



FIFTEEN YEARS OF SUPPORT FOR RICE RESEARCH IN LAO PDR

ACHIEVEMENTS THAT REVOLUTIONISED
RICE PRODUCTION

IRRI



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It is impossible to overstate the significance of the Lao-IRRI Rice Research and Training Project to rice production in the Lao People's Democratic Republic (Lao PDR). Fifteen years have passed since the International Rice Research Institute (IRRI), with generous support from the Swiss Agency for Development and Cooperation (SDC), began laying the foundations for a genuinely outstanding collaboration. Since then, we have seen the country's rice production taking impressive steps forward. This has driven substantial improvements in food security and consequent reductions in poverty. And, just as important, Lao PDR now has a critical mass of well-trained research and extension personnel who staff a fully functional, independent rice research system.

My own association with IRRI goes back more than 30 years. In the 1970s, I had the good fortune to spend time at IRRI as a student. More recently, from 1996–2001, I was privileged to sit on the Institute's Board of Trustees. Through this association, I have come to know IRRI and her scientists as both mentors and friends. For this reason, although the success of the Lao-IRRI Project is nothing short of remarkable, it comes as no surprise.

I have supported the project from its outset and it is truly gratifying to have witnessed the progress made through the hard work of all concerned scientists from IRRI and other institutes, Lao research and extension staff, government and non-government organisations, donors such as SDC, and, last but not least, the rice farmers of Lao PDR. It is the farmers and their families and, in turn, all of the Lao people who are the true beneficiaries and champions of increased rice production and rice self-sufficiency in Lao PDR.

*Dr. Siene Saphangthong
Lao Minister for Agriculture and Forestry*

During the 1970s and 1980s, rice production growth in Lao People's Democratic Republic (Lao PDR) was sluggish. The green revolution that led to rapid increases in rice productivity in many other Asian countries did not have the same impact in Lao PDR. The country was suffering from food deficit, especially during flood and drought years. The national capability for rice research, including developing improved technologies and adapting technologies from other countries, was also weak. There was a clear need to rapidly increase rice production and achieve the national goal of being self-sufficient in rice – the staple food of the population – and from which the average Lao person receives around two-thirds of his or her calories.

The Lao-IRRI Rice Research and Training Project, funded by the Swiss Agency for Development and Cooperation (SDC), was established in 1990 to assist the Government of Lao PDR to achieve rice self-sufficiency on a sustainable basis. The Lao-IRRI Project, as it is known, set out to help develop improved rice technologies by undertaking research, setting up a functional rice research system, and enhancing the scientific and managerial skills of Lao national staff. The Lao-IRRI Project, as a result of a collaboration agreement between Lao PDR's National Agricultural and Forestry Research Institute (NAFRI) and the International Rice Research Institute (IRRI), has developed technology packages consisting of improved varieties and complementary crop management practices. The project has also played a key role in the institutional development of the Lao rice research system through research capacity building and enhancing the skills of Lao scientists.

The Lao-IRRI Project has generated substantial impact over the past 15 years. Many of these impacts are likely to increase further as improved technologies become more and more widely disseminated.

“The government introduced favourable agricultural policies. At the same time, IRRI arrived with technologies and know-how and SDC came in with long-term financial support. The government's support has been a big factor from the very start, and the impact it has had on the Lao rice industry is really unprecedented.”

*Dr. Ty Phommasack,
Vice Minister for Agriculture and Forestry*

NATIONAL-LEVEL IMPACT

From 1990 to 2004, the national annual rice production increased from 1.5 million to over 2.5 million tons. This represents a net increase of almost 70%, and an annual growth rate of over 5%. Increase in yield was the main factor driving this production growth. Most of the production growth was achieved after 1995, when improved technologies from the Lao-IRRI Project became increasingly available. Both rice cultivation area and yield increased rapidly, with the expansion of dry season rice being the main source of area growth.

