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Extending rice crop yield improvements in Lao PDR: an ACIAR–World Vision collaborative project

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Extending rice crop yield improvements in Lao PDR: an ACIAR–World Vision collaborative project

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Cover: Mr Soda Souvannaphong (World Vision Lao PDR) and Dr Phoudalay Lathvilayvong (Director, Thasano Rice Research and Seed Multiplication Centre) with one of the new varieties of rice grown for the ACIAR–World Vision project. Photo: David Harris

Foreword

In 2001, the Australian Centre for International Agricultural Research (ACIAR) initiated a collaborative program of extension projects with a non-government organisation, World Vision (WV) Australia. The aim was to extend research and development outcomes from selected ACIAR projects to the low-income farming communities of Thailand, Lao PDR and Vietnam. There were six projects and each involved a combination of participatory research and extension. A feature of the program was the opportunity for ACIAR to gain an entrée into World Vision's network of localised Area Development Programs.

Selected components of the program were chosen for an impact assessment. The first of these was a review of the Thai fish-farming project (ACIAR Impact Assessment Series Report No. 66). A second review assessed the impact of the Thai low-chill fruit project (ACIAR Impact Assessment Series Report No. 70).

This report presents the findings of a third review, which looked at the project on improving rice crop yields in southern Laos. The objectives of the project were to improve food security and alleviate poverty through higher rice yields. Most of the project activities were focused on encouraging acceptance of new rice varieties and improving growing practices.

A combination of embedded farm trials and training proved to be an effective way to show the gains from better crop-management practices. It also provided proof of the performance of new rice varieties under local growing conditions and the benefits of appropriate fertiliser treatments. Cooperation with local government extension agencies has had additional benefits in the form of improving the skills of extension officers.

The area of impact of the project was substantial, with a large number of villages in six districts of Savannakhet province participating in the project activities. The impact assessment shows there have been significant gains in food security for the adopting farmers. There has been a widespread acceptance of the new rice varieties and wet-season rice yields have improved. The success of the project shows what can be achieved from a moderate investment in collaborative extension activities with in-country agencies that have established relationships with low-income farmers.

Nick Austin
Chief Executive Officer, ACIAR

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Acknowledgments

This assessment could not have been completed without the cooperation of World Vision Lao PDR (WVL), which was facilitated by Mr Grant Power from the Head Office of WVL in Vientiane. Mr Siddhartha Sahu, Operations Team Leader at the WVL Savannakhet Provincial Office, ensured the cooperation was effective by arranging access to key staff members. His commitment to the exercise was very much appreciated.

Other WVL staff members in Savannakhet provided assistance during the course of site visits. They have been noted in the list of contributors to the impact assessment given in Appendix 3. The assistance of Ms Sarah Whittaker with planning the site visits was greatly appreciated.

Staff members of WVL and various District Agriculture and Forestry Offices in Savannakhet collected survey information for the impact assessment. This task involved face-to-face interviews with farmers. It required patience in explaining the questions to farmers and a commitment to ensuring the survey responses were accurate. The task was diligently completed and the efforts of the people involved were highly valued.

The assistance of Mr Soda Souvannaphong from the WVL Savannakhet Provincial Office requires special mention. He organised the site visits in each district and arranged meetings with government officials. He supervised the survey activity and the training of people involved in the questionnaire interviews. Mr Souvannaphong was the key source of WVL knowledge on the project and collected data to support the assessment. He was generous with his time, and his patience, advice and organisational efforts were greatly appreciated.

Executive summary

In 2001, the Australian Centre for International Agricultural Research (ACIAR) initiated a collaborative program of extension projects with World Vision (WV) to enhance the adoption of results from technical research projects. There were six projects in Thailand, Lao PDR and Vietnam. In general, the project objectives focused on poverty alleviation and/or food security.

There was a combination of participatory research and capacity building in each project. The projects were implemented by the in-country WV agencies in areas of poverty where the farm households had limited land and low incomes.

To evaluate the effectiveness of the program, selected projects were chosen for an impact assessment. Two assessments have been completed—low-chill fruit growing in northern Thailand and low-cost fish farming in northern and central Thailand. This report presents the assessment for a project on improving rice crop yields in southern Laos.

The Improving Crop Yields project

Subsistence agriculture is common in Savannakhet province, Laos, and farm output is dominated by rainfed rice production. There are high levels of poverty and many households experience rice-deficit periods during the year. Farmers have limited land, and food security depends on yields from the wet-season rice crop.

In the past, yields were constrained by poor soil fertility, a low-input production system, deficiencies in growing practices and a lack of access to new varieties. Fertiliser use was limited and farmers lacked technical skills in soil preparation and crop management. Opportunities for rice sales to generate farm income were limited.

The objective of the project, hereinafter referred to as the Improving Crop Yields (ICY) project, was improved food security and poverty alleviation through higher crop yields. There were two components of extension activities: wet-season rice and dry-season cropping. Most of the project resources were devoted to increasing rice yields by encouraging acceptance of new varieties and improving growing practices.

The project involved a combination of rice-growing trials on volunteer farms and training activities. There were three phases of the project, which was implemented in six districts. The first two phases ran from 2000 to 2006 in Phalanxai, Outhomphone and Atsaphangthong districts. Trials were established on 375 farms in 104 villages. The number of potential beneficiaries was estimated at 9,674 farm households.

A number of new rice varieties were trialled during phases one and two. Towards the end of phase two, farmer selections had identified the favoured varieties. There was a seed distribution of these varieties in 2006. A process of seed multiplication and rice swaps within the villages facilitated the adoption of the new varieties.

Phase three was a 1-year project extension in Phine, Atsaphone and Xonnabouly districts. The same process of trials and rice swaps was implemented in 30 villages. There were 90 trial farms and 4,225 potential beneficiaries. Phase three included seed distribution to villages with no trials or training activities. This involved an extra 8,755 farm households.

Rice production benefits of the project

A farm survey in selected trial villages provided a perspective of the project impact. Average farm outputs were derived for each of the six districts. They were compared with a 'no impact' base case to estimate the project benefits. The estimate allowed for differences in the timing and extent of the output gains achieved by different groups of beneficiaries.

The change in farm outcomes for the 22,654 potential beneficiaries generated a project benefit of A$149.4 million. The survey results provided a representative indicator of the yield change in each district. The change was small in comparison to the trial outcomes. There was a high level of acceptance of the new varieties but fertiliser use remained very low. In some villages many farmers did not apply fertiliser.

Net benefits of the Improving Crop Yields project

The present value of the project net benefits is A$73.8 million. The gains are substantial, and the project has had an extensive impact across the six districts. Funding for the phase three extension to Phine, Atsaphone and Xonnabouly was a worthwhile investment.

The project objectives have been achieved in the participating villages. Rice yield gains have enhanced the food security of adopting farmers. This will improve the nutritional content of household diets. The project has also generated some poverty alleviation benefits through increased rice sales.

Yields are not as high as the trial performance of the new varieties. Greater acceptance of the new varieties by observer farmers in phase three districts could increase the benefits in future years. There is also potential for larger benefits if the changes in rice-growing practices are more widely embraced.

- Fertiliser treatments by most adopting farmers are well below the recommended application rates that are necessary for higher yield gains.
- Further yield gains from higher fertiliser treatments would generate larger poverty alleviation benefits and encourage a shift towards commercial farming.

The assessment is sensitive to adoption assumptions for the project impact in non-trial villages. This involved the 8,755 farmers who received only a seed distribution of the new varieties. A sensitivity analysis was prepared using 'best case' and 'worst case' scenarios. It shows the net benefits would vary between A$66.9 million and A$88.1 million for an adoption response that was weaker or stronger than anticipated, respectively.

Some lessons from the impact assessment

Collaborating with WV Lao PDR (WVL) was an effective way to encourage adoption of ACIAR research results and acceptance of new rice varieties. The collaboration utilised WVL's established relationships with farmers and government extension staff. This was important for generating interest in the project and overcoming limitations in the capacity of government extension services.

The combination of farm trials and training activities was an effective way to show the gains that could be achieved from better crop-management practices. It provided proof of the performance of new rice varieties under local conditions. It also showed the difference in yield outcomes for growing rice with and without fertiliser applications.

This approach contributed to the success of the project. It had some advantages over the alternative of 'community' trials in central locations. Competing demands for the time of farmers and the costs of travel to trial sites may increase the risk that some farmers could lose interest in the project. In some situations this can be an impediment to wider adoption.

Embedded trials in the crops of volunteer farms generated a lot of interest in the project. Villagers could easily monitor the progress and outcomes of the trials. Training activities were developed around the trials. Meetings of trial and observer farmers reinforced the training lessons and were a forum for discussing issues that emerged.

The project impact was not as strong in the non-trial villages and for observer farmers in the trial villages: yield gains were lower. Follow-up extension activities a few years after the trials ended could have enhanced the effect of the project.

Fertiliser treatments were well below what was required to obtain the yield results that were achieved in the trials. The cost has probably deterred many farmers, despite the trials proving the extra yield gains that could be achieved. Food security was the priority and many farmers would have taken a conservative approach to fertiliser use.

Farmers are not realising the full potential of the new varieties and rice-growing practices. A lack of understanding of the principles of farm financial management may be a contributing factor. Some training in basic farm-management economics would have been a useful complementary extension activity for the project.

The benefits from the dry-season cropping extension activities were limited. The lack of water limits the options for dry-season crops. A concentrated focus on the most suitable options and a smaller target area may have generated a bigger impact. Trade-offs between income from off-farm work and dry-season cropping may have limited the interest of farmers. This is an important consideration for projects that alter the balance of labour use.

1 Introduction

The impact of Australian Centre for International Agricultural Research (ACIAR) investments in research and development (R&D) projects in developing economies depends on the effectiveness of post-project extension activities. A reliance on in-country agencies to encourage the application of research results is often ineffective. For this reason, ACIAR emphasises the importance of extension in project design.

An alternative approach to realising the potential benefits of R&D outcomes is to invest in complementary extension projects. To assess the effectiveness of this strategy, ACIAR funded a program of extension projects in selected developing economies in collaboration with World Vision (WV) Australia. The aim of the program was to use WV staff engaged in community development activities to encourage the adoption of results from ACIAR research projects.

World Vision is a non-government organisation (NGO) active in several countries where ACIAR invests in R&D projects. It focuses on poverty alleviation, food security and social welfare improvements among the poorest members of rural communities. The WV agencies in these countries have close links with the farming communities in locations where they have established Area Development Programs (ADPs).

More generally, WV collaborates with government agencies to deliver health, education and other welfare programs to the poor. This includes self-help extension projects aimed at poverty alleviation and food security. Through these collaborations, WV has established relationships with local government extension services and other welfare agencies.

The ACIAR–WV projects were funded through a joint activity called 'Facilitating farmer uptake of ACIAR project results: World Vision collaborative program' (PLIA/2000/165). The program had six components, or projects, spanning three countries:

- Reform of farming practices to prevent agrichemical pollution of water resources in southern Thailand
- Growing low-chill temperate fruits in the hilly areas of northern Thailand
- Profitable fish farming using low-cost feed in north-eastern Thailand
- Rodent control in rice crops using integrated pest management techniques in southern Vietnam
- Improving soil fertility in Binh Thuan province of southern Vietnam
- Improving crop yields in rice production systems in the southern lowlands of Lao PDR.

Each component involved participatory research by farmers, and training activities based on the results from related ACIAR projects. Limitations on the reach of WV's development projects due to resource constraints possibly prevented realisation of the full potential benefits of the collaboration.

WV's activities focus on the poorest members of local communities and do not extend to all parts of the country. A development project is not necessarily implemented in all areas where WV has an established presence. This is because community decisions on project participation are optional and decentralised.

The potential direct beneficiaries from each program component are limited to a targeted group of the poorest farmers in particular communities. Other farmers are excluded from WV development activities. Adoption of the extension advice beyond the target group relies on other farmers observing and applying the changes in farming practices.

The collaborative program was administered through WV Australia but the individual extension projects were implemented by the in-country WV organisations. They arranged for in-country project partners to provide technical advice and extension assistance as necessary.

Funding for the entire program was A$1.799 million over the 2000–01 to 2007–08 period. The ACIAR contribution of A$1.453 million accounted for about 80% of the funds. Initially, the program was designed so that all components would have similar budgets and run for 2–3 years. Extensions were granted for some projects and the completion dates varied accordingly.

