclude that the project has established that the interventions it has developed and field tested, and is promoting, result in increased profitability for farmers at the sites in Vietnam, Indonesia, Thailand, and China. Increased profitability is due to reducing the costs of inputs (*i.e.*, material and labor for applications) of seed, pesticide and fertilizer, with no or little increases in overall rice yields or total production. There is similar potential for increased profitability for Sri Lanka and Myanmar, with the important exception in Myanmar that some intensification, particularly increased (balanced) fertilizer use will be necessary.

Recommendation 1: More formal and detailed financial information is needed for the interventions trialed and demonstrated at the sites as part of Phase 1.

Recommendation 2: A "sustainable intensification" approach of increasing some inputs, particularly fertilizer, be taken for Myanmar.

1(b) CORIGAP has made strong progress towards optimizing "integrated sustainable rice production systems"

Vietnam: Unlike the other countries, Vietnam has the full suite of CORIGAP interventions and local country support to optimize integrated sustainable rice production systems. Its government has issued policies supportive of boosting rice farm productivity and profitability in a sustainable manner. Thus, collaborative efforts are bearing results, in general. There are strong, active local partners, who are on the ground for scaling out activities and preparing for global competition, and entrepreneurship through contract farming of quality rice, backstopped by a national policy (refer to 2e). The country coordinator is able to inform policies relating to rice production and to align

CORIGAP interventions to national rice programs given his technical competence and position at the Ministry of Agriculture and Rural Development.

The learning alliance facilitated by the project has led to initiatives for management of rice straw and promotion of mechanization, which helped optimize "integrated sustainable rice production systems" (*i.e.*, laser leveler for AWD and reduced water use). It has also led to engagement of universities and the private sector. Although DARD partners find adaptive research difficult, they recognize it has enhanced their confidence and competence as researchers and extension workers in giving advice. For the farmers, it has enabled them to actually see results of CORIGAP interventions and to explain to neighboring farmers who ask about these technologies. Visits and technical assistance from IRRI CORIGAP scientists are viewed positively by local partners.

Extension activities seem to be in full swing and in various forms (*e.g*., print materials, media, training programs, field days), and even included hosting Thai CORIGAP farmers on a study visit—a good example of cross-country learning. Local partners, however, have expressed concern on how to effectively communicate some technical terms to farmers (*e.g*., greenhouse gas emission which could be the 'sixth reduction').

We conclude that there is strong progress in Vietnam on all fronts toward optimizing "integrated sustainable rice production systems" and resulting in high levels of adoption. This could be attributed, at least in part, to the long-term partnership with IRRC that has led to empowerment of local partners and their ownership of the technologies. CORIGAP work relating to contract farming or understanding the value chain should be strengthened and the work on field calculator should be fine-tuned as these support Vietnam's focus to be an exporter of quality rice. Regrettably, progress may be affected by the retirement of the country coordinator, considering that the project is on its last year. This may need attention including assistance with strategies to communicate technical terms relating to "integrated sustainable rice production systems" (*e.g.*, greenhouse gas emission) to facilitate farmers' appreciation and understanding.

Indonesia: As noted under 1(a) above, promising production systems have been developed at both project sites in Indonesia. The strength of the post-harvest work in South Sumatra is notable and there are strong linkages with the private sector in production of grain dryers, and is a firm base for a learning alliance. Progress at the newer Yogyakarta sites has been impressive given the short time the project has been active there, and has established functioning farmer groups with reasonable female representation, as research-extension interfaces, but there not yet been formation of a learning alliance at that site. The in-field technologies are nearly "farmer-ready" and large-scale demonstration sites are needed to fine-tune them, and to demonstrate to farmers that the proposed changes are safe in terms of reliably producing profitable crops. There is still some convincing to be done.

Thailand: The CORIGAP site in Chainat was established recently but has formed a functioning farmers' self-help group at Wat Pakaew village based on CROP approaches. At present, only a few (2 in Wat Pakeaw and 4 in Nakhon Sawan) identified themselves as CORIGAP collaborators but by the end of 2015 about 26 existing community rice centers involving about 1000 farmers form a basis for changing from CROP to CORIGAP. Recruitment of new members, particularly from the younger

farmers, can be expected in both provinces. Extension materials, particularly mounted posters as preferred by the farmers, were evident at both sites and appeared appropriate. There is as yet no real learning alliance in either province, but given the need to integrate improved in-field practices, hermetically sealed storage of seed rice, and mechanization at all stages, and initial contacts with millers, the sites are good candidates for establishing formal learning alliances.

China: Long standing research partnerships between IRRI and GDRRI, and CORIGAP's choice of local champions and counterparts have made possible strong progress in China on optimizing integrated sustainable rice production systems. The addition of AWD to enhance 3CT, for instance, was reported to have started on previous research work in Guangdong. The IRRI counterpart, an IRRI alumnus, is credible, competent, and with hands-on/personalized approach. In addition, he seems to have strong communication skills and a good team working with him on this project to strengthen research and facilitate extension activities. Apparently, he also relates well with local officials and farmers, who have taken to themselves the promotion of 3CT and won awards and recognitions, too. His team and local partners attribute their competence to the adaptive research they jointly implement and the training received through the project.

Extension strategies are varied and innovative (*e.g.*, website, technical board, videos/CD, leaflets, training at various levels from national to village, field days, media, email query and advisory, a poem, and an app for android to be released soon), although farmers still request more extension materials. It is not clear if these have promoted cross-learning with other CORIGAP sites but, there are certainly many good strategies to share and learn from. Within China, project activities have led to greater interests and partnerships (*e.g.*, visits to the field trials by local leaders and technicians from other provinces), mainly with the national and provincial governments themselves promoting and co-funding 3CT or 3CT + AWD. This could be a good partnership model for other CORIGAP country sites to follow. However, there are also factors limiting optimization of integrated sustainable rice production systems. There is no planned formation of a learning alliance and there were initial government restrictions on gathering certain data that could help better understand impacts of sustainable rice production.

Sri Lanka: As mentioned in 1(a), work here is still at a preparatory phase. The current focus is to fine-tune and validate the Rice Crop Manager (RCM) given the current practice of blanket and fixed timing and rates of fertilizer recommendations in the region. The plan is to add other agronomic management guidelines, especially on weed management, which is a concern in the area, and is endorsed by the reviewers. Work on AWD needs to convince the irrigation authority to gain its support. Engagement of the private sector should be initiated.

Myanmar: Complete production systems were not expected to be developed in Myanmar at this stage of CORIGAP. Good progress is evident for the learning alliances in Maubin and Bogale villages building on IRRC work mostly in the post-harvest area with flatbed dryers. Interfaces and connections with the private sector are being cultivated, which could lead to price premiums for better quality rice. These, and FGDs and survey work, provide an excellent base for further RD&E.

Overall, we conclude that progress in establishing integration of systems is uneven, and is strong in the well-established IRRC sites that have strong postharvest components, particularly in Vietnam

where opportunities for linking farmers to merchants are being cultivated and developed.

These are the sites where good linkages have been forged with the private sector. They represent models that should be applied to the sites in countries where linkages to the private sector are weaker, or depend on *ad hoc* opportunities.

> Recommendation 3: The project should intensify its efforts to systematically engage with the private sector at those sites where this is relatively weak (Yogyakarta, Guangdong, all sites in Myanmar and Thailand).

1(c) CORIGAP has reduced rice yield gaps in lowland rice cropping systems by combining the outputs from (1a) and (1b). The consortium has developed improved approaches and technologies for more productive and ecologically sustainable production.

Vietnam: CORIGAP activities in Vietnam appear generally well on track and more advanced in comparison with the other countries because of supportive government policies and the long term partnership that started with the IRRC. The uptake of 1M5R and improvements to it, for instance, continues and there is great progress in postharvest and field calculator activities. However, the CORIGAP interventions have made little progress in reducing the 27% yield gap, although there was significant progress with reducing the input costs and ecological footprint of rice production through the use of smaller inputs. In addition to crop establishment limitations that were identified by the project, there are probably more significant constraints preventing farmers from attaining the yields of top performing farmers. This needs further study. In the meantime, it is equally prudent to take advantage of the government's focus on improving rice quality, farmers' incomes, and sustainability, with the rapid growth of contract farming, consumer awareness on safe products, and global competition.

In relation to the field calculator and sustainability indicators, data from household field surveys and adaptive trials have been used to validate these resources. Preliminary outputs from the surveys indicate that the best farmers have higher yields, more sustainable practices, and greater profitability.

Indonesia: Good progress has been made in increasing wet and dry season rice yields in Indonesia and closing the yield gaps at the two project locations. The yield was maintained or increased with reduced inputs of nitrogen (N) fertilizer and pesticides most likely resulting in increased profitability and reduced environmental impacts. The Field Calculator and associated indicators have not yet been applied in Indonesia. Insect biodiversity assessment of the ecological footprint has started at the Yogyakarta sites. The S. Sumatra sites on coastal swamps appear to have additional environmental concerns relevant to ecologically sustainable production because of the potential for

soil subsidence from the decomposition of peat layers, salinization, and acidification from exposure of potential acid sulfate subsoils. Water management at field and irrigation systems scales are key to managing these hazards. It may be possible to adapt the field tubes used for AWD purposes as piezometers to guide water management, and in particular the prevention of water tables falling below the depth of peaty or potential acid sulfate (sulfidic) layers.[4]

Thailand: To date, the in-field interventions have not reduced yield gaps but have most likely increased the profitability of rice production by reducing inputs of seed, fertilizer and insecticides with corresponding benefits to environmental quality. This would appear appropriate for a large exporting country that has does not emphasize local or national food security. Some training in the Field Calculator and environmental indicators has been provided to a Thai collaborator of the Land Development Department (LDD) but the approaches are not well established in the team overall. The Thai team assessed environmental impacts of rice farming by sampling and chemical analyses of soil and water samples. The samples, 3 times for inflow and outflow water in a crop season and once for soils at harvest, provide snapshots of potential contamination by excess fertilizer, as well as chemical properties related to general soil and water quality, such as those important for eutrophication. The results indicated that there were no significant concerns that rice growing caused contamination surface water or soils. There are limitations of the work due to the lack of pesticide residue analyses or measurements of water to apply mass balance approaches, but they are sufficient to indicate that direct sampling and analysis approaches can be dropped in favor of the Field Calculator and environmental indicators applied by CORIGAP.

China: Activities are generally on track, with some delays on activities relating to the Field Calculator and sustainability indicators in view of initial government restrictions on required data. The estimated yield gap in the province's study site is 30%, and results of trials and partnerships under CORIGAP are generating evidence of 13% higher yield over farmers' practice through use of 3CT + AWD, plus the additional benefit of reduced ecological footprint of rice production. There is a need and request, however, for additional time to stabilize results on 3CT+AWD. China's Field Calculator will be produced and tested in 2016.