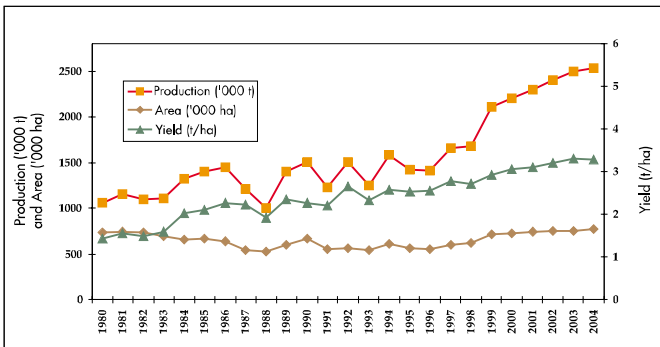


Figure 1: Rice area, production, and yield in Lao PDR, 1980 to 2004

The total production gain at the national level in 2004 was estimated to be approximately 260,000 tons. At a farm-gate price of US\$115 per ton, this corresponds to a value of about US\$ 30 million. The contribution of the northern region is less than 5%, due mainly to smaller rice area and a lower rate of adoption of Lao modern varieties.



Improved Varieties

Since the establishment of the Lao-IRRI Project, two major groups of modern rice varieties have been released:

- ▶ Lao modern rice varieties have been developed specifically for the Lao conditions. These are glutinous varieties selected for good quality, high yield potential, suitability to saline, and low fertility soils. Some are also resistant to common rice insects and disease. To date, nine of such varieties have been officially released and several are in the pipeline for release in 2006–2007.
- ▶ Ten other modern varieties developed in other countries (mainly Thailand and Vietnam) and at IRRI include five glutinous and five non-glutinous have been released.

In addition, 12 traditional varieties including four black rice varieties, were found suitable for areas beyond where they were collected and have also been officially released in selected provinces.

It is important to note that Lao farmers' traditional rice varieties are not being sacrificed. The project has aimed at a well-balanced development of the country's rice industry and, currently, around one-third of Lao PDR's rice-growing area is still planted with traditional varieties.

“Without the Lao-IRRI Project, there would not have been national modern varieties to release. The project has created a ‘rice revolution’ in the country.”

*Dr. Sengpaseuth Rasabandith,
Head of the Food Crops Department,
Agricultural Research Centre*

Improved Crop Management Practices

The research outputs from crop management have been packaged into technological options for wider dissemination to farmers. The major components of the package are:

- ▶ Establishment of 25-day-old seedlings
- ▶ Plant spacing of 15 x 15 cm with 4-5 plants per hill
- ▶ Application of higher and balanced doses of inorganic fertilisers in three splits
- ▶ Use of organic fertilisers
- ▶ Direct seeding in furrows when transplanting is not possible
- ▶ Weed management strategies for the uplands
- ▶ Recommendation of several legume crops to be planted in rice-based farming systems in the uplands

“We worked very closely with the farmers. Involving farmers in all the steps of research, from analysing their problems to finding new technologies, has really been beneficial and has allowed us to get technologies into farmers’ fields.”

*Dr. Bruce Linquist,
Lao-IRRI Project Leader (2004–2005)*



Farm-level impact is assessed in terms of the extent of adoption of modern varieties and techniques, increase of productivity and improving living standard of farmers.

Adoption of research results

Modern varieties

Total rice area planted with modern varieties increases from less than 5% in 1990 to 69% now. Moreover, 80% of the surveyed households have adopted the new varieties. The central region of the country has the highest adoption rate, with over 98% of households growing these varieties on over 86% of the rice area. Adoption is almost 100% in the dry season where rice is grown under fully irrigated conditions.

Crop management practices

The adoption of improved crop management practices is showing a contrasting picture. Most of these technologies are adopted in the central and southern regions, with the lowest rate of adoption in the northern region.

The most widely adopted improved crop management practices are improved nursery bed preparations, use of machinery for land preparation, adoption of closer plant spacing and organic and inorganic fertiliser application.