The program was nominated for an impact assessment entailing a review of three of its projects. The assessment began with a review of the project on fish farming using low-cost feed in north-eastern Thailand (Harris 2010). It found the project generated significant poverty alleviation and food security benefits. In present value terms, the net benefits were estimated at A$6.9 million with a benefit:cost ratio of 5.1 to 1.

A second review assessed the project on low-chill temperate fruits in northern Thailand (Harris 2011). This project was less successful. There were implementation problems and a low rate of adoption. In present value terms, the net benefits were estimated at A$59,000 with a benefit:cost ratio of 1.2 to 1.

This report presents the findings of a review of the Improving Crop Yields (ICY) project on rice-based farming systems in southern Laos (Souvannaphong et al. 2008). The ICY project had three phases and was funded for 8 years. Shortly after the project commenced it was decided that the geographical scope of the extension activities would be confined to selected districts in Savannakhet province.

2 The Improving Crop Yields project

The aim of the ICY project was to encourage the adoption of R&D outcomes that would lead to productivity gains in rainfed rice-farming systems. It made use of research results from ACIAR projects, the National Rice Research Program (NRRP) of Lao PDR and the Lao – International Rice Research Institute (IRRI) Research and Training Project. The focus of the extension activities was to improve rice-growing practices and encourage acceptance of new rice varieties.

ACIAR had been involved in collaborative R&D projects to improve rice yields in the South-East Asian region since the early 1990s. The ICY project was developed to build on the findings of two ACIAR projects:

- Plant breeding strategies for rainfed lowland rice in north-east Thailand and Laos (CS1/1995/100)
- Increased productivity of rice-based cropping systems in Lao PDR, Cambodia and Australia (CIM/1999/048).

The technical knowledge accumulated from these and other projects provided a basis for new extension advice on rice growing in Savannakhet. Gains in food security and poverty alleviation could be achieved through changes in farming practices and the introduction of new rice varieties. Unfortunately, government extension services did not have the resources or technical skills to effectively facilitate widespread adoption of the advice.

World Vision Lao PDR (WVL) is involved in rural development projects in various districts of Savannakhet. Through these projects, it has close contact with low-income farmers in many rural communities. It has also established relationships with officials from the network of District Agriculture and Forestry Offices (DAFOs) in Savannakhet.

The ICY project used these relationships to implement extension activities that focused on improving the technical skills of farmers and demonstrating the benefits of change. In line with the operational focus of WVL, the work was targeted at areas of acute poverty. The objective was to improve food security and alleviate poverty by increasing rice yields. A secondary aim of the project was to improve dry-season cropping.

Rice growing in Savannakhet province

The national diet of Laos is based on rice consumption. In rural areas, rice accounts for up to 80% of the energy intake of the population. This means the wet-season rice crop plays a critical role in food security for low-income farmers.

Subsistence agriculture is common in Savannakhet, and farm output is dominated by the rice crop. Wet-season rice is grown in a rainfed production system. Irrigated agriculture is negligible and dry-season cropping of any kind is limited.

The average yield of wet-season rice crops can fluctuate because of the variability in seasonal rainfall. Rice growing is also vulnerable to drought and flooding at critical times of the plant growth cycle. The wet season runs from April to September and there is very little rainfall outside this period.

Yields are also constrained by poor soil fertility and the low-input production system that is characteristic of rice growing in Savannakhet. Traditional farming practices involve limited use of fertilisers and minimal use of insecticides to combat the gall midge attacks that occasionally occur. Most low-income farmers do not

have the technical skills or financial resources to deal with these problems.

Before the ICY project was implemented, other deficiencies were evident in rice-growing practices. Yields were affected by the traditional approach to soil preparation, seedling growth, rice planting and crop management. The timing, application rates and types of fertiliser treatments were identified as factors where changes were required.

A further constraint on yield performance was the preference for planting traditional varieties of rice when new, more productive varieties were available. Some farmers were reluctant to use the new varieties because of uncertainties about their performance under local growing conditions. In other cases, farmers were interested in the new varieties but could not get access to the seed.

In districts with high levels of poverty, low rice yields were commonplace. Farmers retained their crop for home consumption, and their financial capacity to buy fertiliser and new varieties of seed was limited. Most farmers obtained different seed through rice swaps—an exchange of rice with other village members. Access to the new varieties depended on the availability of seed in the village and a willingness for swaps.

- The practice of rice swaps within a village was identified as a low-cost way of facilitating the adoption of new varieties of rice.
- It was incorporated into the project design and became a key factor in the extent and rate of adoption of the extension advice.

Rice extension activities

The project's extension activities had two components: wet-season rice production and dry-season cropping. The primary activity was facilitating changes in wet-season rice production. Sustained improvements in rice yields were the key to achieving gains in food security and poverty alleviation. Therefore, most of the project resources were devoted to this activity.

Output gains from extension activities on dry-season cropping would be more difficult to achieve because of the lack of water and poor soil fertility. A further limitation was a lack of R&D projects to support the extension activities. Interest in growing dry-season crops was limited, as the dry season was seen as a time for off-farm work to earn income.

Increased rice production required changes in farming practices and the introduction of new, more productive varieties. The project involved a combination of rice-growing trials on volunteer demonstration farms and related training activities. This approach allowed farmers to observe and discuss the trial outcomes and the changes in growing practices.

This was a highly effective way to encourage acceptance of the new varieties, as the trials were undertaken by farmers under local growing conditions. Crop growth and yield comparisons between different varieties could be readily observed. The results of applying the training in rice-growing practices could also be seen.

The alternative approach of using 'community' demonstration sites has to consider the risk that some farmers may lose interest in the trials if they have to travel to observe the outcomes. An advantage of private ownership of crop trials is the stronger commitment and incentive to succeed, as the output is part of the household food supply.

Implementation of the rice extension program followed a standard formula. A group of villages in a district was selected to participate in the trials. In each village, 3–5 farmers volunteered to include trial plots in their next crop. They were given seed and fertiliser for the trial plots. They were instructed on the required rice-growing practices through a range of training activities. The training focused on soil preparation, seed selection and sowing, rice planting and fertiliser treatments.

The trials involved a number of new varieties as well as the traditional varieties that were typically grown in the village. Trial plots were small and divided between plants that received fertiliser treatments and those that did not. Inputs and yield outcomes were formally recorded for comparative assessments.

Seed for new varieties was purchased from the Thasano Rice Research and Seed Multiplication Centre, a government research station attached to the Province Agriculture and Forestry Office (PAFO). The agency was involved in research on new varieties that were suited to

the growing conditions in Savannakhet. As new varieties were released by the centre, they were included in the project trials.

In each village, WVL staff collaborated with local DAFO staff to implement the extension program. This is a Lao government requirement for all NGO activities. The project had to cover the expenses of these officials. A benefit of the collaboration was improvements in the technical skills of DAFO staff. They became better equipped to give advice on rice growing in line with the practices recommended by the project.

WVL and DAFO staff made regular visits to the villages participating in the trials. They monitored crop development and provided technical advice on problems that emerged during the trials. They also organised formal discussion sessions between trial farmers and other village members. This enhanced interest in the project and made the observing farmers more enthusiastic to use the new varieties.

Area of project impact

The project had three phases, and extension activities were implemented in six districts. The geographical coverage of the rice trials was extensive, with 134 villages participating (Table 1). There were 13,899 potential beneficiaries (i.e. trial farmers and observers) in the trial villages, which is around 29% of the total number of farms.

Phase one ran from 2000 to 2003 in three districts: Phalanxai, Outhomphone and Atsaphangthong. A group of villages in Champasak district of Champasak province was initially included in phase one. A decision to rationalise the scope of the project led to the exclusion of Champasak at the end of 2002.

Phase two ran from 2004 to 2006 in the same districts. In both phases, the rice extension program was progressively implemented in different groups of villages. The trials started at different times and the commencement of village adoption varied accordingly.

There was a time lag between the start of the trials and village adoption. Farmers and the project staff generally went through a learning phase in the first year of trials. Difficulties in establishing trial plots were usually overcome in the second year. In the third year, the process of seed multiplication and rice swaps would begin.

Another factor that affected the process of village adoption was the selection of new varieties for rice swaps. In some cases, identifying the most promising varieties required further independent experimentation by the observers. Many farmers took a conservative approach to including the new varieties in their crops. Initial plantings were small but increased as the yield gains became evident.

Phase three was a 2007 project extension, which expanded the program to three new districts: Phine, Atsaphone and Xonnabouly. The extension was granted in response to a request by the Savannakhet PAFO. The new districts were chosen because they were judged to have high levels of poverty and low food security.

WVL and DAFO staff jointly decided which villages would participate in the rice trials. These decisions were based on criteria that included assessments of poverty levels and periods of rice deficits. To ensure sound project management, the number of villages targeted by the program each year was limited.

- The timing of village participation, the number of trial farms and the total number of farmers in trial villages are key variables for the impact assessment.
- Appendix 1 provides details on village participation in the rice trials.

Rice yields and the introduction of new varieties

There were high levels of poverty in the districts that were included in the project. In each district, yields and the extent of monthly rice deficits vary between farms. Average farm performance is better in some villages than in others.

In recent years, rice yields in Savannakhet have averaged around 3.5 tonnes (t)/hectare (ha). Similar yields have been achieved in the six project districts (Table 2), but some village areas have very low yields. ACIAR progress reports for the project indicate yields were much lower on the trial farms. This is not surprising, as the project targeted the poorest villages where rice deficit periods were highest.

Table 1. Improving Crop Yields project impact area[a]

	Total villages[b]	Total farms	Villages in rice trials[c]	Farms in villages with rice trials[d]		Other farms
	no.	no.	no.	no.	%	no.
Districts in phases one and two of project						
Phalanxai	54	5,290	36	2,881	*54*	2,409
Outhomphone	69	12,626	45	4,120	*33*	8,506
Atsaphangthong	40	5,889	23	2,673	*45*	3,216
Districts in phase three of project						
Phine	116	7,862	10	1,363	*17*	6,499
Atsaphone	56	8,393	10	1,698	*20*	6,695
Xonnabouly	63	7,796	10	1,164	*15*	6,632
Total	**398**	**47,856**	**134**	**13,899**	**29**	**33,957**

Source: District Agriculture and Forestry Offices

[a] Project activities confined to six districts of Savannakhet province

[b] Total villages and farms are 2009 estimates provided by District Agriculture and Forestry Offices

[c] Not comparable with total villages—some villages were amalgamated after the project ended

[d] Number of farms in villages with trials of new varieties of rice—see Appendix 1 for details

During phase one it was evident that farmers in the target villages had limited education and were slow to embrace the changes in rice-growing practices. There was also a need to improve the technical advisory skills of the collaborating DAFO extension officers. This slowed progress in completing the trials. Refinements to the design of extension activities improved the effectiveness of the project during the second phase.

As the trials progressed, project staff and farmers became more confident in the new varieties and farming practices. Several new varieties were trialled simultaneously—in 2004 and 2005 the trial plots had nine varieties. Towards the end of phase two, post-trial selections by farmers had identified the favoured varieties. The number of trial varieties was reduced and, in phase three, the rice trials involved only four new varieties.

Rice trials and training activities were not the only ways the project had an impact. Seed distributions of new varieties in non-trial villages also played a role. This occurred in the second and third phases of the project. Appendix 2 gives the timing of trials and seed dispersal. The seed distributions were handled differently in each case.

Once the favoured varieties had been identified, there was a supplementary seed distribution at the end of phase two that extended beyond the final group of trial villages. The 2006 distribution covered 1,701 farmers in 43 villages. Most of the villages had hosted trials in earlier years. An exception was seven non-trial villages in Phalanxai. Farmers in these villages did not observe trials or the application of new growing practices.

It had been intended for this supplementary distribution to cover all villages in Phalanxai, Outhomphone and Atsaphangthong. However, there was not enough time to do this before the new cropping season began. The distribution was restricted and the project impact from intra-village rice swaps was essentially confined to the trial villages.

- The 9,674 potential beneficiaries in the trial villages for phases one and two defined the extent of the impact of the project in these three districts.
- Farm numbers in the seven non-trial villages in Phalanxai were not available.