Sri Lanka: Progress of activities based on the logframe is good, but with some delays (i.e., communication audit). Interventions to improve productivity and profitability of the farmers in the region using component technologies just started. Thus, work on reducing yield gap through integrated sustainable rice production systems is not expected yet.

Myanmar: Not expected yet. The introduction of the Field Calculator and environmental indicator work will be worthwhile in future activities.

Overall, we conclude that the project has made good progress in identifying the causes of yield gaps in each country and has a suite of integrated technologies that can help reduce them whilst reducing inputs of seed, pesticide, and fertilizer, and by implication, environmental impacts. A particular feature of the project is the integration of in-field technologies with supportive activities such as postharvest grain protection, learning alliances, and local and national policy support. This

[4] More detail will be provided in a separate communication.

approach, pioneered and proven in the later phases of IRRC, indicates the project will make significant impacts that are difficult to achieve when they require changes in in-field farm practices (as opposed to research outputs encapsulated in improved seeds). A remarkable achievement of the project was the demonstration that rice yields could be maintained, sometimes with yield increases, even with reduced inputs of seed, water, pesticide, and fertilizer. However, the practices for reducing the yield gaps were not always the most profitable for farmers:

> Recommendation 4: The project should focus on the implementation of practices that significantly reduce yield gaps and at the same time are financially attractive to farmers. In the rice exporting countries of Vietnam and Thailand, it should emphasize increasing profitability for improving the livelihoods of small-scale farmers, with reduced environmental impacts. In China, Indonesia, Myanmar, and Sri Lanka, the focus should be on profitably raising yields, also with minimized environmental impacts.

The Field Calculator and environmental indicators for considering environmental impacts of rice production are a significant positive development since IRRC, and are an important contributor to IRRI's environmental protection related research. It was unclear exactly to whom the tools are directed and this was not clarified by any observations of its application in project countries. Specification of the users (other than researchers) should be followed by an analysis of how best the information contained in the final outputs is presented. For example, for farmers a "traffic lights" system of red (danger of environmental impact), orange (likely impact), or green (impact not likely) may be appropriate. The "spider web" graphic visualization can be misleading particularly because the indicators are not expected to have consistent interpretation (*i.e.* a point plotted at the outermost circle means good for some indicators and bad for others). The name "Field Calculator" should also be reconsidered to find something more meaningful. In general, the calculators and indicators have been thoroughly thought through, exposed, and discussed widely in the region. However, it would be expected that well-developed pesticide impact indicators such as the "Pesticide Impact Ranking Index", or similar[5] indices, which have been applied in less developed countries, would have been utilized for estimating their potential environmental and health impacts, rather than pesticide use efficiency based just on the number of applications.

> Recommendation 5: Introduce and apply the Field Calculator and environmental indicator work to all locations. Clarify who the potential users are and how they would like to receive the resulting information.

[5] http://www.csiro.au/en/Research/LWF/Areas/Environmental-contaminants/Contaminant-chemistry/PIRI, PIRI has been applied in the Philippines, and compared with other tools in: G. Feola, et al. (2011). "Suitability of pesticide risk indicators for Less Developed Countries: A comparison". *Agriculture, Ecosystems and Environment:* 142, 238– 245.

1(d) <u>Strengthen capacity of NARES partners;</u> strengthen research and research-extension partnerships in the respective countries

Vietnam: Partnerships here trace back several years to IRRC, and build on the postharvest learning alliances and the IRRI scholarship program. There is good expertise in pest management/crop protection and mechanization/postharvest. We sensed strong ownership by the NARES of the technologies but, at the same time, there is attribution to IRRI and CORIGAP. Involvement of the national and local governments and of universities gives the partnership a good balance of research, extension, and policy support; while the addition of private sector partners provides the business angle. This blend of partnership can help sustain adoption of sustainable rice production technologies that tend to be complex. Limited capacity to speak the English language was mentioned by local partners as a significant constraint in learning more from the project.

Indonesia: The Indonesian national collaborators are strong and effective partners. They are continuing to benefit from interacting with IRRI and expressed appreciation of training activities. They stated that interacting with IRRI also helped motivation by external stimulation and international exposure. There have been spillovers from province to province, for example, of "Super bags" to Yogyakarta from S. Sumatra and with plant disease expertise in the other direction.

Thailand: A key benefit of Thai participation in CORIGAP above existing GAP programs (CROP) is that it provides a means of implementing improved practices with farmers. The project's activities have resulted in effective research-extension partnerships, and this can be expected to develop further, with learning alliances with a wider range of stakeholder, as the project develops. The Thai group has also benefited from training by IRRI and the project sponsored a farmers' visit to the longer established Vietnamese sites.

China: Partnerships here have started during the IRRC and is quite strong on nutrient management. There is a good mix of research and extension partners, mostly from the public sector. Its choice of country coordinator and IRRI counterpart (see 1b) has added credibility to the project and this certainly facilitates promotion and adoption of technologies. Members of the GDRRI research team have benefitted from trainings/workshops/internship by CORIGAP and have been publishing their CORIGAP work in scientific journals.

Sri Lanka: Already, five RRDI staff have participated in CORIGAP-sponsored training workshops; one has been sent for a 6-month internship at IRRI on physiological stress, and another has been supported by the project for a PhD dissertation. Under the current circumstances concerning AWD, it would be helpful for CORIGAP to provide training on AWD to participants from RRDI and the irrigation authority.

Myanmar: R&D capacity in Myanmar is not as well developed in the other countries because of decades of isolation. Capacity building in Myanmar has been a notable achievement of the project and the country is benefiting by cross country linkages fostered by IRRI. Research-extension interfaces are being strengthened. There are three postgraduate students supported by CORIGAP. The project is providing many opportunities for Myanmar scientists to attend international training

courses, workshops and conferences that had been made very difficult until recently. Emphasis on raising R&D capacity is appropriate for Myanmar.

Overall, the project has made major contributions to capacity building of researchers and extension specialists in the participating countries[6], and is continuing to do so even at sites that have already received substantial training by IRRI and other agencies. Capacity building activities seem to have mainly focused on strengthening technical competence and thus may need to shift a bit in its last year toward sharing and learning of extension-communication strategies and techniques in preparation for scaling out of crop and NRM management technologies. The integrated approach of the project has improved the research-extension nexus in all countries, and this has been important in China and Thailand that have good research capacity but were relatively weak, or just needed more support, in getting research findings out to those who can use them.

1(e) Future directions: Assess the <u>current setup</u> and develop recommendations on the need to sustain activities based on perceived needs/ opportunities/ challenges.

In this section, we consider the main future directions and develop specific recommendations for each country. Additional recommendations for the future of the project are presented in 3d (below).

Vietnam: There are excellent prospects for widespread adoption and benefits in the Mekong Delta, and CORIGAP should continue to facilitate and pursue these to reduce the possible loss of momentum if the project is terminated or contracted. Policies, good funding support, active team members and partners, and strong interest among farmers are all in place. When the Field Calculator is completed, this should further help spread adoption. However, the farmers' diaries, which support work on the Field Calculator, may need to be simplified to gain better acceptance. The focus in Vietnam should be on profitable and sustainable quality rice production, which meets the farmers' and the government's priorities. This includes improving postharvest practices, mechanizing farm operations, and analyzing the value chain and market.

The current project set-up seems effective, but as expressed in 1b above, the strong show of progress may be slowed down by the retirement of its country coordinator in the project's last year. Thus, there must be arrangements to effect a smooth transition.

Indonesia: Strong RD&E teams in Indonesia and promising technologies that are near "farmer ready" position the project well to establish large real-world scale demonstration areas with farmers. There were no apparent problems with the setup of the project in Indonesia. There is an administrative problem of late receipt of funds from IRRI that has been solved by in-country bridging arrangements but it would be helpful for the Indonesian team if IRRI funds were available earlier in the year. The Indonesian team requested assistance with getting their research published internationally.

[6] Some 1,300 trainees (43% female) in about 50 training events, with 9 Phd and 3 MSc students.

Recommendation 6: In Phase 1, expand the demonstration work in Indonesia with the aim of convincing farmers of the reliability of profitable rice production with small environmental footprints.

Thailand: The project setup in Thailand is generally effective and has made good progress since its recent implementation (in 2013). The Field Calculator and environmental indicator work did not seem to be well established in the project and may have "fallen in between" the Rice Department and Land Development Department. Progress in this area is important given the linkages proposed between the project and the Sustainable Rice Platform (SRP). The loss of Dr Ruben Lampayan from the project concerned the project team regarding AWD evaluation and they requested his retention.

In Thailand the project needs to further develop and test the existing proposed interventions following the highly interactive approach they have initiated at the two sites. It can be expected that the project can successfully increase the profitability of rice production, with environmental benefits, but not increase overall rice yields and production. This may well be entirely appropriate for a large exporting country.

China: The work in China has also started very well although some additional trials are needed to tune the addition of AWD to previous 3CT practices to ensure that yields are stable and significantly increased so that there is a stronger basis for recommending it for wide-scale implementation. Aside from water saved, the energy saved in the form of reduced pumping costs in using AWD should also be communicated for better appreciation of the technology. Whilst the Chinese team may be capable of funding and executing the required research with their own resources, CORIGAP may help provide essential guidance on mobilizing extension agents or government partners in multiplying and distributing information materials and still fill an important function at the Guangdong sites. Lastly, and similar to Vietnam, the loss of the CORIGAP Country coordinator in the last year of the project is a great concern. This must be addressed to minimize negative effects on the project.

Recommendation 7: The work in Thailand and China has started well but additional support is needed to further test existing promising interventions leading to imminent large-scale trials that will convince farmers, and to widen the range of stakeholders in a learning alliance.

Recommendation 8: CORIGAP should more firmly establish the Field Calculator and environmental indicator approach into the Thai Rice Department and Land Development Department.

Sri Lanka: As a newcomer to the project the development of integrated technologies is not very advanced. The project should continue to test individual technologies with a view to integrating promising combinations leading up to introducing the full suite of CORIGAP approaches.

Myanmar: Steps have already been taken to establish a site solely for CORIGAP activities, in Letpadan, Bago Division. There are preliminary plans for new sites further north in the irrigated areas of the Central Dry Zone. Further support for the learning alliance at the existing sites in the Ayeyarwady delta is required to further the promising work on gaining price premiums for grain quality. The experience from the established sites should be very beneficial in establishing and operating the new sites.

> Recommendation 9: In Myanmar and Sri Lanka CORIGAP should steadily expand its activities at most of the sites to the full range of activities operating elsewhere. The arrangements and experience gained in-country to date, and elsewhere, position the project well to deliver impacts within the next few years.