Increase of productivity

Yield performance

The average yield of modern varieties is higher than that of traditional varieties with a yield advantage of 0.3-1.3 tons per hectare per season depending on the region. The varieties developed from the Lao cultivars out-yield varieties developed in other countries. For example, the yield advantage in the central and the southern regions is 1.1 and 0.7 tons per hectare per season respectively.



Yield stability

Yield stability from season to season is a desirable characteristic that helps improve household food security. Rice varieties developed in Lao PDR have been found to offer the most stable yields in both the wet and dry seasons in comparison with imported and traditional varieties.

Rice cropping intensity

Rice cultivation during the dry season started mainly in mid-1990s, with the availability of irrigation and photo-insensitive short duration modern rice varieties. Just under a quarter of the surveyed households grew a second crop of rice in the dry season. The central region has the highest rice cropping intensity.

Improving living standard of farmers

Most households reported that their welfare had been improved over the last 5-8 years, especially the modern varieties adopters showing that they are better off compared with others.

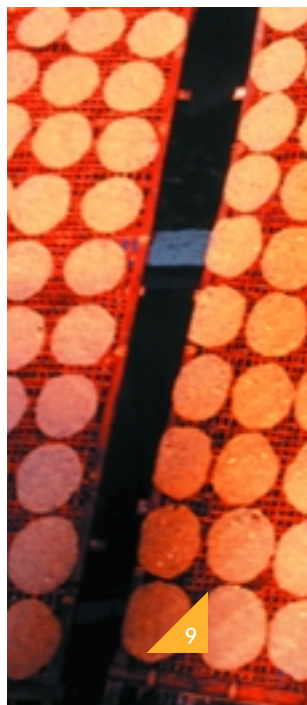
Household rice self-sufficiency

Almost 80% of the sampled households reported that they were self-sufficient in rice. The proportion of self-sufficient households was higher among modern varieties adopters (82%) relative to non-adopters (58%).

Farmers' income

Lao modern varieties generate additional net return of about US\$ 42 per hectare. The main factor driving this gain is yield improvement.

The adopters of the Lao modern varieties have higher cash income from rice compared with non-adopter households, with an average additional cash income from rice of US\$159 in 2004. This represents an increase in net returns of about 20%.





Rice production is an important source of livelihood in rural areas. Technology-induced growth in rice supply generates positive impact on poverty reduction in two ways. First, it increases rice production and availability for household consumption. Second, increased supply of rice in the market will also help keep the price of rice low. Urban poor, landless farm labourers, and food-deficit households rely on rice purchases to meet their food needs. For such households, a reduction in the price of rice is equivalent to an increase in income. In Lao PDR, rice-deficit households are usually poor. Farm households that adopted improved technologies increased their rice consumption, generated more cash income from rice, and improved their overall welfare.

It is fair to say that improved technologies generated have contributed to an overall reduction in poverty. Despite this overall effect, the technology-generated impact is initially limited mainly to those farm households that have adopted improved technologies, although flow-on effects will most likely benefit others in the longer term.

Gender

Impact of the modern varieties and technologies on the workload of men and women within households was not assessed. Nevertheless, adoption of modern varieties by male- and female-headed households is similar. Similarly, rice self-sufficiency level and yield of improved varieties are similar between male- and female-headed households. There is no apparent built-in bias in the nature of the technologies that disadvantages female-headed households. Despite this fact, male-headed households are able to generate more cash income and, proportionately, more male-headed households reported an improvement in general welfare. This reflects social and economic conditions that allow male-headed households to benefit more from emerging economic opportunities.

The Lao-IRRI Project emphasised the need to include as many women staff as possible in its training programmes. This was constrained by the relatively low proportion (10-15%) of female staff in Lao agricultural and related organisations.

“Qualified women have had an equal chance of being selected in any of the Lao-IRRI Project’s training programmes. There is no evidence at any level of discrimination in training programmes based on gender.”