Adoption of new varieties in other villages was dependent on inter-village rice swaps or seed purchases. The role of rice swaps with farmers from the ICY villages was probably limited. There were difficulties with some of the trials, and post-trial adoption in the ICY villages generally involved low fertiliser treatments.

Table 2. Average rice yields in project districts

	Phalanxai		Outhomphone		Atsaphangthong	
	t/ha	% annual change	t/ha	% annual change	t/ha	% annual change
2000	3.2	–	3.4	–	3.1	–
2001	2.7	−15.6	3.4	0.9	3.0	−1.9
2002	2.9	7.4	3.9	13.7	3.5	15.1
2003	3.0	3.4	3.0	−23.1	2.7	−22.9
2004	3.0	0.0	2.9	−3.3	2.9	7.4
2005	2.5	−16.7	3.9	34.5	3.2	10.3
2006	2.9	16.0	3.1	−21.8	3.1	−3.4
2007	3.3	12.4	3.3	8.9	3.4	10.0
2008	3.3	−0.3	3.4	1.2	3.4	0.6
2009	3.3	1.8	3.4	0.6	3.4	0.3
2010	3.4	2.4	3.4	1.8	3.5	0.6
	Phine		**Atsaphone**		**Xonnabouly**	
	t/ha	**% annual change**	**t/ha**	**% annual change**	**t/ha**	**% annual change**
2000	3.5	–	3.1	–	3.1	–
2001	3.2	−8.6	3.5	12.9	3.5	12.9
2002	3.3	3.1	3.3	−7.1	3.4	−2.9
2003	3.1	−5.5	3.1	−4.6	2.8	−17.6
2004	3.0	−3.8	3.1	0.0	3.1	8.9
2005	2.9	−3.3	3.0	−3.2	2.5	−18.0
2006	3.3	13.8	3.1	1.7	3.5	38.0
2007	3.3	−1.2	3.4	12.1	3.6	3.2
2008	3.3	0.6	3.4	0.6	3.6	0.8
2009	3.3	0.6	3.4	0.0	3.6	0.3
2010	3.2	−3.0	3.4	−0.3	3.5	−3.3

Source: District Agriculture and Forestry Offices; data collected in each district throughout the year

Note: Average yields are rounded to 1 decimal point; % annual change is calculated from un-rounded numbers.

This would have limited the size of the yield gains and curtailed external interest in rice swaps.

Farmers from non-trial villages would need to see examples of sustained, sizeable yield improvements to be interested in a rice swap. They would have observed the post-trial yield outcomes in the ICY villages, which would have been less impressive than the trial results with high fertiliser treatments. There was no extension advice or encouragement to adopt from ICY project staff.

In phase three, the supplementary seed distribution program was handled differently. It was extended beyond the trial villages. The plan was to distribute seed to all villages in Phine, Atsaphone and Xonnabouly. However, it was not possible to do so before the new cropping season, so the distribution was restricted. It was targeted at selected non-trial villages and written growing instructions were provided with the distributed seed.

There were 10 trial villages in each phase three district and 4,225 potential beneficiaries in these villages.

WVL estimates show the 2007 supplementary seed distribution reached another 8,755 farmers in 147 villages, over and above the farmers in the 30 trial villages. This additional group of beneficiaries is included in the estimates of the project impact for phase three districts.

The project impact was probably a little weaker in the phase three districts. Training on rice-growing practices in the trial villages was limited to a single year. It would have been less effective than the attention given to the trial villages in earlier phases of the project. This probably limited the yield gains achieved by observer farmers through the seed duplication and rice-swap process.

Beyond the trial villages the project impact relied entirely on the autonomous efforts of farmers to grow the new varieties. Farmers experimented independently using written instructions. Poor results would have weakened their interest in new varieties.

More generally, seasonal conditions could have influenced the results of the project. Rainfall deficiencies at critical times may have limited the yield gains and the subsequent acceptance of the new varieties. Data supplied by the Savannakhet Meteorology Office show reduced wet-season rainfall in some districts in 2007 and 2009 (Table 3). However, this was not judged to be an important consideration in assessing the project impact, as dry conditions would have affected all rice varieties.

During some of the trials it also became apparent that yields from the new varieties were affected by gall midge attacks. Local varieties were more resistant to this insect pest. The severity of the problem varied with seasonal conditions and, in some cases, it probably affected the level of acceptance of the new varieties, especially in some areas of Atsaphone.

In general, the prospects for sustained adoption of the new varieties and farm practices are likely to be strongest among the trial farmers. Trial results showed large yield gains of new varieties over traditional varieties. Their firsthand experiences will probably lead to rapid adoption of new varieties and minimal use of traditional varieties within a short period.

Observer farmers in the phase two trial villages will also be reasonably strong adopters. The rate of substitution for traditional varieties may be slower as they assess their own experiences. These farmers are likely to be more conservative and continue allocating a small portion of their crop to the traditional varieties.

In the phase three trial villages, the adoption response by observer farmers is likely to be a little weaker. Trial farmers in these villages received less support than the trial farmers in phase two districts. Extension training activities were truncated and yield outcomes were probably less impressive—no trial results were reported for phase three districts. In general, this would suggest a more conservative crop allocation to the new varieties.

In the non-trial villages of phase three districts, adoption was probably not as strong as the response in the trial villages. It relied exclusively on the 2007 seed distribution. With no training activities or trials to observe, the autonomous efforts of farmers in these villages were probably less successful. Lower uptake of the new varieties seems likely.

Despite the graduated adoption response, the potential impact of the project is substantial. Adoption will be strongest on the 465 trial farms across the six districts. Observers in the trial villages are also likely to be strong adopters, especially in the phase two districts.

- There are 22,654 potential beneficiaries; 47% of the farms in the six districts.
- This number does not include farmers in the seven non-trial villages in Phalanxai that were part of the 2006 seed distribution.
- The exclusion of these farms will mean that the project benefits are slightly understated.

Dry-season crop extension activities

Some project resources were allocated to an extension program on dry-season cropping. It focused on the districts targeted in the first and second phases of the rice program. Savannakhet Meteorology Office data show that there is very little rain during the dry season, so the prospects for food security gains from this component of the project were limited.

The approach was similar to the rice extension program. Volunteer demonstration farms in selected villages experimented with alternative crops. Training in soil management and crop-growing practices was provided. Most of the resources were used to purchase and distribute seed for alternative crops.

Table 3. Wet-season rainfall (mm) in project districts[a]

	Phalanxai	Outhom-phone[b]	Atsaphang-thong	Phine	Atsaphone	Xonnabouly
2000	1,324	1,196	1,599	1,976	1,702	1,694
2001	1,283	1,858	1,688	1,768	1,638	943
2002	1,787	1,531	1,938	1,796	2,265	1,677
2003	1,126	1,427	1,367	1,443	1,283	1,129
2004	1,256	1,376	1,399	1,240	1,469	1,161
2005	1,863	1,633	1,858	1,932	2,031	1,514
2006	1,038	1,288	1,130	1,129	1,239	1,338
2007	744	1,149	1,135	770	925	922
2008	868	1,227	1,541	1,220	1,444	1,260
2009	698	841	1,307	1,206	1,332	996
Average[c]	**1,199**	**1,353**	**1,496**	**1,448**	**1,533**	**1,263**

Source: Savannakhet Meteorology Office

[a] Total rainfall for the May–September period.

[b] Rainfall recording stations were at Seno (Outhomphone), Donghene (Atsaphangthong), Phalan (Phalanxai), M. Phine (Phine), Nakoutchan (Atsaphone) and Nonsavang (Xonnabouly).

[c] Average refers to 2000–09 period; shaded years indicates annual rainfall was >20% below average.

Before the ICY project, some farmers were already growing small quantities of dry-season crops for home use. Vegetable growing was a common activity. But many farmers were not growing any crops because of production difficulties and alternative uses for their labour. Many farmers engaged in off-farm work to generate income.

Experimentation with dry-season crops involved a range of different products. Seed was provided for crops such as lettuce, beans, cabbage, cucumber, chillies, onion, garlic, tomatoes, cucumber, eggplant, peanuts, maize, coriander and mustard. Fruit trees such as mango and tamarind were also tried in the initial stages of the project. In most areas the lack of water limited the options for commercial production of dry-season crops in the rice fields.

Dry-season extension activities mostly targeted the villages that participated in the rice trials. While the scope of these activities was limited, they were not tightly focused on the most feasible cropping options. A summary of the timing of the extension activities is included in Appendix 2. It shows the involvement of 127 villages and 528 trial farms across the six districts.

There was no indication in the ACIAR progress reports of major changes in dry-season cropping following the completion of extension activities. It was not possible to establish the level of persistence after the trials. Many alternative crops were either unsuitable or did not perform well. This would have discouraged the trial farmers from persisting with dry-season cropping and reduced the interest of observers.

Adoption of dry-season cropping was not presented as a major outcome of the project. Discussions during the impact assessment field visits indicated that off-farm work had a higher priority in the dry season. This is not surprising, given the need to generate income. Time spent on tending dry-season crops under difficult growing conditions would probably not yield the same financial return as off-farm work. It is likely that interest in growing dry-season crops has remained limited due to a lack of commercial marketing opportunities, production difficulties and the higher returns from off-farm work.

In general there are limited prospects for a significant impact from this component of the project. Access to water is a major constraint and any increase in output

will mostly involve small amounts of vegetables for home use. Some farmers who were active growers before the ICY project may have altered their output mix. There may also be some farmers who have begun to grow small quantities of vegetables in response to the extension activities.

The impact may have been greater if more resources had been allocated to the extension activities over a longer period. A more intensive extension activity in the targeted villages over 2–3 years may have generated more interest. A sharper focus on a smaller number of crops that were likely to be viable under the growing conditions may have generated a stronger adoption response.

The total investment was A$480,000, with ACIAR contributing 91% of the funds. Apart from WVL administration and project staff costs, the funds were used for expenses such as seed and fertiliser purchases. WVL also had to cover the expenses of local government officials who were involved in the extension activities.

Rice seed, fertiliser and dry-season crop seed were supplied to the trial farmers free of charge. Project funds also covered the cost of distributing rice seed in 2006 and 2007. The Thasano Rice Research and Seed Multiplication Centre produced the seed for the new varieties of rice. WVL had to purchase the seed at market prices and cover the distribution costs in the six districts.

Project expenditure

ACIAR and WV Australia were the project's sole funders over its 8 years of operation (Table 4). There was no financial contribution by WVL, as the organisation is totally reliant on foreign funding. The Lao PDR Government and Savannakhet government agencies did not contribute to the cost of the project.

Table 4. Expenditure (A$) on the Improving Crop Yields project[a]

	ACIAR	World Vision Australia	Total funding	
			Nominal	2011 A$
2000–01	50,000	6,000	56,000	74,000
2001–02	99,000	12,000	111,000	143,000
2002–03	67,000	6,000	73,000	91,000
2003–04	20,000	0	20,000	24,000
2004–05	40,000	20,000	60,000	71,000
2005–06	40,000	0	40,000	46,000
2006–07	101,000	0	101,000	113,000
2007–08	20,000	0	20,000	22,000
Total expenditure[b]	436,000	45,000	480,000	584,000
Agency share	91%	9%	–	–

Source: ACIAR (pers. comm.)

[a] Annual expenditure is for the year ending 30 June.

[b] Due to rounding of data, totals may not be exact.

3 Net benefits of the Improving Crop Yields project

To gain a firsthand perspective on the level of adoption of project advice, two field trips were undertaken. They involved meetings with WVL project staff, government officials and farmers. WVL arranged visits to selected villages in four of the project districts. DAFO officials participated in the village visits. A list of the people who were consulted during the visit is provided in Appendix 3.

The food security and poverty reduction benefits of the project have primarily come from the rice extension component. Farmers adopting new varieties and rice-growing practices gained benefits from increased rice yields. The benefits can be assessed from the number of adopters and estimates of the change in the value of farm output.

- The same per unit valuation can be applied to any additional rice retained for home use or sold commercially.

Survey of project beneficiaries

Economic gains from applying the training advice and results of the rice trials will vary between farmers. The acceptance of new varieties and the rate of substitution for traditional varieties will differ. There is also likely to be some variability in the application of new rice-growing practices. For example, the timing and quantity of fertiliser treatments will vary because it is a major input cost and many farmers have limited income.