Overall, the project's set up and approaches are effective with good prospects for impacts, as already evident in Vietnam. There is no need for significant changes in the project's set up in terms of its administration and mode of operation except for the need to effect smooth transitions with the loss of key members of the team. The overall objective should be to bring the entire suite of CORIGAP activities to all countries, recognizing tailoring is required for each country as recommended in this report.

TOR 2. Effectiveness: Project Outcomes and Actual and Potential Impacts

2(a) Farmer Community level:

Vietnam: Fifty Long An farmer-members of Go Gon Cooperative, covering 82 ha, who received VietGAP certification in summer-autumn of 2015, attributed this to their CORIGAP training through DARD. This is clearly a farm-level impact of the CORIGAP project. Evidence for outcomes are farmers' testimonies of sharing the CORIGAP interventions with their neighbors and expressing lessons from the project as follows: (i) visit and monitor their fields often to prevent pests and diseases at early stages; (ii) do not spray frequently or spray only when needed; (iii) keep records; (iv) reduce use of pesticide, fertilizer, and seeds; and (iv) do not cause litter from pesticide packages. CORIGAP's facilitation to transfer the 1M5R to DARD and private sector extension specialists from eight provinces that reportedly led to some 34,500 farmers participating in training and, subsequently, 240,000 farmers using it over 300,000 ha with gains of US$160/crop or US$128/ha is excellent evidence of impact.

Indonesia: Benefits in terms of increased yields and reduction of post-harvest losses are evident in S. Sumatra and these can be attributed to previous IRRC activities and their extension into CORIGAP. There is evidence of early adoption of CORIGAP interventions at Yogyakarta but no information was provided on formal impact analysis (which is beyond the scope of this review). Reductions in the use of agrichemicals and increased yields are likely but not yet quantified in either financial or environmental terms.

Thailand: There has not yet been any evidence of farm-level impacts of CORIGAP. Strictly speaking, there are only a handful of farmers identified as CORIGAP practitioners at present. However, there is a pool of over 1000 farmers (in 2015) engaged in CROP type activities at community rice research centers and more of these can be expected to be recruited into CORIGAP in the next year, and more so if the project continues.

China: CORIGAP interventions have been adopted by farmers, who claim that they are now the "best farmers" in their area. The cost-reducing practices they use give them high yield and increases in incomes (*e.g.* before, they sprayed pesticides 4 to 5 times and the yield was 250 kg/mu; now they spray not more than three times, but the yield is 450 kg/mu; farmers estimated increases in their incomes at 20-30%, while the Gaoyao Agricultural Bureau reported 10-15% increases). GAB also indicated that adoption of 3CT now covers 100,000 ha and this has spread to neighboring townships. These are potential additional areas for the spread and adoption of 3CT + AWD.

Sri Lanka: Farm community level impact is not yet expected at this phase of the project.

Myanmar: There has not yet been evidence of farm-level impacts beyond the farms involved in the project, and was not expected in this Phase of the Project.

Overall, the project has learnt key lessons from IRRC and, in particular, the need to produce, support, and encourage local "champions" and multi-stakeholder groups with close connections with the first purchasers of rice grain[7], and CORIGAP was able to do this, more or less, from its inception. The project's progress in gaining farm-level impacts varies among the countries, as would be expected given their different starting points. The project has a promising approach with a proven track record for gaining farm-level outcomes and impacts. The less advanced countries will benefit from the experience gained in CORIGAP (and IRRC) in countries in which most of the suite of CORIGAP interventions have been established. This may favor more widespread adoption, with benefits in additional countries, but probably comes at the expense of slower progress in each individual country as resources, particularly IRRI senior staff time, are spread thinly.

2(b) Innovation/ business model development (production economics + innovation process):

Vietnam: Business models for introducing machinery (*e.g.,* re-circulating batch dryer and laser leveler) are taking off well with expressions of interest from cooperatives and manufacturers; and for rice straw management, including mushroom production (related to straw collection from using

[7] Rejesus RM, Martin AM, Gypmantasiri, P. 2013. Meta-impact assessment of the Irrigated Rice Research Consortium. Special IRRI Report. Los Baños (Philippines): International Rice Research Institute. 174 p.

combine harvesters). The reviewers observed high interest from local project implementers to learn more about mushroom production, particularly on spawn production and other uses of rice straw. The concept of contract farming is making significant strides here with strong support from government and expressions of interest among farmers.

Indonesia: The post-harvest experience and linkages with private-sector manufacturers that were carried forward from IRRC are effective and delivering benefits in S. Sumatra, and formation of a learning alliance was achieved. Additional mechanization, particularly laser leveling, has also been successfully promoted. Further integrations of mechanization, from field preparation with laser leveling, seeding, agrichemical applications, harvesting, straw management and post-harvest handling is needed. Piecemeal introduction of one mechanization activity has a knock on effect on other processes, for example, drum seeding is more effective in leveled fields with good control of water, and combine harvesting results in changes in straw management (as seen in Vietnam). There has been little visible activity in business model development in Yogyakarta to date.

> Recommendation 10: A more integrated and holistic approach be taken in relation to mechanization throughout entire cropping cycles.

Thailand: Little evidence was presented with regard to business model development beyond the farmer self-help groups and their initial interactions with a small number of small-scale millers. One farmer is contracting out a powered drum seeder. Mechanization is important and expanding in Thailand so this aspect warrants further R&D.

China: There is no significant activity yet on this aspect.

Sri Lanka: There is no activity on this aspect.

Myanmar: Learning alliances in Maubin and Bogale villages are engaging the private sector effectively in relation to raising rice quality with better varieties and post-harvest handling, including threshing immediately after harvest and improved drying equipment. Links have been built between farms and wholesalers. It is a strength of the work in Myanmar and would be useful elsewhere in the country.

Overall, market integration with farmers is most developed in Vietnam, which demonstrates the potential benefits in terms of driving adoption of improved agronomic practices when there are close linkages between rice producers and the purchasers of the grain.

2(c) Capacity building impacts:

Capacity building in relation to NARES partners and strengthening of research and research-extension linkages were discussed in 1 (d) (above). In this section, we focus on capacity building of

the end user small-scale farmers and the participants they interact with. *Will the project meet the Phase 1 goal of 50 farmer groups being certified as following Rice GAP?*

Vietnam: As mentioned above, Long An farmers of Go Gon cooperative have attributed to CORIGAP training delivered by DARD their VietGAP certification that they received in summer-autumn 2015 for 82 ha involving 50 farmers. An additional six farmer groups were reported to be collaborating with CORIGAP in Vietnam. There are no data on the age of these participating farmers but from observations during the visit there are very few young farmers.

Indonesia: Both BPTP teams in Indonesia are effective and benefit from on-going interactions with IRRI in CORIGAP. Post-harvest and rodent protection capacity is strong in S. Sumatra. It was evident that CORIGAP activities were raising the capacity of two farm groups near Yogyakarta, in which women were represented to some extent. The farmers have sufficient exposure to evaluate proposed interventions, are willing to learn, and willing to be convinced about some counter-intuitive suggests, particularly that it is possible to raise rice yields with smaller agrichemical inputs.

In addition to the two farmer groups at the new site near Yogyakarta, there are nine in the longer established in S. Sumatra sites (involving 287 families).

Thailand: Two effective farmer groups were visited by the reviewers in the project villages and women were very strongly represented and they seemed relatively young. In Thailand the training was conducted with individual farmers but subsequent support on GAP was provided through the community rice centers (CRCs), the number of which has grown steadily to reach 10 in Chainat and 16 in Nakon Sawan by 2015. One exchange visit of farmers was made to Vietnam and should have been very instructive, particularly in relation to engagement with the market chain. The project is playing a key role in building capacity of the Rice Department to engage farmers and to implement GAP related work.

China: Training activities on 3CT and AWD were conducted in three of its four sites, with more than 50% female participants. From observations during the visit there seemed to be very few young farmers involved in the project.

Sri Lanka: See response to 1(d). There seems to be no GAP program in place yet although two farmer groups have been established at each of the two field sites.

Myanmar: See 1(d) concerning Myanmar RD&E agencies. Two farmer groups are active in each of the two established villages and the project has developed very effective linkages with farmers, and is in the process of forming two more in each of two additional villages.

Overall, the project reports a total of 66 farmer groups and engages some thousands of individual farmers. In general, there seems to be good engagement with women farmers but not with young farmers.

2(d) Scientific impacts:

The project reported 21 scientific journal and book chapters from 2013, 38 conference presentations, and 17 posters for professional conferences. Some of the journal papers stemmed from IRRC but a large number of conference presentations and posters were derived from CORIGAP and will no doubt be converted to journal papers in the next year or two. The scientific output is impressive given the applied and adaptive nature of most of the project's activities. This reflects IRRI's appointment of post-doctorate staff in key positions, as well as linking with research students, and is endorsed by the reviewers as an appropriate strategy to both execute the project whilst maintaining scientific rigor and outputs. The project offers opportunities for some of the in-country researchers to publish in international journals and the project has been open to this, and should continue to make contributions so that this research gets published widely.

2(e) Policy impacts:

Vietnam: There is excellent progress in Vietnam in terms of policy impacts. CORIGAP interventions are recognized to be aligned with Rice VietGap, the SFLF, and hopefully soon with the WB-funded VnSat that aims to re-structure the rice industry toward exporting better quality rice. CORIGAP interventions were also acknowledged as strengthening Policy Decision 62, which promotes farming practices that meet standards for contract farming (*e.g.*, less residue). A spill-over from IRRC is the promotion of 1M5R through the World Bank-Agricultural Competitiveness Project (WB-ACP) that scaled-out the technology to 240,000 farmers (300,000 ha) in 2013. Through the WB-ACP, a laser leveler was acquired by a CORIGAP partner and this is expected to enhance AWD adoption as well as fertilizer and weed management. It has been a requirement that only members of a cooperative who have undergone 1M5R training can have assistance for agricultural machinery and infrastructure.

Indonesia: The CORIGAP interventions are consistent with Indonesian government policies and fit well with the large national program *GP-PTT* (which has recently been incorporated into *UPSUS*[8]), There was no apparent large effect of the project on influencing policies but it has in place appropriate channels for influencing policy development by engagement of senior officials. This has already resulted in preliminary spillover of the project's approach to Central Java Province.

Thailand: CORIGAP interventions are consistent with Thai government policies. Senior members of CORIGAP have held discussions with appropriate Thai officials but so far it appears the project has received policy advice but there was no evidence that the project had provided any to senior levels.

China: The 3CT complements and aligns with China's policy on environment protection. It also supports the High Yield Creation Program plus the "Super Rice", where the use of the 3CT is recommended along with IPM and other technologies. It is important to note that even before the project started, the 3CT has already been recognized in 2012 as one of China's key strategies for farming. Websites of related national rice production programs have the 3CT as one of its recommended practices. In Guangdong, the 3CT was recognized as a province-wide strategy earlier in 2008. Work on adding AWD to 3CT has encouraged co-funding from government.