*Dr. Monthathip Chanpengsay,
Deputy Director of Research, NAFRI*

Ethnicity

Lao people consist of several diverse ethnic groups, which are categorised into four ethno-linguistic families i.e Tai Kadai, Mon-Khmer, Hmong-Mien, and Tibeto-Burmese. Generally, these groups are categorised into “lowlanders” and “highlanders”. The Tai Kadai – known as Lao Leum – inhabits the lowlands, mostly in the central and southern regions, and cultivates paddy rice. The remaining groups – known as Lao Theung (high) and Lao Sung (very high) – traditionally reside in the mountains of the northern region and practise slash-and-burn agriculture. With recent changes in agricultural policies and land allocation and distribution, these highlanders now also cultivate paddy rice. The highlanders are the ethnic minorities in Lao PDR, and their incidence of poverty is twice the national average.

The Lao Leum group has the highest modern varieties adoption rate and has clearly benefited from improved technologies for lowland rice production. More than 80% of Lao Leum households are using these varieties. The Lao Theung and Lao Sung have adopted improved technologies to a slightly lower extent, although this difference appears to be related more to regional location than to ethnicity itself. Language barriers could also explain some of the differences. For all ethnic groups, adoption is lowest in the northern region.



Biodiversity

It is widely accepted that Lao PDR has one of the world highest levels of rice biodiversity and appears to be the centre of biodiversity for glutinous rice. To preserve this, NAFRI has been supported in establishing a germplasm collection of over 3,000 traditional Lao varieties as well as a germplasm bank. Indigenous knowledge of traditional varieties has been documented and conservation of wild rice varieties in their natural habitat improved. A collection of 659 germplasm accessions together with indigenous knowledge in 18 districts across the country is now available and over 1,000 traditional varieties evaluated through participatory varietal selection for promoting in-situ conservation of biodiversity.

Lao PDR is the second largest contributor to the International Rice Genebank based at IRRI Headquarters. Some traditional varieties are being used in current varietal enhancement programmes, which have developed varieties that are scheduled to be released for upland farming systems.

The project is contributing to the conservation of rice biodiversity in Lao PDR. Apart from being an indicator of overall environmental health, strong biodiversity can provide genetic materials for future agricultural use. Farmers have traditionally exploited natural biodiversity to develop resilient production systems that can meet their livelihood needs. However, such traditional systems are under threat as agricultural production systems are intensified to meet the increasing demand for food and other products for growing populations.



Environment

Environmental concerns related to agricultural intensification include the excessive use of potentially hazardous chemicals such as fertilisers and pesticides, over-exploitation of groundwater, and degradation of marginal lands.

The average quantity of fertiliser use in Lao PDR is still quite low. A substantial proportion of farmers still do not use fertilisers. Insufficient use of fertilisers in Lao PDR appears to be of more concern than excessive use. Use of pesticides (insecticides, herbicides, and fungicides) is also low. NAFRI recommends to practise integrated pest management and apply pesticides only when they are absolutely necessary. To minimise any potential adverse impact on human health from inappropriate application, the project has specified clear guidelines on application procedures and has trained local staff.

In 2004, irrigated rice accounted for less than 10% of the total rice area. Most Lao irrigation involves pump-lifting of water from the Mekong River. Groundwater is hardly used to irrigate rice.

Land degradation arising from the slash-and-burn system of shifting cultivation in the mountainous areas is an important concern. This practice contributes to the soil erosion and deforestation as farmers expand production in steeply sloping areas and encroach upon forests. The root cause of such a practice is low or decreasing food productivity. In addition to rising population pressure, low agricultural productivity often forces farmers to expand food production into marginal land. An increase in food productivity through improved technology can reduce the intensification pressure on marginal uplands. The improved rice technologies generated therefore have the potential to help reduce environmental degradation in sloping uplands. Increasingly, improved rice technologies are being adopted in the northern mountainous regions.



The rice research system in Lao PDR was in its infancy at the start of the support. The Department of Agriculture had several staff conducting adaptive research on rice. Contact and exchange of information on rice technologies with the international community was limited. Since the support began, a fully functional national agricultural system – consisting of several research stations located in different regions of the country and managed by well-trained staff – has evolved.