A further source of difference is farm-management skills. There is generally a range of skill levels within a farming population—some farmers aspire to best practice, others are less committed. In the ICY project most of the potential beneficiaries were observers of the rice trials. They received less training and less attention than the trial farmers. Their willingness to diligently apply the new farming practices would have varied.

Regional differences in farm performance are likely to be another source of variability in the project impact. Trial villages were located in different areas of the six districts. While growing conditions are similar, some areas may achieve higher rice yields than others.

Information from the farm trials cannot be used to assess the project impact. The trials proved sizeable yield gains were feasible under local growing conditions, but post-trial crop compositions will vary. It is also unlikely that rice-growing practices will mimic the effort invested in the trial plots.

- Once the trials and training activities ended, the adopting farmers were probably not as diligent in following the recommended growing practices.
- For example, chemical fertiliser had to be purchased after the trials and farmers may not have been as willing to follow the required treatment rates.

To obtain a perspective on adoption outcomes, a survey of farmers in the six districts was conducted. A questionnaire was developed to establish the dimensions and performance of a rice enterprise before and after the project. The information was used to develop some of the assumptions for the impact assessment calculations.

WVL and DAFO staff collected the survey information in late 2010. It focused on farm performance for the 2009 wet-season rice crop. Three villages in each of the

six districts were included in the survey. In each village, a random sample of 10 farmers was selected to complete the questionnaire. The only requirement was for the sample to include some of the volunteer trial farms.

The sample of 60 farmers in each district (i.e. total sample 360) was sufficient to obtain a reasonable indication of the project impact in the trial villages. A summary of survey results for each district is provided in Appendix 4. The questionnaire covered a range of issues. The key variables were farm income, crop composition between different rice varieties, rice yields and fertiliser applications.

Official data on farm performance for the 137 villages that participated in the rice trials were not available. Survey results were used to derive average farm outcomes for the six districts. They provided a reasonable indicator of rice enterprise developments since the project ended. There was some district variability in average farm sizes:

- Farmers surveyed in the phase two districts had an average farm size of 2.0 ha to 3.5 ha and an annual household income of A$400 to A$480.
- Farmers surveyed in the phase three districts had an average farm size of 1.3 ha to 2.5 ha and an annual household income of A$445 to A$660.

Several features of the survey results are worth noting. From a physical performance perspective, the results showed the following:

- There has been a high level of acceptance of the new varieties in all six districts.
- In phase two districts, the shift into new varieties has been very high and, in 2009, the average crop share for traditional varieties was less than 10%.
- There was a further small decline in the use of traditional varieties in the 2010 crop in phase two districts.
- In phase three districts, the substitution of traditional varieties was lower and, in 2009, the average crop share for traditional varieties was around 20%.
- There was a significant decline in the use of traditional varieties in the 2010 crop in phase three districts.
- Rice yields were lower than district averages but have increased since the project was implemented.
- Adoption of new farming practices has been significant and almost 50% of survey respondents in phase two districts have changed their approach.
- Application rates for chemical fertiliser were very low and in phase three districts some farmers did not apply any fertiliser.
- Fertiliser treatments have increased since the project was implemented, with the application rates higher in phase two districts.
- Organic fertiliser is widely used but use of pesticides for crop protection is non-existent.
- Project training or seed distribution for dry-season cropping was limited and more evident in phase two districts.
- There has been almost no increase in the number of farmers engaged in dry-season cropping since the project was implemented.

From a financial perspective, the key findings of the survey included the following:

- Off-farm income accounts for most of the household income and the small amount of farm income mostly comes from rice sales.
- In Outhomphone, three-quarters of the survey respondents sold some rice but in other districts the number of sellers was much lower.
- In all districts, rice sales were limited.
- Average returns from rice sales were similar in all districts.
- Chemical fertiliser is expensive and, when it is used, becomes a major input cost.
- There is very little income generated from dry-season crop sales.

Estimating the project benefits

The project impact can be evaluated by estimating the change in farm output. This entails comparing the effect of adopting the new rice varieties and growing practices with a base case of no adoption. Indicators of the change in farm output were derived from the WVL survey results, with inputs and outputs valued at market prices.

Changes in output were combined with estimates of the number of project beneficiaries. However, there were differences in the timing and extent of the output gains achieved by different groups of beneficiaries. Therefore, the evaluation estimate had four elements:

- separate estimates of the project impact for each district
- differences in the timing of the extension activities for groups of trial villages within the districts—the starting points for adoption varied
- differences in the project impact between trial farmers and observer farmers in the trial villages
- differences in the project impact for the phase three non-trial villages that received only a seed distribution.

The evaluation is confined to the direct impact of the project, which is the village-level response to rice trials and seed distribution. The farming populations of the villages exposed to the project activities are the potential direct beneficiaries. These farmers had an opportunity to observe or experiment with the new varieties and rice-growing practices. The adoption response of these farmers was linked to activities funded by the ICY project.

It is likely that adoption of new rice varieties has occurred in other villages with no direct link to the project activities. In some cases, the seed may have been purchased by farmers and distributed through intra-village rice swaps. It is also possible that some inter-village rice swaps have occurred. Some rice swaps may have involved ICY project villages.

The interest in rice swaps by non-ICY villages would depend on the yield gains achieved by the project adopters in ICY villages. If the gains were not impressive, the enthusiasm for rice swaps may be weak. Autonomous experiments with new varieties in non-ICY villages did not involve training on growing practices. In some cases, the new varieties may not have performed well because of problems such as gall midge infestation.

It was not possible to make an informed judgment about the extent of adoption of new varieties in non-ICY villages or the extent of rice swaps with ICY villages. On balance, it seems reasonable to take a conservative approach to including any indirect benefits in the assessment, so they are excluded. To the extent that there are some yield-improving rice swaps with ICY villages, the impact assessment may understate the project benefits.

There were 22,654 potential direct beneficiaries of the project. These include the farm population of the ICY project villages and the farms that participated in the phase three seed distribution to non-trial villages. WVL survey results show use of the new varieties was close to 100%—almost all farmers included some new varieties in their 2009 rice crop. The variability was in crop allocations between new and traditional varieties.

In estimating the project impact, all of the potential direct beneficiaries were assumed to include some new varieties in their rice crop. Some farmers may nevertheless retain a preference for the traditional varieties. For example, the gall midge problems in Atsaphone may cause some farmers to reject the new varieties. To the extent there are farmers that completely reject the new varieties, the impact assessment may overstate the project benefits.

Assumptions made to develop the project impact and base-case circumstances were largely based on WVL survey results. Information on village and farm numbers was provided by WVL. Market prices for rice and fertiliser were used to estimate changes in the net value of farm output by the project adopters (see Appendix 5).

Estimates of the project impact

The key variable in estimating the project impact is the change in rice yields. During the course of the project, a range of information was collected on yield performance (Table 5). In general, it confirmed that significant gains were possible. The trial results also showed that fertiliser treatments had a substantial effect on the yield of the new varieties.

A survey of phase two districts in 2007 showed a significant difference in the yield gains by trial farms and observer farms after adoption. It confirmed the project impact will be lower for observer farms. For consistency with assumptions on farm area and fertiliser use, WVL survey results were used as an indicator of the impact on rice yields. They were disaggregated between trial and observer farms to account for this difference.

Table 5. Yield (t/ha) information for new rice varieties

	Phalanxai	Outhom-phone	Atsaphang-thong	Phine	Atsaphone	Xonnabouly
Yields before Improving Crop Yields (ICY) farm trials[a]						
– average	1.8	2.5	..	1.9	2.2	1.5
Yields from ICY farm trials[b]						
– average	3.1	3.4	3.5	2.2	3.0	2.6
– with fertiliser	3.5	3.8	4.0	2.3	3.3	2.8
– no fertiliser	2.8	2.9	2.9	2.1	2.8	2.3
Yields achieved after ICY farm trials[c]						
– average	2.0	2.7	2.0	–	–	–
– trial farms	2.6	3.3	2.5	–	–	–
– observers						
NRFP[d]	1.8	2.5	2.2	–	–	–
TRFP[e]	1.7	2.2	1.6	–	–	–
Indicative change in yield performance[f]						
– before project	1.5	0.9	1.3	1.9	1.7	1.2
– after project	1.8	1.5	1.6	2.4	2.2	1.7
– change	0.3	0.6	0.3	0.5	0.5	0.5
trial farms	0.4	0.9	0.4	0.4	0.4	0.5
observers	0.3	0.4	0.2	0.6	0.5	0.5

Sources: Lefroy-Braun and Winch (2004); Shrestha et al. (2006); Manivong and Douangsavanh (2007); Manivong et al. (2008); ACIAR (pers. comm.).

a Pre-project benchmark survey results for Outhomphone and Phalanxai reflect farm outcomes before the 2001 wet season. No results were available for Atsaphangthong. Results for Phine, Atsaphone and Xonnabouly reflect farm outcomes for the 2006 wet season.

b Average of trial results in 2004, 2005 and 2006 for favoured new varieties (TSN2, TDK6, PNG1 and NTN1).

c Average for 2007 wet-season crop based on project impact survey results.

d New rice-farming practices (NRFP)—adopted new farming practices after planting new varieties.

e Traditional rice-farming practices (TRFP)—maintained traditional farming practices after planting new varieties.

f Average for 2009 wet season based on World Vision Lao PDR survey results—see Appendix 4.

Rice yields in the WVL survey results are lower than PAFO estimates of district yields. This probably reflects the project focus on the poorest farmers and the low fertiliser use. The changes in yields are the key factor in estimating the project impact and the WVL survey results are consistent with the findings of the 2007 adoption survey. They show that the trial farmers did better than observers in the phase two districts (see Table 5).

The survey results show that the post-adoption yield change in Atsaphangthong and Phalanxai was lower than that in other districts. ACIAR progress reports noted there were selection difficulties with the farm trials in these two districts. It suggests management of the trials was less effective than in other districts, and this may explain the difference in post-adoption yield changes.

Survey results for crop areas and yields were used to estimate average farm output after adoption. The value of the rice output was adjusted for the cost of fertiliser use. The average yield is assumed to be representative of the full impact of adopting the new varieties and

rice-growing practices. There has been a high level of acceptance of the new varieties among the survey respondents.

- Plantings to traditional varieties in 2009 were less than 10% of the crop in phase two districts and around 20% in the phase three districts.
- There may be a rise in the use of new varieties in coming years but its effect on the change in average yields will be minimal.
- Survey results for yields are lower than trial results because fertiliser application rates were much lower than those in the trials.

Adoption time lag is another key variable in estimating the project impact. It takes time to achieve the full benefits of adopting the new varieties. The shift to crops dominated by new varieties will be slowed by the rice-swap process and the conservativeness of farmers. The assumed adoption time path begins with the first year of rice trials and there are different annual adoption rates for trial and observer farmers.

For various reasons, the speed of acceptance of the new varieties by farmers will vary. Some farmers will take longer to achieve the post-adoption rice yields as represented by the assumptions derived from the WVL survey results. These assumptions were based on a high level of acceptance of the new varieties.

A further consideration is differences in the effectiveness of the extension activities. The impact assessment assumes there is an effect on all potential beneficiaries. Some farms, such as trial farms, will achieve the yields embodied in the project impact assumptions, but others will not.

Differences in the effectiveness of the project will dilute the impact of adopting the new varieties and farming practices. In some cases, this may be reflected in a reluctance to switch to crop allocations dominated by the new varieties. In other cases, it may reflect a reluctance to fully apply the required farm practices and fertiliser treatments.

Acceptance time lags and differences in the effectiveness of extension activities are incorporated in the adoption assumptions (Table 6). The main assumptions, derived from discussions during the impact assessment field trips, are as follows:

- there is a 2-year lag between trials and initial changes in crop allocation by trial farmers in phase two districts to allow for a learning period during the trials
- there is a 3-year lag between trials and initial changes in crop allocation by observer farmers in phase two districts to allow for the seed-multiplication process
- observer farms in phase two districts achieve 80% of the assumed project impact, to allow for a conservative approach to acceptance and retaining a higher crop allocation to traditional varieties
- there is a 1-year lag between trials and initial changes in crop allocation by trial farmers in phase three districts, to allow for improved effectiveness of the trials
- trial farms in phase three districts take 4 years to achieve the assumed project impact, to allow for the limited training on farming practices
- observer farms in phase three districts take 5 years to achieve the assumed project impact, to allow for the limited training on farming practices
- observer farms in phase three districts achieve 60% of the assumed project impact, to allow for a little more conservative approach to adoption.