[8] Contraction of *Upaya Khusus Pencapaian Swansembada Pangan (*Special Efforts for Self Sufficiency Achievement) for rice, maize and soybean.

Sri Lanka: Discussions with high level officials have been conducted, which has ensured the project is consistent with national policies for rice, including maintaining self-sufficiency.

Myanmar: CORIGAP activities are consistent with Myanmar's Government's priorities. The project has been active in engaging senior agricultural officials but there was no evidence that the project had significantly influenced Myanmar policies.

Overall: The project is consistent and complementary with government policies at each site and reflects the frequent and intensive consultations of senior CORIGAP staff with senior agricultural officials in each country. There is evidence of the project influencing policies in Vietnam, but not in other countries. It appeared the policy related work was rather *ad hoc* or opportunistic, or may not have been documented. The policy work of the project did not make links with closely related policy issues and could consider its implications in terms of:

- demand management of irrigation water and implications of wider scale adoption of AWD if it makes water available for other uses (expansion of irrigated land, or environmental, domestic, industrial uses).
- subsidization of fertilizer inputs
- regulation of pesticide use
- the project's potential to increase rice production and in so doing reduce pressure for expansion of rice production in less resilient production areas in upland or coastal areas, or its potential contributions to reducing losses of productive rice fields to urban expansion.
- changes in demand for rice in terms of changing diets, food security and safety.

Lessons learnt from the excellent research led by Drs Rutsaert and Demont need to be documented for the benefits of countries where they have not worked, or where it was not intensive, so that it does not have to be repeated from scratch for each project site.

> Recommendation 11: A more systematic approach with formal documentation is needed for the policy advisory and advocacy role of the project.

2(f) Future directions: Assess the current setup and develop recommendations on the need to sustain activities based on perceived needs/ opportunities/ challenges.

See responses to 1(e) (above) and elsewhere for comments and specific recommendations for each country, and 3(d) (below) for more general recommendations for the future.

TOR 3 Efficiency of the Project: Execution of the Consortium

3(a) Assess the effectiveness of the structure and organization in optimizing the implementation of the research and extension agenda

Vietnam: There were no concerns expressed on the level of cooperation between the coordinating unit and management team. The in-country CORIGAP country coordinator facilitated the research-extension interface and the project's linkage with national policies. He appreciates that the partnership deals with the business side/value chain, and not just technology development. The DARD partners, on the other hand, felt that they could benefit more from the partnership if language was not limiting.

Indonesia: Excellent cooperation is evident by the two BPTP offices with IRRI and between the two offices. Mutually beneficial exchanges have already occurred between the two BPTP offices and early spillover to Central Java is occurring. Implementation of the project in the field and interactions with farmer groups has been effective. Linkages to senior agricultural officials and their involvement has been very good. There seems to be no problems arising from the project structure.

Thailand: Excellent cooperation is evident between IRRI and the Rice and Land Development Departments. The Rice Department's interactions with provincial agencies (Chainat Rice Research Center and Nakhon Sawan Rice Seed Center) in setting up the farmer groups are also effective. Development of a stronger bond between the Rice and Land Development Departments is needed to clarify the hosting, development and implementation of the Field Calculator and environmental indicators work. On-going support from IRRI is required for these aspects, and business development, but the current organizational structure is adequate.

China: There seems to be excellent cooperation and synergy among CORIGAP implementers in China – one can sense the team work and its positive effect on the project, which was reported to be evident on the successful hosting of the CORIGAP meeting in May 2015. Between those in China and the IRRI team, cooperation appears fine except for a few concerns: (1) sudden termination of the service of the IRRI coordinator given that the project is in its last year; and (2) limited funds for extension activities. However, the latter is best obtained from local sources.

Sri Lanka: Even though IRRC did not have previous activities in Sri Lanka, the Director General of the Department of Agriculture expressed strong support for the CORIGAP project which indicates a good relationship.

Myanmar: Excellent cooperation is being made by IRRI and the Myanmar collaborators. It is helped by the IRRI office in Yangon, and by longer term interactions in IRRC.

Overall: At first sight, the management structure appears top heavy and with perhaps one layer too many. In general, and in practice, CORIGAP's current structure and organization are proving effective (no doubt reflecting IRRI's long experience with IRRC and other projects), and not excessive. As noted above, in-country arrangements are satisfactory and supportive. There is no need for significant changes to the project's structure.

The provision of more resources to each site, in the form of funds and more time of senior IRRI staff, would probably result in more rapid introduction of CORIGAP interventions. However, this is more appropriate for less developed country collaborators (Myanmar, Sri Lanka) than the other countries

that should be able to draw on in-country funding support. There may be a risk of over-reliance on IRRI post-doctoral staff for project implementation.

CORGAP is a very important project to IRRI and its Global Rice Science Partnership, and the Sustainable Rice Partnership. It is providing IRRI access to national agricultural research and extension services (NARES) with a two-way street of benefits – the NARES benefit from interacting with IRRI and IRRI benefits from working close to the rice growers and their market chain. In general, CORIGAP makes a major contribution to IRRI's capacity to interact with NARES. It contributes to maintaining IRRI's relevance and importance in rice-producing countries. The project is also important on the world stage as a pioneer of implementing multidisciplinary approaches to gaining production and environmental impacts through natural resource management. The project constitutes the main part of IRRI's current work relating to the practical implementation of interventions to reduce environmental impacts of rice production, and currently at least, to its gender-related research.

3(b) How effectively has CORIGAP fostered cross-country partnerships and learning?

The interactions of NARES with IRRI was observed to be productive and cordial, and provides access to existing and emerging technologies between countries. The transfer of knowledge between cooperating countries, either directly with the network of the project or brokered by CORIGAP, is an efficient means of multiplying the benefits of established and embryonic research findings. Visits by farmers from one country to another (*e.g.*, Thailand to Vietnam) appears effective in exchanging experience and should be encouraged. Work on the re-circulating batch dryer in Vietnam is an example of cross country partnerships and learning (Cambodia, Philippines, and other countries)

3(c) Consider the formal documentation

IRRI's annual reports to SDC were detailed and comprehensive. Extension materials viewed during visits to the field appeared relevant and useful and it was observed that these were being used, for example, at the locations of farmer group meetings in Thailand and Indonesia.

It is commendable that CORIGAP maintains a newsletter that gives a face to the names, and stories about project activities, outcomes, and impacts. There should be more feature stories of farmers who have adopted CORIGAP-developed technologies.

If CORIGAP could identify with the help of its local partners at least 10 other development/extension agencies in each country that have interests in food security and sustainability, they could be additional recipients of its reports and publications. This could be a pathway to trigger new partnerships. Local partners could be encouraged to reprint some of their newsletter articles in their own publications to increase reach. It could also tap social media (if acceptable in the country's culture) for wider public engagement on the more general area of food security and sustainability as entry points to share CORIGAP research findings and newsletter articles. In terms of sharing and access, note that China has no access to Google-based systems.

There must be improvement, as earlier mentioned, in formal documentation of financial gains from interventions and policy advocacy/advisory role of the project. There must be consistency as well.

3(d) Future directions: General overview

Here we record more general comments. In general, we consider that the project is making good progress but has not advanced as far as originally planned in most aspects. Nevertheless, the project has good prospects for successfully converting research-based interventions for the benefits of small-scale farmers, and to the environment, of intensive rice-based cropping systems. CORIGAP has successfully developed a means of gaining adoption of farm-level changes in practice that have, in general, been very difficult to obtain, especially in less-developed countries. It has developed an approach, currently most advanced in Vietnam, which can, with some adjustments for particular sites, be applied in the other five countries and elsewhere. Its administrative structure has been honed by several years' experience and will be suited for work in the future.

In the countries where there are already policies supportive of integrated sustainable rice production systems, as well as sufficient evidence that these are working, CORIGAP should focus more on scaling out activities to take advantage of the momentum and opportunities. As one of the country coordinators said, there have been so many trials and training activities already. Climate change and trade liberalization are realities that could result in the need for further research on appropriate technologies. These countries may be at "tipping points" in relation to climate change.

5. Conclusions

Although running behind schedules envisaged in the project design document, the project has made sufficient progress to show that it has very good prospects for achieving key impacts of improved livelihoods for small-scale farmers, with reduced environmental impacts. This is shown by its impacts at its most advanced sites in Vietnam and South Sumatra, and is underpinned by formal external economic assessment of the closely related previous programs of IRRC. Much remains to be done to demonstrate financial and environmental benefits, and completion of the Field Calculator tool and environmental indicator work is required for this purpose, particularly for the newer project sites. The objectives as originally envisaged cannot be achieved at most project sites in the remaining 12 months of the project but sufficient progress has been made to make the recommendation:

> Recommendation 12: That an early decision be made to continue CORIGAP in a Phase 2. Revisions and tuning should be made in accordance with the recommendations of this review.

We endorse and congratulate participants on the successful approach and mode of operation of the project, which has proven robust when applied to sites with varying operating environments. However, we do not mean continuation without some real change or "carrying on as is", but that the recommendations made here be adopted. In particular, the emphasis on "closing yield gaps" should

be shifted to “increasing farm profitability with minimal environmental impact” for Vietnam and Thailand; and profitably raising yields also with minimized environmental impact for the other countries. An increase in farmers’ profit may encourage more farmers to continue farming and improve their practices to increase yield and quality and may also encourage younger farmers to engage in farming. The monitoring tools should be completed in Phase 1 and applied to larger scale demonstrations of integrated interventions that will convince farmers.

In terms of team composition, experts on extension/development communication/technology promotion/information and educational campaigns could help guide project activities in Phase 2, but still with scientists for technical backstopping and value chain experts to ensure relevance and to optimize efforts. Activities on communication audit, planning, and outreach, and message design would have to be strengthened, with the local partners taking the lead.

Acknowledgements

We are grateful to the entire CORIGAP team for the excellent organization of the arrangements for the review. Particular thanks go to Alex Stuart and Pieter Rutsaert who accompanied the reviewers on the field visits, and to Grant Singleton for overall management of the review and for providing information in response to particular requests.

6. Appendixes

6.1. Review Travel Schedule and IRRI Los Baños Presentations

(a) Travel schedules

Ian Willett, Karen Barroga, plus IRRI postdocs Alex Stuart and Pieter Rutsaert

Ian and Karen arrive in Los Baños, Philippines on November 30. Meetings will all CORIGAP staff at IRRI on December 1-2, 2015.

Ian, Karen, Alex - Vietnam (December 3-6)

- 3 December: Arrive in HCMC at 0830, meet with Dr Pham Van Du at 0930 in HCMC, then travel to Can Tho at 1030.
  1530: Meet with Can Tho DARD. [overnight in Can Tho]
- 4 December: 0600 - Travel to Thay Ky CORIGAP field site and meet with two farmer groups (1 VietGAP group and 1 Large model farmer (SFLF) group).
  PM: Travel to Long An [overnight in Long An]
- 5 December: 0600 - Travel to CORIGAP site in Hung Thanh commune (Tan Hung district) to meet with farmer group.
  PM: Meet with Long An DARD before travel back to HCMC [overnight in HCMC]
- 6 December AM: Departure for Jakarta/Guangdong

Ian, Alex - Indonesia (December 6-9)

- 6 December: Ian and Alex arrive in Yogjakarta at 1735.
- 7 December: AM - Meeting with BPTP Yogjakarta
  PM - Visit CORIGAP field sites
- 8 December: AM - Meeting with BPTP South Sumatra (they will fly to Yogjakarta)
  PM - General discussion until 1600. Ian and Alex then travel back to Jakarta with flight at 1820.
- 9 December AM: Departure to Bangkok

Karen, Pieter - China (December 6-9)

- 6 December: Karen arrives in Guangdong at 1410, Pieter at 1120.
- 7 December: Meeting at GDRRI
- 8 December: Trip to the experimental stations and demonstration sites related to the CORIGAP project
- 9 December AM: Departure to Bangkok

All - Thailand (December 9-11)

- 9 December: Review team arrives in Bangkok between 1050 and 1310. 1500: Meeting at Thai Rice Department. At 1700 travel to Chainat [overnight in Chainat]
- 10 December: Travel to field sites in Chainat and Nakhon Sawon to meet with farmer groups. Travel back to Bangkok [overnight in Bangkok]
- 11 December: Ian and Karen will work on report in hotel in Bangkok and Pieter and Alex travel back to Manila.

(b) Program for Project Presentations at IRRI Los Baños

1 December 2015 CESD Meeting Room 1		
0805H	CORIGAP: General overview of project	Grant Singleton
0840H	Update on yield gap analyses/adaptive research	Alex Stuart
0910H	Discussion	
0920H	Country presentation: **China**	Ruben Lampayan
1000H	Morning tea	
1020H	Country Presentation: **Vietnam**	Martin Gummert, Alex Stuart
1105H	Country Presentation: **Thailand**	Ruben Lampayan Alex Stuart
1145H	Discussion	
1200H-1305H	LUNCH BREAK	IDR for invited people
1305H	Progress with Field Calculator: **Vietnam and Thailand**	Krishna Devkota, Sarah Beebout, Alex Stuart
1340H	Postharvest and participatory stakeholder processes (PIPA plus LA)	Martin Gummert Reianne Quilloy
1430H	Entry points for sustainability in rice value chains	Matty Demont Pieter Rutsaert
1520H	COFFEE/TEA BREAK	
1540-1605	General discussion	
1615H	Reviewers meet with DDG-R and CESD Head (DDG-R Office)	Matthew Morell; David Johnson
1705H	Reviewers return to the Guest House	Informal meeting Dr Bouman
1830H	Dinner in the Guest House	All

2 December 2015		
0805H	Country Presentation: **Sri Lanka**	Amitha Bentota; Virender Kumar
0850H	Country Presentation: **Myanmar**	Nyo Me Htwe Grant Singleton
0925H	Country Presentation: **Indonesia**	Buyung Hadi Martin Gummert Grant Singleton
1010H	COFFEE/TEA BREAK	
1030H	Environmental Indicators	Sarah Beebout
1115H	Pattern of incidence and abundance of arthropod guilds as an indicator of rice ecological health: Assessment framework	Buyung Hadi
1145H	Discussion	
1205H	LUNCH BREAK	IDR for invited people
1310H	PhD projects: Overview	Grant Singleton
1335H	Supporting women in rice farming: Where can we contribute?	Pieter Rutsaert
1420H	Communication Activities	Reianne Quilloy
1440H	Open discussion	
1505H	Afternoon Tea	
1525H	Where next with CORIGAP?	Grant Singleton
1600H	Open General Discussion	
1700H	Finish	
1705H	Reviewers return to the Guest House	
	Reviewers depart for Vietnam, 3 December 2015	

6.2. Core questions to supplement and cross check information in IRRI presentations and reports.

Senior officials and private sector representatives

Have you received any policy related information from CORIGAP?
If so, what was the advice and did it have any influence on policies at any level? (ToR 2e)
How does CORIGAP align with national policies?
Has the introduced integrated interventions increased profitably of small scale farmers? (ToR 1a)
How has your (NARES) capacity been strengthened by CORIGAP? (ToR 1d)?
What is your opinion on the project arrangements and any suggestions for improvement? (ToR 1e and 3a)
Any suggestions for additional follow- up activities and future directions? (ToR 2f and 3d)

Province or District partners

Has there been any uptake of CORIGAP recommendations and how extensive is it (impacts)? (ToR 2a)
(R) Has the introduced integrated interventions increased profitably of small scale farmers? (ToR 1a)
How well developed are the proposed integrated rice production systems (interventions) (ToR 1b)
Did the learning alliance and adaptive research approach engage key actors in public and private section, how? (ToR 1b).
How has your agric. RD&E capacity increased in the project? (Tor 1d).
(R) What is your opinion on the project arrangements and any suggestions for improvement? (ToR 1e and 3a).
Evidence of CORIGAP fostering market integration of small holder farmers with business (ToR 2b).
What should happen next, after the project Phase 1 ends? (Tor 1e).

Villagers and farmers

How did you become aware of the project and its recommendations? (ToR 2a)
Have you made any changes in your practices as a result of the project, if so what and what are the benefits? (ToR 1a). To business practices as well as production practice?
(R) What should happen next, after the project Phase 1 ends? (Tor 1e).

6.3. Visit reports

Visit Report - Vietnam
Karen Barroga and Ian Willett
3-6 December 2015

Introduction
We were accompanied by Dr Alex Stuart of IRRI to Vietnam. The visit started with a meeting with the CORIGAP Country Coordinator, followed by key partners from government agencies in Can Tho and Long An provinces, and farmers who are involved in the project. The team also had a chance to visit the field of one of its farmer-partners in Can Tho Province. Before the team left Vietnam, we also had an opportunity to meet with Ms. Helena Aminatou Ba, one of the postgraduate students supported by CORIGAP, who is studying the sustainability of rice contract farming in Vietnam.

Highlights of the interviews and discussions with the country coordinator, key partners from government agencies.

A. Progress of the Project

1. Local project implementers appreciate the CORIGAP project for adding a business perspective (*i.e.,* research on contract farming, training on mushroom production) to help increase farmers' income. In other words, the project was not just about technology development.
2. The work started under the IRRC - from "*3 Reductions, 3 Gains"* to "*1 Must Do and 3 Reductions",* and now the "*1 Must Do and 5 Reductions*" (1M5R) and is now taking the following directions:
   i) making the recommendations more specific (e.g., how much certified seeds to use by reducing the rate from 120-150kg/ha to 80kg/ha)
   ii) preparing for scaling out activities
   iii) linking farmers and traders for contract farming
3. As to the project's progress in reducing the yield gap, there is a common observation among local partners that with 1M5R, only a minimal increase in farmers' yield could be achieved. Reduction in input costs was attainable and pronounced. The "reduction" recommendations were assessed by project implementers to have likely reached 60% to 70% adoption. The project is also appreciated for reducing damage to environment, often expressed in term of reduced risk of poisoning to farmers and their families.
4. Adaptive research activities, although considered difficult and demanding, provide local partners with strong science-based evidence for the recommendations that they give to farmers. Thus, these build their confidence and strengthen their competence. IRRI experts' presence to provide technical assistance and guidance is considered very useful. Project partners also think that farmers enjoy the activities because they see the effect of, for example, reduced seeding rate and pesticide use.
5. The learning alliance is positively received.
6. Doing the farmers' diary is posing great challenge because many farmers do not like to do it or miss to fill up some information. Thus the extension officers provide assistance and guidance during farmers' meetings.
7. Extension materials have been produced and information dissemination activities through media have been done to create greater awareness and improve learning of CORIGAP

interventions. There have also been training and demonstration activities and field trips. RIPPLE magazine is also shared among members of project team.

B. Alignment with/Influence on Policies

1. CORIGAP interventions are acknowledged to help strengthen Policy Decision 62 released in 2013 by promoting farming practices that meet standards for contract farming and by studying market linkages and preferences. Decision 62 is scheduled for review very soon as policies in Vietnam are reviewed every two years.
2. Local champions are exerting efforts to incorporate CORIGAP interventions under the VNSat large scale implementation project funded by the World Bank. This provides an opportunity for CORIGAP interventions to be scaled out.
3. Other national projects are enhancing implementation of CORIGAP interventions. For instance, the Agricultural Competitiveness Project in Vietnam funded by the World Bank provided laser levelers, which enhances adoption of alternate wetting and drying.
4. CORIGAP interventions are also promoting and supporting VietGAP certification. Farmers who trained under 1M5R want VietGap certification because they expect to gain better income.

C. Future Directions

1. Scaling out of 1M5R
2. Diversification of cropping (rice-rice-vegetable/soybean)
3. Market linkage/Value chain
4. Quality rice production

D. Other Concerns and Suggestions

1. Dr. Pham Van Du, the local champion, is retiring before the year ends to join FAO. As Vietnam's local champion, this poses a concern on project success and continuity as it seems that there is no arrangement yet for his replacement.

2. There should be more cross learning visits (e.g., Vietnamese farmers visit Thailand) and more partners invited during project meetings for improved learning and information dissemination.

3. Additional training activities on mushroom production, particularly on spawn production, and for other uses of rice straw; and more farmers' field days. There should also be more capacity building activities for project staff on best management practices.
4. Although they intend to continue with work started by CORIGAP and will try to source other funds to enable this, activities will likely be more limited when CORIGAP support ends.
5. Market linkage is considered difficult and challenging as well as communicating to farmers the concept and value of greenhouse gas emission.

Highlights of the interviews and discussions with farmers:

A. Use of CORIGAP interventions

1. In general, farmers are using certified seeds at a lower seeding rate; have reduced their use of pesticides and fertilizers (from 12 to 8-9 bags); as well as postharvest losses through use of combine harvester and following proper timing of harvest. For Small Farmer, Large Farms (SFLF) farmers, the use of synchronous planting is being implemented.

2. Their neighbors from within and outside their village are asking about the CORIGAP interventions: what they are doing, how to join, how to do their farming practices, effect on

their income. Male farmers prefer to use additional income to contribute to their obligation to repair the concrete canal banks, while the women would prefer to spend it on house repairs.