A separate set of assumptions was used for farms involved in the 2007 seed distribution. These farmers were from villages with no trials or training activities. Their independent experimentation with the new varieties was probably less effective than the outcomes in trial villages. The level of adoption was probably lower than that in trial villages.

Assumptions for the project impact from the 2007 seed distribution in non-trial villages were a modification of the assumptions for the phase three observer farms:

- there is a 2-year lag between the year of seed distribution and initial changes in crop allocation, to allow for a longer experimentation period and the difficulties with unassisted trials
- seed distribution farms will take 6 years to achieve the assumed project impact (i.e. 2014), to allow for the lack of training on farming practices
- these farms achieve 40% of the assumed project impact, which is two-thirds of the impact achieved by observers in the phase three trial villages.

Table 6. Adoption assumptions for rice trial villages[a]

	Project impact (% adoption) for villages involved in					
	2001 trials	**2003 trials**	**2004 trials**	**2005 trials**	**2006 trials**	**2007 trials[b]**
Trial farms						
2001	0	0	0	0	0	0
2002	0	0	0	0	0	0
2003	0	0	0	0	0	0
2004	33	0	0	0	0	0
2005	66	33	0	0	0	0
2006	100	66	33	0	0	0
2007	100	100	66	33	0	0
2008	100	100	100	66	33	25
2009	100	100	100	100	66	50
2010	100	100	100	100	100	75
2011	100	100	100	100	100	100
Observer farms						
2001	0	0	0	0	0	0
2002	0	0	0	0	0	0
2003	0	0	0	0	0	0
2004	0	0	0	0	0	0
2005	20	0	0	0	0	0
2006	40	20	0	0	0	0
2007	60	40	20	0	0	0
2008	80	60	40	20	0	0
2009	80	80	60	40	20	20
2010	80	80	80	60	40	30
2011	80	80	80	80	60	40
2012	80	80	80	80	80	50
2013	80	80	80	80	80	60

[a] Shaded area reflects the first year of rice trials.

[b] Different adoption assumptions were used for non-trial villages that received only a seed distribution.

No other information was available to shape the adoption assumptions for this group of project beneficiaries, which is a possible source of uncertainty in assessing the impact of the project. A sensitivity analysis was prepared to assess the implications of using adoption assumptions that are either more optimistic or more pessimistic.

A 'no impact' base case

Project benefits are estimated by comparing the impact scenario against the 'no impact' base case. In developing a base-case scenario it is worth noting that the impact of the project is unlikely to have a significant effect on market prices. This is because the commercial impacts from the increased rice output will be limited.

The project targeted villages with high poverty levels and lengthy periods of rice deficit. Survey results show most of the extra rice output has been used to improve food security. Rice sales are limited, and future increases are unlikely to have an appreciable effect on market conditions in Savannakhet or other areas of Laos. Under current production practices (i.e. low fertiliser treatments) further growth in output is likely to be limited and used mostly for home consumption.

Adopting households are eating more rice, and less rationing is needed to meet the deficit periods. This additional rice would not have been purchased if the project had not been implemented, because the beneficiaries had very little capacity for extra food purchases. The extra rice consumption had a value equivalent to the local market price and this was used to value the benefits of the increased output.

The base case for the six districts was developed from the survey results. If the project had not been implemented, it is reasonable to assume the rice crops would have excluded the favoured varieties that emerged from the trials. This implies farmers would not have been able to access the new varieties by other means.

It is also reasonable to assume the continuation of traditional rice-growing practices and input use. Fertiliser would have been applied at the same rates as before the project was implemented. Crop areas were unchanged from the assumptions used to estimate the project impact. Rice yields remained constant at the levels applying in the year before the trials commenced.

- A summary of the project impact, the base case and the project benefits for each district is provided in Appendix 6.

Project benefits

The annual benefits of the project reach a steady state in 2014–15, at an annual gain of A$5.8 million (Table 7). The benefits are sustained in subsequent years. Therefore, an annuity for the benefits that accrue in perpetuity for the period of 2015–16 and beyond is included in the impact assessment. This is the approach stipulated by the ACIAR impact assessment guidelines (Davis et al. 2008).

The results show an aggregate non-discounted benefit of around A$149.4 million. Project benefits are a little higher in phase two districts, where they accounted for about 53% of the benefits. Most of the benefits will be achieved in future years as the improvement in rice yields is consolidated in the targeted villages.

- Benefits are highest in Outhomphone (A$52.0 million) (Table A15) because of the large number of farmers involved. There were 4,120 beneficiaries in this district.
- Outhomphone accounts for 35% of the project benefits and Xonnabouly (A$29.9 million) for another 20%.
- The benefits are lower in Atsaphangthong and Phalanxai, where the combined gains are estimated at A$27.9 million.
- The benefits in Atsaphone (A$23.1 million) may be overstated if problems with gall midge infestation lead to a lower level of acceptance.

The estimate of project benefits has not accounted for any gains from the dry-season crop extension activity. As noted earlier, the potential gains from this activity are likely to be limited. The lack of rainfall is a major constraint. There was very little information on the adoption outcomes from this component of the project.

WVL survey results show no change in dry-season cropping. Gains from changes in dry-season cropping are likely to be small and will not make a significant difference to the project assessment. The rice extension component is the primary source of project benefits. To the extent that there are gains in dry-season crop production, the impact assessment may understate the project benefits.

Table 7. Rice production benefits of the Improving Crop Yields project[a]

	Phase one and two districts	Phase three districts	Total
	A$'000	A$'000	A$'000
2002	0	0	0
2003	0	0	0
2004	0	0	0
2005	11	0	11
2006	63	0	63
2007	231	0	231
2008	538	0	538
2009	1,081	6	1,087
2010	1,636	297	1,933
2011	2,523	1,158	3,681
2012	2,810	1,542	4,352
2013	2,957	2,033	4,991
2014	2,957	2,525	5,482
2015	2,957	2,818	5,775
2016[b]	62,105	59,177	121,282
Total[c]	79,872	69,554	149,426

[a] Non-discounted benefits expressed in 2011 dollar terms, years ending 30 June.

[b] Values are the present value of an annuity for the benefits accrued in perpetuity after 2015.

[c] Due to rounding of data, totals may not be exact.

Net benefits of the project

The discounted net benefits of the project are derived by comparing project expenditure with the estimated benefits. The present value of the net benefits is A$73.8 million (Table 8). This estimate is based on a discount rate of 5%. It generates a benefit:cost ratio for the project of 146 to 1.

The net benefits are substantial and the project will significantly improve food security for the adopting farmers and will lead to improvements in the nutritional content of household diets. The project is also generating some poverty alleviation benefits. Some adopting farmers have increased their rice sales and are earning higher farm incomes.

The yield gains are not as high as expected, given the performance of the new varieties in the trials. Higher acceptance rates for new varieties among the observer farmers in phase three districts could boost the size of the project benefits. There is also some potential for larger benefits if the changes in rice-growing practices are more widely embraced over time. Additional gains would primarily arise from fertiliser application rates that were higher and more closely aligned with the recommended treatments.

The project objectives have been achieved in the villages that participated. The geographical impact of the project is large. Funding the project extension to phase three districts was a valuable investment. When assessed against the cost of the project, the benefits are impressive under alternative discount rates:

Table 8. Net benefits of the Improving Crop Yields project[a]

	PV of project costs	PV of project benefits	PV of project net benefits
	(A$m)	(A$m)	(A$m)
Project evaluation—5% discount rate[b]	0.5	74.3	73.8
Benefit:cost ratio	–	–	146.3
Project evaluation—10% discount rate[b]	0.4	24.6	24.2
Benefit:cost ratio	–	–	54.8
Project evaluation—1% discount rate[b]	0.6	527.5	526.9
Benefit:cost ratio	–	–	929.9
Progressive project evaluation[c]	0.5	4.9	4.3
Benefit:cost ratio	–	–	9.6

[a] Discounted present value (PV) of net benefits expressed in 2011 dollar terms.

[b] Evaluation includes annual outcomes for the 2001 to 2015 period plus an annuity for the benefits arising in perpetuity after 2015.

[c] Progressive evaluation for the period from 2001 to 2011 using a 5% discount rate.

- The present value of the net benefits varies between A$24.2 million for a 10% discount rate and a gain of A$526.9 million for a 1% discount rate.

Attribution of the estimated net benefit should be divided between ACIAR and WV Australia. Based on the respective shares of the project expenditure, this would attribute 91% of the benefit to ACIAR. The return on investment for each agency would be a net benefit of A$67.2 million due to ACIAR's contribution and A$6.6 million due to WV Australia's contribution.

- A progressive evaluation for the gains achieved for the 11-year period to 2010–11 shows a total net benefit of A$4.3 million.

The evaluation is sensitive to adoption assumptions for the project impact from the 2007 seed distribution in non-trial villages. The assumptions imply a limited impact that takes several years to achieve. It involves 8,755 farmers in the phase three districts and it could make a significant difference to the end result. A sensitivity analysis was prepared on the project impact for this group of beneficiaries.

A 'best case' scenario is the impact equivalent to that on observers in the phase three trial villages. A 'worst case' scenario would be an impact equivalent to one-third of the impact for phase three observers. The results show the net benefits would range between A$88.1 million and A$66.9 million for a 5% discount rate (Table 9). It confirms that the gains would be significantly different if adoption by this group of beneficiaries is stronger or weaker than anticipated.

Table 9. Sensitivity analysis of project impact in non-trial villages[a]

	PV of project costs	PV of project benefits	PV of project net benefits
	(A$m)	(A$m)	(A$m)
Project evaluation—5% discount rate	0.5	74.3	73.8
Benefit:cost ratio	–	–	146.3
Stronger adoption—5% discount rate[b]	0.5	88.6	88.1
Benefit:cost ratio	–	–	174.4
Weaker adoption—5% discount rate[c]	0.5	67.4	66.9
Benefit:cost ratio	–	–	132.7

[a] Discounted present value (PV) of net benefits expressed in 2011 dollar terms. Sensitivity analysis of adoption assumptions for farms involved in the 2007 seed distribution.

[b] Assumes farmers achieve 60% of the assumed project impact.

[c] Assumes farmers achieve 20% of the assumed project impact.

4 Concluding comments

Savannakhet province has high levels of rural poverty and there are times of the year when many farm households are short of rice. This is especially the case in the districts targeted by the ICY project. In general, the farmers have limited land, and food security is dependent on the success of the wet-season rice crop. Options for dry-season cropping are limited by the lack of reliable rainfall.

Poor soil quality, traditional rice-growing practices and a lack of access to new varieties have constrained yield improvements. In the past it has been difficult for many farmers to produce enough rice for their annual household consumption requirements. There were few opportunities for sales of surplus rice to generate income.

Farmers in the six districts targeted by the ICY project have limited land areas. Survey results showed average rice-growing areas of:

- 2.6 ha in Phalanxai, Outhomphone and Atsaphangthong
- less than 2.0 ha in Phine, Atsaphone and Xonnabouly.

Improved food security and poverty reduction require higher wet-season rice yields from the available land areas. New varieties and improved rice-growing practices have the potential to significantly boost rice yields. The aim of the project was to encourage acceptance of new varieties and changes in cropping practices.

Impact on rice deficits and poverty

Household incomes in the project impact area are low and heavily dependent on off-farm income. Average annual household incomes for the WVL survey respondents were:

- around A$445 in Phalanxai, Outhomphone and Atsaphangthong
- around A$550 in Phine, Atsaphone and Xonnabouly.

The primary benefit of the rice extension component of the project has been a significant reduction in rice deficits during the dry season. Household diets have improved and there have been some small poverty alleviation benefits. The WVL survey results provide an indication of the average farm income generated from rice sales:

- In Phalanxai, Outhomphone and Atsaphangthong, rice sales were worth A$68, about 15% of household income.
- In Phine, Atsaphone and Xonnabouly, rice sales were worth A$55, about 10% of household income.
- The survey results showed that the increased rice output had contributed to a small increase in commercial rice sales.

The extent of poverty reduction was constrained by the limited yield improvements. As the first priority for farmers was food security, the opportunities for sales of surplus rice were minimal. There could be higher poverty alleviation gains if the recommended fertiliser treatments and rice-growing practices were more widely embraced.