3. The seeding rate, which has been reduced from 180-200 kg/ha to 120-140kg/ha, should now be pegged at 120 kg/ha (it cannot be further reduced) because of their sandy soil. This can only be lowered further if they shift to transplanting using a mechanized transplanter.
4. Lessons: (i) farmer has to be an expert of his field; (ii) visit field often for pest and disease monitoring for prevention at early stages; (iii) do not spray frequently or spray only when needed; (iv) keep records – field diaries have helped. Long An farmers to note their expenses; (v) reduce - pesticide, fertilizer, seeding rate; and (vi) do not litter pesticide packages

B. What they like about the project

1. Although their yields have remained the same or only slightly higher (400-600 kg/ha more according to Long An farmers), farmers appreciate the CORIGAP interventions and activities that help increase their incomes (*i.e.*, 300-400,000 dong/ha according to Can Tho farmers) through lower input cost and production of high quality rice while protecting the environment; providing a platform for exchange of experiences, more training activities, and more detailed guidance; and helping improve relationships with their neighbors. They find the technologies easy to learn but require big changes in their practices.
2. Long An farmers were able to get a VietGAP certification in summer-autumn 2015 for 82ha (50 farmers) of the 464ha of the Go Gon coop. This was attributed to their CORIGAP training by DARD.

C. Concerns and suggestions

1. More assistance on increasing the selling price of rice because price is still the same or only slightly higher, even with improved quality.
2. To fast track dissemination it was suggested that there should be more model farmers/farms (suggested by male farmers from Can Tho) and higher price for rice (female farmers); more trainings, demonstrations, and study/cross visits
3. Give farmers a straw baler to facilitate straw collection for mushroom production and avoid added labor cost. Also, a transplanter (chair of coop).
4. AWD still needs fine-tuning and its adoption needs a well-leveled field, which is hard to attain with their kind of soil. There was request for a laser leveler to avoid additional cost of pump irrigation (suggested by female farmers).
5. Community effort is considered important to be successful or to create impact.
6. Simplify the farmers' field diary (e.g., 2 columns only: date and activities)
7. Do not stop the project because 50 farmers have not yet received certification. Also, there is a need for a transplanter, dryer, storage, and additional combine harvester. Synchronous planting makes it hard to respond to requests for hiring a combine harvester.

Meetings and people consulted in Vietnam

Meeting	Name	Position/Designation
3 Dec 2015 At MARD in Ho Chi Minh City	Ministry of Agriculture and Rural Development, Ho Chi Minh City	
	Dr. Pham Van Du	Deputy Director General, Department of Crop Protection, Representative Office for South Vietnam and CORIGAP Country Coordinator

At DARD in Can Tho Province	Department of Agriculture and Rural Development (DARD), Can Tho	
	i) Ms. Kieu	Deputy Director and Key Partner, CORIGAP
	ii) Ms. Hieu	Director, Plant Protection (delivered a presentation)
	iii) Ms. Thuy	Deputy Director, Plant Protection
	iv) Ms. Van	Deputy Director, Crop Management
	v) Mr. Hung	Director of Extension Center, Provincial Level
	vi) Ms. Ngoc	Head of Plant Protection, District Level
	vii) Ms. Le	Deputy Chair
	viii) Mr. Long	Staff, Crop Management Division
	ix) Mr. Hieu	Staff, Crop Management Division
	x) Mr. Tao	Staff, Crop Management Division
	xi) Mr. Pham van Quyn	Director (over dinner)
	xii) Ms. My Phung Hieu	(translator)
5 Dec 2015 At Hung Thanh commune	DARD, Long An	
	i) Ms. Thu	Head, Crop Production and Long An Corigap coordinator
	ii) Mr. Truyen	Deputy Director, DARD
	iii) Mr. Thach	Head, Plant Protection Section
	iv) Mr. Cang	Head, Extension Station, District Level
	v) Mr. Hoang Van Sinh	Vice Chair of Tan Hung District
	vi) Mr. Xinh Ni	Vice Head, DARD District
	vii) Mr. Cam	President, Hung Thanh Commune
	viii) Mr. Em	DARD Staff, District level
5 Dec 2015 Ho Chi Minh City	i) Ms. Helena Aminatou Ba	CORIGAP-supported postgraduate student studying sustainability of rice contract farming in Vietnam

With farmers

Meeting	**Name**	**Position/Designation**
4 Dec 2015 At Than Ky	CORIGAP Farmers from Than Ky, Can Tho (4 female, 4 male)	
	i) Nguyen Van Thanh	Members of VietGap Group
	ii) De Ngoc Thiem	
	iii) Bui Thi Thuy	
	iv) Cu Thi Hung	
	v) Vu Van Thu	
	vi) Pham Van Thuyet	
	vii) Nguyan Van Khiem	
	viii) Nguyan Van Lam	
	ix) Vu Van Nghiem	
	x) Nguyen Van Huan	
	xi) Nguyen Van Giang	Members of Small Farmer, Large Field (SFLF) Group
	xii) Do Van Hoa	
	xiii) Ga Thi Thuyet Nhung	
	xiv) Do Thi Chae	
	xv) Do Van Giap	
	xvi) Nguyen Van Gia	
	xvii) Nguyen Van Thoae	
	xviii) Nguyen Tien Hung	

	xix) Nguyen Phi Long	
5 Dec 2015 At Hung Thanh Commune Office	CORIGAP Farmers, Tah Hung District, Hung Thanh, Long An (0 female, 8 male)	
	i) Tri	Director, Go Gon Farmers' Cooperative
	ii) Nguu	Members, Go Gon Farmers' Cooperative *Note:* Of 103 members of Go Gon Coop, 53 are participating in CORIGAP, totalling 272ha. Twelve of the 53 are women.
	iii) Cuong	
	iv) Tim	
	v) Manh	
	vi) Quang	
	vii) Huong	
	viii) Linh	

In Can Tho, the following DARD staff provided assistance: (i) Tran Thi Kim Thuy; (ii) Tran Hai Long; (iii) Tran Thi Yen Plurang; (iv) Ze Hiu Nhan; (v) Dang Nhat Miang. In Long An, Ms Thu coordinated. Dr Nguyen Thi My Phung, Deputy Director An Giang Department of Agriculture and Rural Development served as translator in all meetings.

Visit Report – Indonesia

7-8 December 2015
Ian Willett

Introduction

CORIGAP has field sites near Yogyakarta and in South Sumatra. The Yogyakarta site is new, starting in 2014, whereas the S. Sumatra sites was involved in IRRC and continued with CORIGAP. Leaders from South Sumatra, Dr Harmanto and Mr Budi Raharjo traveled to present their site's results in Yogyakarta. Country coordinator Dr Nuning Argo Subekti of ICFORD also traveled to the meeting. We were hosted for an all-day meeting on 7 December by Yogyakarta *BPTP*[9] (also AIAT – Assessment Institute for Agricultural Technology). The CORIGAP leaders are Director Dr Sudarmaji and CORIGAP coordinator is Dr Arlyna Budi Pustika. There are about 10 people in the Yogyakarta team.

On 8 December the BPTP team accompanied Drs Willett and Stuart to Madurejo village (Prambanan sub-district) on the outskirts of Yogyarkarta. We inspected CORIGAP demonstration trial plots of *PTT+Tabela* (ICM+drum seeder), and paddies planted with a mechanical transplanter. The newly-planted plots consisted of entire paddies as farmers' plot sizes are small. We were able to observe all stages of crop production in one place as there is no crop synchronization. Soils and irrigation infrastructure appeared favorable. Fertilizers inputs are subsidized and water is charged at a low flat rate only in the dry season. CORIGAP work began later than elsewhere, in 2014.

A meeting with the farmers of Madurejo and Jogotirto villages was held at the farm leader's home of Mr Haryanto. Mr Sanglan, secretary of the farmers' group represented Jogotirto. There were 10 male and 3 female farmers present along with most of the BPTP team and Drs Harmanto and Budi from South Sumatra.

Highlights of the presentations, interviews and discussions with the country coordinator, key partners from government agencies:

A. Progress of the Project

1. Rapid rural appraisal and baseline surveys were completed for the Yogyakarta sites in 2014. Key problems are neckblast, insufficient water in the dry season (for a 3rd rice crop), and labor shortages at peak sowing and harvest times.

[9] Bahasa Indonesia acronyms are shown in italic

2. The yield gap defined by the difference between the top 10% farmers and the mean was very large – 45% (5.3 vs 9.6 t/ha) for the Yogyakarta sites. There is already evidence that this yield gap can be closed by 0.5 to 1.5 t/ha. This large gap may be exceptional due to the season or sampling, and will continue to be monitored.
3. Focus discussion groups were held for the gender equity and market access studies at the Yogyakarta sites by mid-2014.
4. CORIGAP has introduced alternate wetting drying (AWD) irrigation, drum seeders, IRRI "Super Bags" (hermetically sealed bags, Berbah site).
5. Demonstration trials included comparisons of ICM, ICM+AWD, ICM+drum seeder, and farmers' practice as a control.
6. There were 3 replicates in two sub-districts near Yogyakarta, 24 farmers in 2 groups.
7. Larger scale demonstration sites with addition of mechanical transplanting involving 60 farmers have been established near Yogyakarta.
8. Yields in the "frontier" expansion in coastal lowland tidal swamps of S. Sumatra are about 4.8 t/ha in the wet season but have been smaller in the dry season.
9. ICM, drum seeders and post-harvest dryers have been implemented at 2 sites (Telang and Selah) in S. Sumatra.
10. RRA were completed in S. Sumatra. The cropping pattern sometimes includes fallow, maize or soybean, between paddy crops. Yield gaps were about 33% (5.88 vs 3.96 t/ha). With good water management it is expected that 6 t/ha is achievable in the short term.
11. In S. Sumatra training has been provided in drum seeding, rat control, variety selection, leaf color chart and a soil test kit (site specific nutrient management under ICM not yet implemented).
12. Grain drying has been widespread in S. Sumatra with more than 50 husk furnace units being produced. Hermetic bags trialed for seed storage. Solar bubble dryer is being tested.
13. The introduction of more productive varieties, drum seeder, and rodent control, has resulted in a large expansion of dry season cropping, to 20,000 ha in S. Sumatra.
14. AWD and field calculator/environmental indicator work have not been applied yet in S. Sumatra. There may be some progress in reducing pesticide and fertilizer use.
15. All BPTP participants appreciated IRRI's capacity building and stated that external stimulation provides good motivation. IAARD has provided additional funds for training.