The project has generated large benefits in meeting food security deficiencies. The rice-deficit period has declined and the nutritional content of the household diet has improved. This will have important social benefits for village communities by improving the quality and sustainability of their way of life. Measuring the human health benefits of better diets is beyond the scope of the study.

No allowance has been made for any increase in dry-season food production resulting from ICY project activities. This may have occurred in some cases and enhanced the human health benefits of the project. The food security and associated human health benefits may be understated to some extent because of this omission.

Some lessons from the impact assessment

Figure 1 gives a schematic view of the pathway to the project benefits. Capacity building of farmer skills in rice growing has had substantial economic and social impacts. Acceptance of the new varieties and recommended fertiliser applications were potential risks that could emerge after the rice trials finished. A sustained commitment to applying the skills that were learnt is a risk factor for the sustainability of project benefits.

A few observations can be made that may be relevant for future projects that involve extending the results of ACIAR technical research. The project was part of an ACIAR–WV collaborative program and was an experimental investment for ACIAR. The project:

- was a collaboration with an NGO providing development assistance for poor farmers in selected districts of Savannakhet province
- focused on extension training with volunteer farm trials to prove the suitability of new rice varieties in local conditions and the benefits of changes in farming practices
- involved farmer experimentation of growing different varieties in their rice crop under the direction of project staff
- had extension activities that were based on the results of technical research funded by ACIAR and an IRRI rice project
- involved close cooperation between WVL staff and DAFO extension officers to deliver training activities and guidance on the farm trials.

Collaborating with WVL to implement the extension activities was an effective way of encouraging adoption of ACIAR research results and new rice varieties. The capacity of government extension services to deliver an effective extension program was limited. The collaboration made use of established WVL relationships with farmers and DAFO staff. This was important for gaining the trust and commitment of farmers.

The project reached a large number of poor farmers in the six districts and thus had an extensive impact. Using volunteer farmers in each village to demonstrate the gains that could be achieved was an effective way to communicate the principles of good crop management. It generated interest and contributed to the success of the project.

Villagers could easily monitor the progress and outcomes of the trials. Training activities were developed around the trials. Meetings of trial and observer farmers during the trials reinforced the training lessons and were a forum for discussing issues that emerged.

These privately managed trials established a strong incentive to succeed, because the plots were part of the household food supply. The alternative approach of 'community' trials in central locations has a higher risk that farmers could gradually lose interest in the project. Competing demands for the time of farmers and the burden of travelling to trial sites can be impediments to wider adoption in some situations.

It is likely that the project impact was strongest among the trial farmers. This was evident in the survey results. They received close attention and advice from the project staff. The impact was not as strong for observers whose adoption was reliant on their willingness to apply what they learnt from observing the trials, village discussions and training.

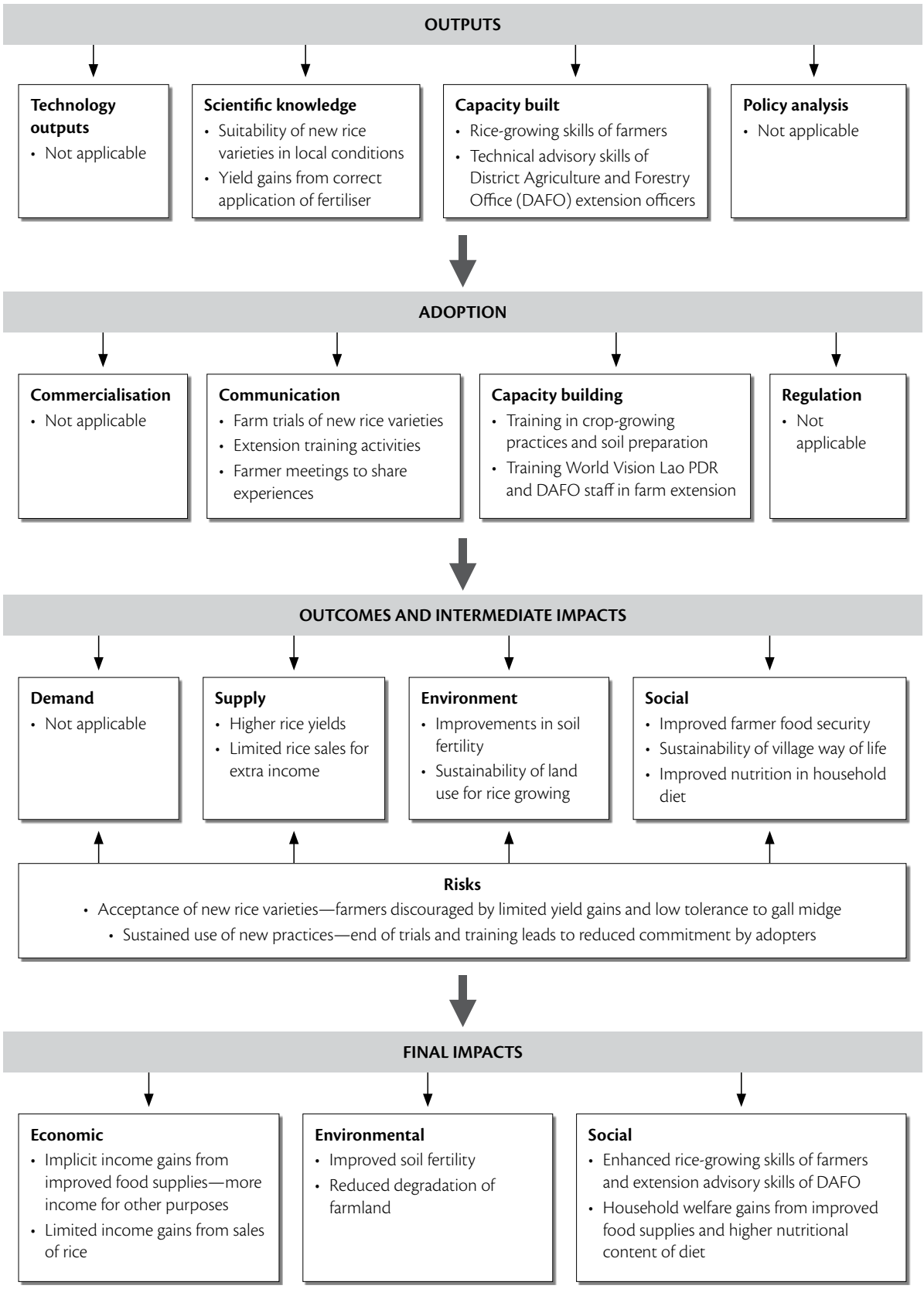

Figure 1. Improving Crop Yields project: pathway to benefits

The design of extension programs to facilitate adoption by observers is important for the effectiveness of this approach. Follow-up extension activities a few years after the trials ended could strengthen adoption and reinforce the training lessons. They would provide opportunities for 'refresher' training and to respond to issues that may arise in the application of the rice-growing practices.

Seed dispersal without trials or training probably resulted in weaker adoption outcomes. Project finances were limited and it was not possible to fully extend the same approach to all villages in the six districts. Follow-up extension activities in non-trial villages could enhance the project impact.

Fertiliser treatments affect the yield performance of the new varieties. The cost of the recommended applications appears to have deterred many farmers. This is despite the trials proving the extra yield gains that could be achieved.

Recommended nitrogen-phosphorus-potassium (NPK) fertiliser treatments were 150 kg/ha in the ratio of 15–15–15 before transplanting and two applications of 50 kg/ha of 46–00–00 NPK during crop growth. The survey results indicated that the average total application rate of 16–20–00 NPK for the six distracts was 48 kg/ha. This was well below what was required to achieve the production outcomes of the trials.

Additional yield gains from higher fertiliser treatments could generate surplus rice for commercial sales. Some of the extra income could be used to cover the cost of higher fertiliser treatments. But food security was the priority for most farmers and many would have taken a conservative approach to fertiliser use.

Income from rice sales will remain limited until food security concerns are resolved. Until that point is reached, there is an understandable reluctance to apply more fertiliser. The adoption impact under a higher but suboptimal fertiliser treatment has not been sufficient to trigger a shift from subsistence farming.

- Farmers are not realising the full potential of adopting the new varieties.
- More generally, the underperformance of rice crops from suboptimal fertiliser treatments would apply to all rice varieties—traditional and new.

Decisions on input use have to be assessed against the returns from rice sales. For poor farmers on low incomes with little experience in commercial agriculture, this would be a difficult judgment to make. It may be due to a lack of understanding of the principles of farm financial management.

Some training in farm-management economics would have been a useful complementary extension activity for the project. It may have given farmers a better understanding of the gains from higher fertiliser treatments, leading to a stronger project impact. Sustained poverty alleviation will require a shift from subsistence farming towards a more commercially oriented approach.

In some districts, gall midge attacks were a problem that emerged during the course of the project. The low resistance levels to gall midge in the new varieties probably reduced their acceptance. A lack of experience in effective, least-cost pesticide treatments was a common issue raised during the impact assessment farm visits. An extension activity on the technical and financial aspects of pesticide use would be worthwhile in areas where gall midge was a problem.

Project benefits from the dry-season cropping extension activities have been limited. Fewer resources were devoted to this component of the project. Lack of water limits the options for dry-season farming. A more concentrated focus on the most suitable options and a tighter definition of the target area may have increased the project impact.

The trade-off between income from off-farm work and income generated from dry-season cropping probably limited the interest of farmers in this component of the project. This is an important consideration when developing extension projects that require changes that significantly alter the balance of labour use. A stronger R&D support base may have been needed before resources were invested in this component of the project.

Appendix 1
Village participation in rice trials

Table A1. Village rice trials in Phalanxai[a]

Village	Initial rice trials[b]	Number of farms	Village	Initial rice trials[b]	Number of farms
Phontan	2001	53	Xieng Lai Khok	2003	67
Ban Xuong		135	Ban Duan		32
Napho Tai		95	Non Sueng		76
Term Yai		60	Nong Seng		58
Term Noi		72	Luao Luang		120
Kueng Gip		64	Kasok Tai		77
Vangkhone		42	Natu Noi		36
Xieng Lai Nam		52	Ban Luao		28
Nalai		177			
Dong Phosi		95			
Kalong Nua	2004	89	Naporkang	2005	95
Kalongtai		115	Huaiyaphuk		57
Nuanchan		51	Nonkhamxai		34
Kalong Kok		89	Nakangthong		29
Bungtale Nua		88	Naphovat		78
Bungtale Tai		108			
Nakangse		127			
Nonsavang	2006	99	Tomai	2006	128
Nakae		34	Nasaku		94
Dongbang		137	Oudomxai		90
				Total farms:	2,881
				Total villages:	36

Source: District Agriculture and Forestry Office (DAFO), pers. comm.

[a] Farm numbers are 2009 estimates provided by DAFOs.

[b] Year of village participation reflects first year of trials.

Table A2. Village rice trials in Outhomphone[a]

Village	Initial rice trials[b]	Number of farms
Nakham	2001	150
Nong Pan		84
Dong Nai		95
Dong Tha		123
Non Oudom		76
Phokuen		137
Panuam		123
Phonsavang		77
Nonngang	2004	50
Huamuang		128
Sanamxai		97
Xaisaad		136
Thampha		47
Huai Mao		104
Don Mee		63
Koodcai		121
Nakasor		77
Tadkadeng	2006	60
Nonpalai		156
Naphosai		101
Napong		101
Phonthong		57
Kud Kaso	2003	54
Nadua		40
Natai		90
Sakud		77
Phontut		70
Nonvilai		70
Luao Luang		134
Phon Nakhu		87
Nasanod	2005	128
Dongmakngeo		169
Sompavilai		53
Nanokkhian		70
Nasakham		80
Nasaithong		97
Kangphosi		143
Chomcheng		65
Nondokmai		52
Nong Ahong		90
Ay	2006	109
Nakaeng		117
Nachan		61
Nonsavang		59
Nonkung		42
	Total farms:	4,120
	Total villages:	45

Source: District Agriculture and Forestry Office (DAFO), pers. comm.

[a] Farm numbers are 2009 estimates provided by DAFO.

[b] Year of village participation reflects first year of trials.