B. Alignment with/Influence on Policies

1. Indonesia has a policy of raising rice production as its population increases. It imports rice in some years and the government aims for self-sufficiency. CORIGAP is consistent with the national program *Upaya Khusus Pencapaian Swansembada Pangan (UPSUS* or Special Efforts for Self Sufficiency Achievement) for rice, maize and soybean.
2. Implementation of the national program is based on integrated crop management (ICM or *PTT*) which has plans for extensive scaling out under *Gerakan Penerapan* or *GP-PTT*, part of *UPSUS*. Interventions proposed by CORIGAP are consistent with *PTT*, for example the application of IRRI's Crop Manager as developed for Indonesia. CORIGAP therefore had a direct outlet for its research findings to a development project for large-scale out-scaling.
3. CORIGAP is supportive of the expansion of rice growing land in its work in coastal lowlands in South Sumatra, and may have useful lessons for other areas such as in Kalimantan.
4. In S. Sumatra the BPTP has communicated the benefits of reduced seed rates to UPSUS and may feed into national policies. Senior leaders have visited the field sites.

5. There is less influence from the Yogyakarta site as it is new, but they expect to communicate the benefits of drum seeding and mechanical transplanting for labor savings after some more research.
6. It was noted that the neighboring province of Central Java had been influenced by the promising results, suggesting possible spillover is possible.
7. As fertilizer inputs are subsidized there is a conflict with the objective of reducing its use to quantities optimal for grain production and protective of the environment.
8. It was not clear if there is a need for greater involvement of local agricultural offices (*Dinas Pertanian*).

C. Future Directions

1. Wider scale implementation, particularly relating to mechanization (drum seeder, mechanical transplanter and its seedling trays) as request by the farmers.
2. Application of the field calculator and inclusion of environmental impacts, not yet done in Phase 1.
3. Advance the soil test kit approach to site specific nutrient management within IRRI's Crop Manager (Indonesian version *Layanan Konsultasi Padi - LKP*).
4. Keep a focus on more production of cheap rice for the expanding population.
5. The production conditions in South Sumatra are relatively unfavorable as the surface soils are peaty and they have potential or actual acid sulfate sub-soils. These soils require very good water control to maintain rice production and to protect the surface water from acidification and deoxygenation. They have additional environmental hazards to those relating to excessive fertilizer use, greenhouse gas emissions, or pesticides found at other CORIGAP sites, and these aspects warrant greater consideration.

D. Other Concerns and Suggestions

1. BPTP has had to find funds to bridge gaps waiting for IRRI money transfers
2. BPTPs would appreciate more help from IRRI to get their research published internationally

Highlights of the interviews/discussions with farmers at the Yogyakarta site

E. Use of CORIGAP interventions

1. The farmers emphasized that they need to be very convinced of new technologies before they would adopt them. They requested larger scale demonstrations and involvement of larger numbers of farmers than the 25-30 currently involved. They noted that the Crop Manager fertilizer rates are lower than their current practices and need further convincing before reducing their rates.
2. The drum seeder is attractive in reducing labor and seed rates but the fields need good water control.

F. What they like about the project

1. The farmers expressed an interest in AWD mostly because it allows monitoring of water levels in soil during dry periods that have already resulted in fewer disputes between farmers in distributing irrigation water during dry periods (water traverses farmers' plots to downstream neighboring farms).
2. Machine transplanting is attractive as it is labor saving and it would allow seedling production near the farmers' homes

3. The farmers did not suggest any changes to treatments. Some embryonic adoption can be claimed as several farmers are voluntarily applying practices being demonstrated by the project. There has been only very basic adaptive research at this site and there are as yet no learning alliances or any interactions with the private sector. This will be important in the future especially in support of mechanization for crop establishment and harvesting, which appear inevitable.

G. Concerns and suggestions

1. There are labor shortages at times of planting and harvesting and a corresponding interest in mechanization. The drum seeder is acceptable in the wet season where there is some control of water levels but is not reliable for the dry season. A back-up system of crop establishment is needed.
2. It is often too dry to produce a 3rd rice crop, and they suggest wells could be dug or that the third crop should be *palawija*, with seed maize likely to be most profitable
3. The farmers said that the labor requirements for the solar bubble dryer are too large.

Meetings and people consulted in Indonesia

Meeting	Name	Position/Designation
7 Dec. 2015	Indonesian Agency for Agricultural Research and Development	
	Dr Nuning Argo Subekti	CORIGAP Country Coordinator
At BPTP Yogyakarta	BPTP Yogyakarta	
	Dr Sudarmaji	Director and Team Leader, CORIGAP
	Dr Arlyna Pustika	CORIGAP contact, Plant Protection
	Mahargono Kobarsih	Post-harvest
	Riefna Afriani	Agronomist
	Charisnalia L.	Agronomist – weeds
	BPTP South Sumatra	
	Dr Harmanto	BPTP Director
	Budi Raharjo	CORIGAP lead contact
	Village Leaders	
8 Dec. 2015 Madurejo Village	Mr Haryanto	Madurejo village group leader
	Mr Sanglen	Jogotirto, secretary of village group

Visit Report – China

Karen Barroga
6-9 December 2015

The China visit offered an opportunity to meet with the CORIGAP Country Coordinator, Dr. Xuhua Zhong, who gave a report about the activities and accomplishments of the project. Dr. Zhong was an IRRI scholar (PhD and postdoc). I also met with members of his team and with Dr. Wang Feng, the GDRRI General Director. Dr. Feng briefed us about the GDRRI activities. CORIGAP has three sites in China: Renhua, Gaoyao, and Yangxi but only the Gaoyao site was visited and partners from the Gaoyao Agricultural Bureau (GAB) were interviewed after their report presentation. For the farmer discussion, I met with one group of farmer-partners (8 male, 2 female) from the Boxi Demonstration

village site of Gaoyao. Visits were also arranged to the Dafeng Experimental Station and the Guangzhou Baiyun Experiment Station, where Dr. Zhong and his team conduct studies on AWD and long-term experiments on nutrient use efficiency.

Highlights of the interviews and discussions with Country Coordinator and key partners from government:

A. Progress of the Project

1. The work on 3 Controls Technology[10] that was started during the IRRC was continued under CORIGAP, with the addition of alternate wetting and drying technology. The AWD at 15 cm depth is now recommended to rice farmers in Guangdong to save on water and reduce greenhouse gas emission by 30%, while maintaining grain yield. A paper has been published on this in Agriculture Water Management Journal (163:2016). However, in general, use of AWD is not seen to significantly translate into higher yield. Thus, further adaptive studies are needed.

   Aside from AWD, addition of low carbon technology to 3CT is being considered. This technology further lowers use of nitrogen (10% lower than 3CT and applied at a later stage). However, initial results seem to show that findings are variety dependent and further adaptive studies are therefore needed.

   Dr. Zhong related his standard criteria before releasing a technology. It must be effective, reliable, and simple. The 3CT is not perfect but it passes these three criteria.

2. For 3CT alone, the GAB reports its adoption in some 1.5M mu (100,000 ha) and its spread to neighboring townships. Early season 2015 harvest in its demo site showed an increased yield of 54 kg/mu, which is about 13% higher than farmers' practice; while late season yield was 57.8 kg/mu or 13.3% better. Fertilizer use was reduced by one application while there was a 1 02 reductions in pesticide spraying. This, according to them, has resulted in the following benefits: savings on labor time that allows farmers to do other work; less input costs yet with higher yield, an increase of 10-15% income; and less pesticide use leading to safer food for consumption.

3. Various approaches/forms of communication and learning are used to facilitate dissemination of 3CT, namely: (i) a website (www.sankong.org) that was started in 2011 enables viewers/visitors to get advice about the technology directly from Dr. Zhong, watch videos, and more; (ii) posters, technical manuals, and a CD; (iii) technical boards at demo plots, which are not easily lost compared with leaflets; (iv) an app for smartphones to be released very soon; (v) media promotion; (vi) training activities, with strong women participation, at different levels -- local and national, main rice producing counties -- as well as on-site trainings during key growth stages of the rice plant; (vii) farmers' day; (viii) cross visits, such as the Jiangxi extension workers visiting Gaoyao site; (ix) a 7-ha demonstration base (more permanent) that includes a half hectare plot for comparison purposes established in Gaoyao and Xuihue; and, quite interestingly, (vii) a 96 character Chinese poem composed by Dr. Zhong that explains the 3CT practices.

[10] Control nitrogen fertilizer application especially at basal; control number of unproductive tillers; and control pests and diseases

In Dr. Zhong's experience, a natural event could help fast track out-scaling of technology, such as what happened to 3CT. When a typhoon occurred, the non-3CT plot lodged but spared the 3CT plot. This sent a strong visual message, convincing farmers and policy makers to notice 3CT. In another instance, the 3CT plot looked initially poor that it was hard to convince farmers to use the practice. Dr. Zhong assured his co-operator to just continue and promised to compensate for loss/damage. At harvest time, the 3CT plot of rice caught up and the farmer had better yield at less cost.

An image that shows how the length of nodes differ between rice in 3CT plots and farmers' practice has, according to Dr. Zhong, helped him clearly communicate his message about lodging.

4. The adaptive research helps the project implementers to improve CORIGAP interventions and their competence, and have helped them win awards/recognitions, from Dr. Zhong to partners in field implementation, such as the 2013, 1st class award and 2014 Norman Borlaug Award for Dr. Zhong; and some 10 awards for field implementers.

B. Alignment with/Influence on Policies

1. The 3CT complements/aligns with China's policy on environment protection. It supports the High Yield Creation Program plus the Super Rice, where the use of the 3CT is recommended along with IPM and other technologies.

   It is important to note that even before the project started, the 3CT has already been recognized in 2012 as one of China's key strategies for farming. Evidences were provided, showing websites of related national rice production programs having the 3CT as one of its recommended practices. In Guangdong, the 3CT was recognized as a province-wide strategy earlier in 2008.

C. Future Directions

1. Extend AWD and ratooning technologies once more stable results are achieved. Dr. Zhong is considering the inclusion of ratooning in the technology package in view of the additional yield it gives without much additional inputs. He is also confident that AWD will be widely accepted as there are no criteria yet to reduce irrigation cost (irrigation pumps).

2. Inclusion of younger farmers

D. Other Concerns and Suggestions

1. More time is needed to have a more stable result from AWD.
2. With Dr. Ruben Lampayan being no longer part of the project, he hopes that arrangements could be made so that Dr. Lampayan could at least finish Phase 1.
3. Visit of local extension workers/partners to IRRI to learn more about production technologies
4. Project communication be improved given China's case where Google is banned (constant reminder)
5. Funding for extension is limited. Although they are able to pool resources at times, this is not sustainable and may not sit well with other donors according to Dr. Zhong.
6. Print more extension materials for distribution, have more demonstrations and trainings.

Highlights of the interviews and discussions with farmers:

A. Use of CORIGAP interventions

1. Before, the farmers continuously flood their field, but now they pump water only when water level is (mentioned by female farmers)
2. Before, they experience lodging, but with right amount and timing of N application, they do not experience lodging of their plants anymore.
3. Before, they spray pesticides 4-5 times and the yield was 250kg/mu; now, not more than three times, but yield is 450 kg/mu.
4. Other farmers, especially women farmers, ask the farmer-cooperators about their practices
5. 31% of Gaiyai county using 3CT

B. What they like about the project

1. The labor savings (few spraying, no lodging) that allows the both male and female farmers to do other work.
2. Easy to use. For example, with AWD they only need to look at the bottom portion to check water availability.
3. The practices already make them the best farmers in the area, having higher yield attained at a lower cost
4. 20-30% increase in income (although the figure was highly debated between the female and male farmers)

C. Other Concerns and Suggestions

1. More extension materials
2. More demo sites and co-operators

Meetings and people consulted in China

Meeting	Name	Position/Designation
Dec 7 At GDRRI	The Rice Research Institute of Guangdong (GDRRI), Academy of Agricultural Sciences, Guangdong	
	Dr. Xuhua Zhong	Professor and scientist, GDRRI-GAAS and CORIGAP Country Coordinator
	Dr. Junfeng Pan	Water x Nutrient experiment/demonstration, CORIGAP
	Ms. Ka Tian	GMS emission, CORIGAP
	Ms. Bilin Peng	Experiment Assistant
	Mr. Guodong Zhang	Leader of Labor
	Dr. Feng Wang	Director General, GDRRI
	Gaoyan Agriculture Bureau, Gaoyan	
	Mr. Jianfeng Cao	Director
	Mr. Xiangming Liang	Vice Director
	Mr. Yaohua Tan	Head, Crops Section (delivered presentation)
	Mr. Zhiliang Li	

With farmers

Meeting	Name	Position/Designation
Dec 8 At Boxi Village in Gaoyao City	CORIGAP Farmers from Gaoyao (2 female, male)	
	Mr. Xiangcong Lin	Village leader/farmer
	Mrs. Yanying Deng	
	Mrs. Yili Lin	

	Mr. Nishi Lin	
	Mr. Yihuan Lin	
	Mr. Tienrong Lin	
	Mr. Yigua Lin	
	Mr Yijia Lin	
	Mr Zhip Lin	
	Mr. Zhunghung Lin	Village head

Zhong as translator, with Pieter and Jef, and Mr Tan of GAB

Visit Report – Thailand

9-10 December 2015
Ian Willett and Karen Barroga

Introduction

The reviewers were accompanied by Dr Alex Stuart and Pieter Rutsaert of IRRI in Thailand. Presentations were made at the Rice Department of the Ministry of Agriculture and Cooperatives on the afternoon of 9 December and visit was made to two farmer groups on 10 December. Two COIGAP sites are located in the "rice bowl" of the Central Plain of Thailand in Chainat and Nakon Sawan. The Thai group had not been involved in IRRC.

Thailand is the world's largest rice exporter and only consumes about a half of its production. Although it exports high-quality rice, most of that produced from the Central Plains is of lower quality, high yielding varieties. An overarching objective for rice research in Thailand is to reduce the costs of rice production, thus increasing profitability. The Thai Rice Department is promoting "Cost Reduction Operating Principles" (CROP) to achieve this objective. CORIGAP reinforces the concept by reducing both the financial and environmental costs of rice production. CORIGAP treatments are modifications of ThaiGAP (Good Agricultural Practice). As elsewhere, there is a growing shortage of agricultural labor and interest in mechanization.

Highlights of the presentations, interviews and discussions with the country coordinator and key partners from government agencies:

A. Progress of the Project

1. Focus group discussions were held in two villages near Tha Kli. The rice yields are around 4.3 to 6.25 t/ha. The aim is for 6.56 t/ha. The key problems are high costs of production in relation to income, brown plant hopper and leaf blight infestations, water shortages in the dry season, access to capital, and problems with grain and seed drying.
2. CORIGAP contributed to the treatments to reduce costs were by reducing seed rates using drum seeders, and to introduce the AWD technology.
3. CORIGAP treatments are consistent with "3 must do, 3 must reduce" - must do only 1 or 2 crops/year, must use quality seed, and record activities (diary), and must reduce seeding rate, excessive fertilizer use, reduce pesticide use.
4. Adaptive trials included large plots of CROP+AWD, CROP+drum seeding, CROP and farmers' practice. Crop yields were similar for all treatments (2013 dry season, 2014 and 2015 wet seasons) but production costs were reduced by up to USD 165/ha, more often USD 100/ha. Yield increases, or gap closure, not achieved and would be more important in rainfed areas than the Central Plains.
5. Environmental monitoring was done by soil and water analysis. In general there was no concern about contamination of soil and surface water.
6. Significant capacity building was achieved in rodent research and "Super Bags".

7. The introduction of AWD technology coincided with a dry period and was of great interest to the farmers.
8. There appears to be very little capacity with the field calculator or environmental indicator work of the project.
9. Extension materials have been prepared (e.g. posters, calendars) and are ready for printing.

B. Alignment with/Influence on Policies

1. CORIGAP provides a means of implementing CROP – from ideas to field implementation.

2. CORIGAP supports and strengthens the implementation, of and helps operationalize ,the government's Cost Reduction Program, GAP certification, and the Large Field Program.

3. CORIGAP is consistent with reducing production costs and environmental protection policies of Thailand, but has not yet contributed to policy development.

C. Future Directions

1. Whilst there is little prospect for increasing yields there are strong prospects for increasing profitability by reducing production costs. Provide more convincing evidences that could translate to adoption, not just awareness.
2. The reduced inputs are likely to reduce water usage and greenhouse gas emissions. Give less emphasis to soil and water sampling and analysis and bring the Thai team more strongly into the Field Calculator – environmental indicator work.

D. Other Concerns and Suggestions

1. The Thai project team is concerned that a replacement for Ruben Lampayan is not being arranged**.**
2. Simplify the farmer's diary. It seems that other programs also require farmers to keep records. There may be a need to combine some of these.
3. The government's decision not to plant during the dry season stalls the learning process for CORIGAP interventions. The team tries to provide special training activities, such as on hermetic storage, development of rice by-products to ensure continuity/sustain interest of farmers.
4. Training on using the field calculator.
5. Incorporate the biodiversity aspect.
6. To improve appreciation for reduction in costs, farmers must see how these are computed.
7. Farmers are engaged as cooperators in many projects, especially the active or more progressive ones. Thus, there is difficulty inviting them to join the project. This slows down the project.
8. Mechanisms to improve extension service provision especially on farm machine dispatch and rentals

Highlights of the interviews/discussions with farmers at the Thai sites

A. Use of CORIGAP interventions

1. Chainat: A farmers' self-help group has formed for production cost reductions (COST) and only two farmers identified themselves as 'CORIGAP farmers'. They use SSNM in this area.
2. Chainat: The site is new, only connected with CORIGAP since August 2015.

3. Chainat: CORIGAP has raised environmental awareness and introduced drum seeder.
4. Jikree: Four farmers identified themselves as 'CORIGAP farmers' and all follow ThaiGAP.
5. Jikree: Focus group meetings were held in 2013 for needs assessment
6. Jikree: treatments included drum seeding and AWD coincided with a dry period. Drum seeder was effective and reduced seed rates from 120 to 50 kg/ha, and reduced labor costs. The sparser crop density was said to reduce pest and disease incidence leading to a reduction in spraying.
7. Drum seeder is only used in the wet season and has been adapted to be drawn by tractor.

B. What they like about the project

1. Reduced water pumping costs (by about 50% for pump set hire and fuel) resulting from the application of AWD.
2. Reduced pest incidence, attributed to lower plant density.
3. Reduced fertilizer use due to SSNM. Reduced number of applications from 3 to 2 reduced labor costs.
4. Overall estimated cost reduction of about 1250 Baht/ha
5. More farmers are willing to join.

C. Concerns and suggestions

1. Manually drawn drum seeder is not acceptable
2. Still some remaining doubts on suggested interventions, although convinced about reduced seeding rate.
3. Farmers, especially the older ones, need time to learn and more convincing to make changes.
4. Inability to conduct continuous training with continuous cropping (due to lack of water in the dry season) has slowed down the effectiveness of training (gaps between training sessions).
5. Farm diaries are fine for younger farmers but difficult for the oldest.
6. The provision of machine-drawn drum seeders, laser leveling and combine harvesting would accelerate adoption.
7. The farmers have enjoyed the project interactions with IRRI staff.
8. There is a weakness in marketing as the millers need a large volume of GAP-produced rice to mill it separately so that it can be marketed separately to command a price premium.
9. Provide farm machines (laser leveler, drum seeder)
10. Continuous learning engagement even with the government's pronouncement not to plant during the dry season. Otherwise, it becomes harder to convince more farmers.

Meetings and people consulted in Thailand

With researchers and staff members of Thai Rice Department, Bangkok

Meeting	Name	Position/Designation
Dec 9 at Rice Department Bangkok, Thailand	i) Ms. Ladda Viriyangkura	Rice Product Development Division and CORIGAP Country Coordinator
	ii) Mr. Alongkorn Kornthong	Deputy Director General
	iii) Mrs. Pornsiri Senakas	Bureau of Rice Production Extension
	iv) Mr. Somsong Chotechuen	Rice Research and Development

	v) Mr. Varapong Chamarerk	Division
	vi) Ms. Urasaya Boonpramuk	
	vii) Ms. Rossakon Keosa-ard	Bureau of Rice Policy and Strategy
	viii) Mrs. Nisa Meesang	Land Development Department
	ix) Ms. Nopmanee Suvannang	

With farmers

Meeting	Name	Position/Designation
Dec 10 at Chainat Community Center, Wat Pakaew Village	Farmers from Chainat (6 female, 4 male)	
	iii) Mr. Bieo Sripa	
	iv) Ms. Sa-ink Meehring	
	v) Mr. Pean Meehring	
	vi) Ms. Sayan Toorveang	
	vii) Ms. Niramol Sombun	
	viii) Ms. Kluean Phaensamrit	
	ix) Ms. Samoil Pakplaek	
	x) Ms. Pranee Homchan	
	xi) Mr. Bunyarit Homchan	
	xii) Mr. Jarun Anusa-sananan	
At Nong Jikree, Tha Kli District Nakon Sawan Province	Farmers from Nakon Sawan (7 female, 1 male)	
	i) Ms. Chaluay Nachim	CORIGAP demonstrators
	ii) Ms. Jumnong Kulang	
	iii) Mr. Chart Wongted	
	iv) Ms. Sanit Phokaton	Members, observers
	v) Ms. Sungwal Narongplian	
	vi) Ms. Sairung Plueamyen	
	vii) Ms. Wilai Sueaya	
	viii) Ms. Sudjai Injun	

The following Thailand Rice Department personnel CORIGAP partners provided assistance for the farmer group discussions: Ms. Ladda (translation); Ms. Duangporn Vithoonjit, researcher in Chai Nat Rice Research Center; Ms. Nisa of the Land Development Department, Mr Suwit Pueakjeen, Nakon Sawan Rice Seed Center.