Table A3. Village rice trials in Atsaphangthong[a]

Village	Initial rice trials[b]	Number of farms
Nakoi Huai	2003	81
Hua Muang		75
Xai Buathong		107
Bua Kham		172
Nakoi Khok		67
Luan Xai		105
Gailamong		277
Nonhang	2005	119
Nakhamtai		45
Kokokong		38
Dongmakyang		49
Ban Huai		228
Nachan	2004	200
Koktan		34
Napaekyai		242
Tabongphet		179
Sapangkeo		151
Sivilai	2006	76
Nalaikok		113
Nongbua		33
Nonvai		22
Phosikeo		122
Phonphang		138
	Total farms:	2,673
	Total villages:	23

Source: District Agriculture and Forestry Office (DAFO), pers. comm.

[a] Farm numbers are 2009 estimates provided by DAFO.

[b] Year of village participation reflects first year of trials.

Table A4. Village rice trials in phase three districts[a]

Village	Initial rice trials[b]	Number of farms	Village	Initial rice trials[b]	Number of farms
Phine					
Nathom Kao	2007	82	None Yang	2007	168
Tadhai		92	Nakahan		124
Kengkua		63	Konghin		123
Ban Phine		225	Anousanya		107
Maiphosee		170	Oudomdee		209
				Total farms:	1,363
				Total villages:	10
Atsaphone					
Phakkhaya	2007	94	Namarkkua	2007	186
Nahangnoi		203	Nakaomin		94
Koodkhuen		103	Phosai		168
Koodhin		249	Kang Yai		272
Nakoodchan		116	Vangnamone		213
				Total farms:	1,698
				Total villages:	10
Xonnabouly					
Khokhuaxang	2007	162	Kabao	2007	154
Nongtee		142	Vang Khon		125
Phosaikhoun		154	Nabong		80
Ban Na		97	Khoklor		54
Khambounhuang		94	Toum Yai		102
				Total farms:	1,164
				Total villages:	10

Source: District Agriculture and Forestry Offices (DAFOs), pers. comm.

[a] Farm numbers are 2009 estimates provided by DAFOs.

[b] Year of village participation reflects first year of trials.

Appendix 2
Timing of extension activities

Table A5. Timing of rice trials

	2001	2002	2003	2004	2005	2006	2007
Phalanxai[a]							
Villages	10	–	8	7	5	6	–
Farm trials	60	–	24	21	21	21	–
Total farms[b]	845	–	494	667	293	582	–
Outhomphone[a]							
Villages	8	–	8	9	10	10	–
Farm trials	48	–	24	24	30	30	–
Total farms[b]	865	–	622	823	947	863	–
Atsaphangthong[a]							
Villages	–	–	7	5	5	6	–
Farm trials	–	–	21	18	15	18	–
Total farms[b]	–	–	884	806	479	504	–
Phine							
Villages	–	–	–	–	–	–	10
Farm trials	–	–	–	–	–	–	30
Total farms[b]	–	–	–	–	–	–	1,363
Atsaphone							
Villages	–	–	–	–	–	–	10
Farm trials	–	–	–	–	–	–	30
Total farms[b]	–	–	–	–	–	–	1,698
Xonnabouly							
Villages	–	–	–	–	–	–	10
Farm trials	–	–	–	–	–	–	30
Total farms[b]	–	–	–	–	–	–	1,164
Total project participation							
Villages	18	–	23	21	22	23	30
Farm trials	108	–	69	63	66	69	90
Total farms	1,710	–	2,000	2,296	1,719	1,949	4,225

Source: World Vision Lao PDR, pers. comm.

[a] Year of village participation reflects first year of trials.

[b] Total farm numbers are 2009 estimates provided by District Agriculture and Forestry Offices. They reflect the total farms in villages that participated in the trials—see Appendix 1 for details.

Table A6. Timing of rice seed distributions[a]

	2001	2002	2003	2004	2005	2006	2007
Phalanxai[b]							
Villages	10	–	8	7	7	14	–
Farms	60	–	24	21	21	430	–
Outhomphone[b]							
Villages	8	–	8	8	10	20	–
Farms	48	–	24	24	30	943	–
Atsaphangthong[b]							
Villages	–	–	7	6	5	9	–
Farms	–	–	21	18	15	328	–
Phine[c]							
Villages	–	–	–	–	–	–	64
Farms	–	–	–	–	–	–	2,345
Atsaphone[c]							
Villages	–	–	–	–	–	–	50
Farms	–	–	–	–	–	–	3,200
Xonnabouly[c]							
Villages	–	–	–	–	–	–	63
Farms	–	–	–	–	–	–	3,300
Total farmer distribution							
Villages	18	–	23	21	22	43	177
Farms	108	–	69	63	66	1,701	8,845

Source: World Vision Lao PDR, pers. comm.

[a] Reflects initial year of seed distributions— seed was distributed in more than one year in some cases.

[b] During the 2001–2005 period, seed distributions were limited to farmers participating in trials. In 2006, the distribution included trial farms in a new group of villages and distribution of favoured varieties to some villages that had run trials in earlier years. In Phalanxai, seven villages were included in the 2006 distribution that had not participated in the trials—farmers in these villages did not observe trial performance of the new varieties or the application of new rice-growing practices.

[c] Includes distributions to villages that did not participate in trials, which occurred simultaneously with distributions to trial villages. Farmers in villages with no trials did not observe rice-growing performance on trial farms or receive training on rice-growing practices and fertiliser use.

Table A7. Timing of dry-season crop extension activities[a]

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07[b]
Phalanxai						
Villages	4	10	10	7	7	7
Farm trials	20	60	50	21	21	21
Outhomphone						
Villages	7	8	8	9	10	10
Farm trials	35	40	40	27	30	30
Atsaphangthong						
Villages	–	6	6	5	5	6
Farm trials	–	30	30	46	15	18
Phine						
Villages	–	–	–	–	–	2
Farm trials	–	–	–	–	–	6
Atsaphone						
Villages	–	–	–	–	–	–
Farm trials	–	–	–	–	–	–
Xonnabouly						
Villages	–	–	–	–	–	6
Farm trials	–	–	–	–	–	18
Total project participation						
Villages	11	18	24	21	22	31
Farm trials	55	100	120	94	66	93

Source: World Vision Lao PDR, pers. comm.

[a] Villages involved in trials and which received seed or training.

[b] Activities in 2006–07 focused on seed distribution. There was no training.

Appendix 3
Impact assessment consultations

The ICY project had two components of extension activities: wet-season rice production and dry-season cropping. Most of the project resources were devoted to the activity on wet-season rice production. This involved rice-growing trials on volunteer demonstration farms, together with training activities. Farmers participating in the trials were spread across a large number of villages in six districts of Savannakhet province.

Impact assessment consultations with project staff, government officials and farmers were undertaken during visits to Laos in October 2010 and March 2011. WVL arranged for field visits to a selection of villages in four of the districts. Local DAFO officials participated in the village visits. The consultations were arranged to:

- gain a firsthand perspective of the project and farm-level adoption from WVL project staff
- visit the Thasano Rice Research and Seed Multiplication Centre
- visit selected DAFOs and the Savannakhet PAFO to gain an appreciation of how the rice-growing extension advice was being applied and an official perspective on the acceptance of new rice varieties in the ICY project villages
- discuss adoption experiences with farmers on rice-growing practices, fertiliser use, the acceptance of new rice varieties and changes in dry-season cropping
- examine farm production systems for rainfed rice and the state of the 2010 wet-season rice crop
- test a pilot survey questionnaire and provide direction on the impact assessment survey activity
- collect a variety of data and anecdotal evidence to verify the survey results and provide a basis for assumptions used in the assessment.

The WVL project manager, Mr Soda Souvannaphong, participated in all meetings during the in-country visits. During the field visits, meetings were held with groups of farmers in the following villages:

- Bungtale Tai and Huaiyaphuk in Phalanxai district
- Nonngang and Nachan in Outhomphone district
- Vang Khon and Toum Yai in Xonnabouly district
- Phakkhaya in Atsaphone district.

Meetings were also held with a number of WVL staff members and government officials. Key contributors were:

- Mr Soda Souvannaphong, WVL Supervisor for the Xonnabouly Area Development Program in Savannakhet province, and ICY Project Manager
- Mr Kaysone Maykhambou, Manager, WVL Savannakhet Provincial Office
- Dr Phoudalay Lathvilayvong, Director, Thasano Rice Research and Seed Multiplication Centre, Savannakhet Province Agriculture and Forestry Office
- Mr Khamphoon Sengsombath, Head of Office, Outhomphone District Agriculture and Forestry Office, Savannakhet province
- Mr Sengphachan Kannavong, Technical Director, Outhomphone District Agriculture and Forestry Office, Savannakhet province
- Mr Somphouvan Thiansavang, Head of Office, Atsaphone District Agriculture and Forestry Office, Savannakhet province
- Mr Khammon, Deputy Chief of Office, Province Agriculture and Forestry Office, Savannakhet province
- Mr Siddhartha Sahu, WVL Operations Team Leader, Savannakhet province.

Appendix 4
Survey results

Table A8. Survey results for phase one and two districts[a]

		Phalanxai	Outhomphone	Atsaphangthong
Sample size	no.	30	30	30
Average farm size	ha	2.0	3.5	2.3
Annual income from rice sales	A$/farm	37	138	28
Annual farm income	A$/farm	52	155	51
Annual household income	A$/farm	402	450	480
Farm performance for wet-season rice				
Year of Improving Crop Yields (ICY) project trials		2004, 2005	2004, 2006	2004, 2006
Participated in trials	%	30	23	27
Planted ICY varieties in 2009 crop[b]	%	93	100	97
Planted traditional varieties in 2009 crop	%	20	13	23
– share of 2009 crop	% share	12	2	12
Planted traditional varieties in 2010 crop	%	17	3	20
Yield of 2009 crop	t/ha	1.8	1.5	1.6
– yield before ICY project	t/ha	1.5	0.9	1.3
Market price in 2009	A$/t	350	325	305
Sold portion of 2009 crop	%	27	77	37
– share of crop sold	% share	2	7	5
Rice training outcomes				
Changed rice-growing practices[c]	%	57	40	43
Applied pesticide to 2009 crop	%	3	0	0
– used on crops before ICY project	%	0	0	0
Applied organic fertiliser to 2009 crop	%	77	97	87
– used on crops before ICY project	%	73	97	93

Table A8. (continued)

		Phalanxai	Outhomphone	Atsaphangthong
Applied chemical fertiliser to 2009 crop	%	83	100	90
– used on crops before ICY project	%	67	80	73
Fertiliser application rate for 2009 crop	kg/ha	65	64	59
– application rate before ICY project	kg/ha	47	44	52
Most commonly used NPK[d] fertiliser		16–20–0	16–20–0	16–20–0
NPK[d] price in 2009	A$/t	685	705	710
Dry-season crops				
Received training or seed	%	33	17	27
Grew dry-season crops in 2009	%	60	47	33
– grew crops before ICY project	%	60	40	33
Income from sales	A$/farm	13	16	5

Source: World Vision Lao PDR survey

[a] Per farm average for sample from three villages in each district. Survey respondents included participants in rice trials and other village members.

[b] Obtained seed from rice swaps, project distributions to villages or participation in project trials.

[c] Participated in training activities or learnt new practices and approach to fertiliser use from trials.

[d] NPK = nitrogen-phosphorus-potassium.

Table A9. Survey results for phase three districts[a]

		Phine	Atsaphone	Xonnabouly
Sample size	no.	30	30	30
Average farm size	ha	1.3	1.8	2.5
Annual income from rice sales	A$/farm	35	26	112
Annual farm income	A$/farm	59	45	121
Annual household income	A$/farm	552	445	660
Farm performance for wet-season rice				
Year of Improving Crop Yields (ICY) project trials		2007	2007	2007
Participated in trials	%	33	33	37
Planted ICY varieties in 2009 crop[b]	%	97	97	100
Planted traditional varieties in 2009 crop	%	57	50	23
– share of 2009 crop	% share	25	32	5
Planted traditional varieties in 2010 crop	%	47	33	3
Yield of 2009 crop	t/ha	2.4	2.2	1.7
– yield before ICY project	t/ha	1.9	1.7	1.2
Market price in 2009	A$/t	360	365	340

Table A9. (continued)

		Phine	Atsaphone	Xonnabouly
Sold portion of 2009 crop	%	20	40	33
– share of crop sold	% share	3	2	7
Rice training outcomes				
Changed rice-growing practices[c]	%	53	67	47
Applied pesticide to 2009 crop	%	0	0	0
– used on crops before ICY project	%	0	0	0
Applied organic fertiliser to 2009 crop	%	87	87	93
– used on crops before ICY project	%	83	77	73
Applied chemical fertiliser to 2009 crop	%	40	50	93
– used on crops before ICY project	%	40	33	87
Fertiliser application rate for 2009 crop	kg/ha	31	32	36
– application rate before ICY project	kg/ha	30	3	24
Most commonly used NPK[d] fertiliser		16–20–0	16–20–0	16–20–0
NPK[d] price in 2009	A$/t	665	725	685
Dry-season crops				
Received training or seed	%	10	0	0
Grew dry-season crops in 2009	%	73	13	3
– grew crops before ICY project	%	73	13	3
Income from sales	A$/farm	17	4	0

Source: World Vision Lao PDR survey

[a] Per farm average for sample from three villages in each district. Survey respondents included participants in rice trials and other village members.

[b] Obtained seed from rice swaps, project distributions to villages or participation in project trials.

[c] Participated in training activities or learnt new practices and approach to fertiliser use from trials.

[d] NPK = nitrogen-phosphorus-potassium.

Appendix 5
Impact assessment assumptions

Table A10. Average price of rice in project districts[a]

	Phalanxai		Outhomphone		Atsaphangthong	
	A$/t	% annual change	A$/t	% annual change	A$/t	% annual change
2000	181	–	181	–	339	–
2001	202	12	202	12	303	−11
2002	194	−4	194	−4	242	−20
2003	160	−18	187	−4	200	−17
2004	163	2	188	1	188	−6
2005	177	9	190	1	190	1
2006	195	10	221	16	260	37
2007	339	74	218	−1	242	−7
2008	313	−8	313	44	360	49
2009	376	20	335	7	322	−11
2010	452	20	413	23	452	40
	Phine		**Atsaphone**		**Xonnabouly**	
	A$/t	% annual change	A$/t	% annual change	A$/t	% annual change
2000	362	–	192	–	113	–
2001	324	−10	172	−10	101	−11
2002	269	−17	142	−17	113	12
2003	211	−22	123	−13	133	18
2004	188	−11	113	−8	163	23
2005	180	−4	121	7	190	17
2006	185	3	121	−1	221	16
2007	218	18	157	30	242	10
2008	282	29	227	45	360	49
2009	335	19	376	66	335	−7
2010	491	47	491	31	517	54

Source: District Agriculture and Forestry Offices (DAFOs), pers. comm.

[a] Average price received by farmers in local markets. Data collected by DAFOs in each district throughout the year.

Table A11. Average fertiliser prices in Savannakhet

	NPK[a] 15–15–15		NPK 16–20–00		NPK 46–00–00	
	A$/t	% annual change	A$/t	% annual change	A$/t	% annual change
2000	452	–	407	–	384	–
2001	404	−11	364	−11	344	−10
2002	355	−12	307	−16	291	−15
2003	349	−2	307	0	280	−4
2004	338	−3	301	−2	276	−1
2005	498	47	493	64	455	65
2006	545	9	480	−3	454	0
2007	521	−4	436	−9	424	−7
2008	719	38	673	54	626	48
2009	644	−10	590	−12	563	−10
2010	568	−12	537	−9	491	−13

Source: Savannakhet Provincial Trading Department, pers. comm.

[a] NPK ratios reflect nitrogen (N), phosphorus (P) and potassium (K) content.

Table A12. Exchange rate and inflation assumptions[a]

	Australian Consumer Price Index		Lao PDR exchange rate	
	2010–11 = 100	% change	Kip per US$1	Kip per A$1
2001	75.5	–	8,240	4,423
2002	77.7	2.9	9,446	4,945
2003	80.1	3.1	10,590	6,194
2004	82.0	2.4	10,506	7,497
2005	84.0	2.4	10,595	7,978
2006	86.7	3.2	10,575	7,906
2007	89.2	2.9	9,802	7,704
2008	92.2	3.4	9,222	8,257
2009	95.0	3.0	8,564	6,394
2010	97.3	2.4	8,444	7,454
2011	100.0	2.8	8,117	7,741

Sources: ABARES (2010); Bank of Lao PDR (2011); US Federal Reserve (2011)

[a] For years ending 30 June.

Appendix 6
Impact of the Improving Crop Yields project

Table A13. Impact of the project on the value (A$'000) of rice production[a]

	Phase one and two districts			Phase three districts		
	Phalanxai	**Outhomphone**	**Atsaphangthong**	**Phine**	**Atsaphone**	**Xonnabouly**
2002	1,727	2,395	1,959	3,200	2,561	1,130
2003	1,668	2,322	1,559	2,660	2,117	1,291
2004	1,361	2,231	1,272	2,076	1,829	1,540
2005	1,391	2,260	1,191	1,849	1,681	1,903
2006	1,468	2,190	1,145	1,748	1,809	2,174
2007	1,663	2,708	1,641	1,797	1,799	2,556
2008	3,112	2,838	1,569	2,133	2,346	2,832
2009	2,851	4,305	2,391	2,743	3,380	4,201
2010	3,589	5,017	2,218	3,364	5,712	4,026
2011	4,472	6,658	3,296	5,133	7,703	6,647
2012	4,517	6,861	3,335	5,243	7,824	6,800
2013	4,547	6,957	3,355	5,354	7,991	7,014
2014	4,547	6,957	3,355	5,464	8,158	7,228
2015	4,547	6,957	3,355	5,523	8,251	7,369
2016[b]	4,547	6,957	3,355	5,523	8,251	7,369

[a] Expressed in nominal terms, for years ending 30 June. Estimated value of rice production in project districts with adoption effects from the rice extension program.

[b] Values for 2016 are the project impact outcomes for all subsequent years in the impact assessment.

Table A14. Base case of the value (A$'000) of rice production in project districts[a]

	Phase one and two districts			Phase three districts		
	Phalanxai	**Outhomphone**	**Atsaphangthong**	**Phine**	**Atsaphone**	**Xonnabouly**
2002	1,727	2,395	1,959	3,200	2,561	1,130
2003	1,668	2,322	1,559	2,660	2,117	1,291
2004	1,361	2,231	1,272	2,076	1,829	1,540
2005	1,390	2,252	1,191	1,849	1,681	1,903
2006	1,458	2,147	1,143	1,748	1,809	2,174
2007	1,623	2,559	1,625	1,797	1,799	2,556
2008	2,951	2,553	1,520	2,133	2,346	2,832
2009	2,638	3,633	2,249	2,742	3,379	4,198
2010	3,235	3,981	2,017	3,292	5,597	3,925
2011	3,948	5,033	2,922	4,857	7,315	6,154
2012	3,948	5,033	2,922	4,857	7,315	6,154
2013	3,948	5,033	2,922	4,857	7,315	6,154
2014	3,948	5,033	2,922	4,857	7,315	6,154
2015	3,948	5,033	2,922	4,857	7,315	6,154
2016[b]	3,948	5,033	2,922	4,857	7,315	6,154

[a] Expressed in nominal terms, for years ending 30 June. Estimated value of rice production in project districts with no rice extension program.

[b] Values for 2016 are base-case outcomes for all subsequent years in the impact assessment.

Table A15. Rice production benefits (A$'000) of the project[a]

	Phase one and two districts			Phase three districts		
	Phalanxai	**Outhomphone**	**Atsaphangthong**	**Phine**	**Atsaphone**	**Xonnabouly**
2002	0	0	0	0	0	0
2003	0	0	0	0	0	0
2004	0	0	0	0	0	0
2005	2	9	0	0	0	0
2006	12	50	1	0	0	0
2007	45	167	19	0	0	0
2008	175	309	54	0	0	0
2009	224	708	149	1	1	4
2010	363	1,065	207	74	118	104
2011	524	1,626	374	276	389	493
2012	569	1,828	413	387	509	646
2013	599	1,925	434	497	676	860
2014	599	1,925	434	607	843	1,074
2015	599	1,925	434	666	937	1,215
2016[b]	12,585	40,417	9,104	13,987	19,674	25,517
Total[c]	**16,297**	**51,953**	**11,621**	**16,495**	**23,148**	**29,912**

[a] Non-discounted project benefits expressed in 2011 dollar terms, for years ending 30 June. Derived as the difference between the estimated project impact and the base case situation. See Appendix 6 for exchange rate and deflator assumptions.

[b] Values are the present value of an annuity for the benefits accrued in perpetuity after 2015.

[c] Due to rounding of data, totals may not be exact.

References

ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences) 2010. Australian commodity statistics 2010. ABARES: Canberra.

Bank of Lao PDR 2011. Annual report, <www.bol.gov.la/english/index1.php>, accessed 20 March 2011.

Davis J., Gordon J., Pearce D. and Templeton D. 2008. Guidelines for assessing the impacts of ACIAR's research activities. ACIAR Impact Assessment Series No. 58. Australian Centre for International Agricultural Research: Canberra.

Harris D.N. 2010. Extending low-cost fish farming in Thailand: an ACIAR–World Vision collaborative program. ACIAR Impact Assessment Series No. 66. Australian Centre for International Agricultural Research: Canberra.

— 2011. Extending low-chill fruits in northern Thailand: an ACIAR–World Vision collaborative project. ACIAR Impact Assessment Series No. 70. Australian Centre for International Agricultural Research: Canberra.

Lefroy-Braun R. and Winch J. 2004. Baseline survey: improving crop yields project. Lao–IRRI Rice Research and Training Project: Vientiane.

Manivong V. and Douangsavanh L. 2007. Improving Crop Yields project: baseline rice production survey. National Agriculture and Forestry Research Institute, Lao Ministry of Agriculture and Forestry: Vientiane.

Manivong K., Manivong V. and Phengvichith V. 2008. Improving Crop Yields project: impact survey report. National Agriculture and Forestry Research Institute, Lao Ministry of Agriculture and Forestry: Vientiane.

Shrestha S., Boupha T. and Khamphoukeo K. 2006. Sowing seeds in lab and field: the socioeconomic impact of the Lao–IRRI Rice Research and Training Project. International Rice Research Institute: Manila.

Souvannaphong S., Treagust J., Schiller J., Sahu S., Chanphengxay M., Lathvilayvong P. and Inthapanya P. 2008. Facilitating farmer uptake of ACIAR project results: World Vision collaborative program. Project final report for component six—Improving Crop Yields (ICY) in rainfed rice-based systems in central and southern lowlands of Laos, project number PLIA/2000/165. Australian Centre for International Agricultural Research: Canberra.

US Federal Reserve 2011. Federal Reserve economic database—exchange rates. At <www.research.stlouisfed.org/fred2/categories/15/downloaddata>, accessed 20 March 2011.

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57	Montes N.D., Zapata Jr N.R., Alo A.M.P. and Mullen J.D. 2008.	Management of internal parasites in goats in the Philippines	AS1/1997/133
58	Davis J., Gordon J., Pearce D. and Templeton D. 2008.	Guidelines for assessing the impacts of ACIAR's research activities	
59	Chupungco A., Dumayas E. and Mullen J. 2008.	Two-stage grain drying in the Philippines	PHT/1983/008, PHT/1986/008 and PHT/1990/008
60	Centre for International Economics 2009.	ACIAR Database for Impact Assessments (ADIA): an outline of the database structure and a guide to its operation	
61	Fisher H. and Pearce D. 2009.	Salinity reduction in tannery effluents in India and Australia	AS1/2001/005
62	Francisco S.R., Mangabat M.C., Mataia A.B., Acda M.A., Kagaoan C.V., Laguna J.P., Ramos M., Garabiag K.A., Paguia F.L. and Mullen J.D. 2009.	Integrated management of insect pests of stored grain in the Philippines	PHT/1983/009, PHT/1983/011, PHT/1986/009 and PHT/1990/009
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72	Lindner R. 2011.	Frameworks for assessing policy research and ACIAR's investment in policy-oriented projects in Indonesia	ADP/1994/049, ADP/2000/100, ADP/2000/126, AGB/2000/072, AGB/2004/028, ANRE1/1990/038, ANRE1/1993/023, ANRE1/1993/705, EFS/1983/062 and EFS/1988/022
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74	Brennan J.P. and Malabayabas A. 2011.	International Rice Research Institute's contribution to rice varietal yield improvement in South-East Asia	
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