Infrastructure and Research Systems Development

During the first two phases of the Lao-IRRI Project (1990-1995), physical infrastructure such as buildings, laboratories, and screening facilities were constructed and research farms were established. Facilities were constructed to support research and training in Vientiane and in other regions. Eleven major research stations and facilities were constructed with this support.

In addition to physical infrastructure, the project has contributed substantially to the development of a functional national rice research system and the establishment of a network of research stations across the country. A network of regional research centres under the umbrella of the National Rice Research Programme has been established for developing and validating locally adapted agricultural technologies.





Figure 2: Locations of research stations and activities in Lao PDR, established through support from the Lao-IRRI Project

Human Resources Development

Human resources development is one of the main objectives of this support. Given the initial limited capacity, it was important to develop and upgrade skills in almost all aspects of rice sciences as well as in research planning, management, and implementation. Hence, the human resources development programme was designed to quickly build a critical mass of staff with various skills needed to set up a functional research system. Lao staff have received more than 4,600 training opportunities including degree and non-degree training. Staff have been sponsored for formal degree training (B.Sc., M.Sc., and Ph.D) in reputed universities in and outside the region. Short courses, on-the-job training, participation in national and international conferences, seminars, workshops, and other skill-building activities have been continuously provided.

A broad spectrum of agricultural organisations consisting of research, education, development planning, and extension organisations were targeted for human resources development in



rice sciences and related disciplines. Almost every agricultural organisation in the country has staff trained by the Lao-IRRI Project. Over 75% of these organisations are headed by and/or have trained senior research and management staff.

“You can’t go anywhere in Lao PDR and not bump into somebody who has benefited from Lao-IRRI. If you are in the agricultural sector, there have just been hundreds of people who have been trained through Lao-IRRI. Training has been huge.”

*Dr. Bruce Linquist,
Lao-IRRI Project Leader (2004–2005)*

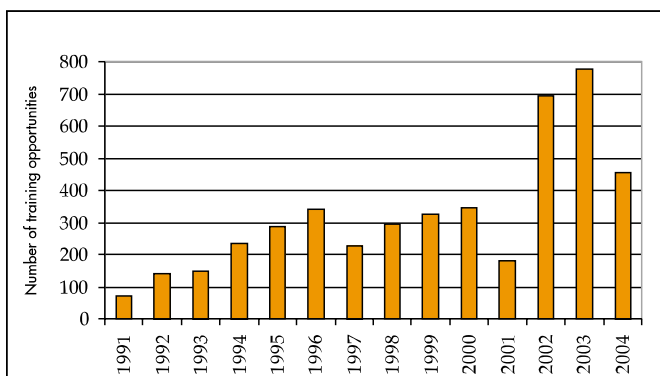


Figure 3: Number of training opportunities supported by the Lao-IRRI Project, 1990–2004

“The project has been the principal source of capacity building and technological development in the rice sector in Lao PDR.”

*Ministry of Agriculture and Forestry,
National Strategy for Agricultural Development*

In the final phase of the Lao-IRRI Project, Lao national staff took on an increasing role in research planning and management. The project further supported training for senior and middle managers

INSTITUTIONAL IMPACT

to improve their planning and management skills and thus ensure smooth transition of research management to national staff when the Lao-IRRI Project comes to an end. These people are now ready to take on leadership roles in the overall management of research systems and programmes.

More than 150 papers on rice and related sciences have been presented at professional meetings and many of these papers have been published. Most of these publications are co-authored by Lao scientists. To encourage the publication of scientific research nationally, the Lao-IRRI Project also supported the development of the Lao Journal of Agriculture and Forestry.

“The Lao-IRRI Project has been instrumental in bringing into the country complementary collaborative research, extension programmes and training, potential donors, and developing linkages, thereby facilitating NRRP collaboration with other international agencies.”

*Mr. Kouang Douangvila
NRRP Director*

“The National Rice Programme is now sustainable. Even if IRRI went home tomorrow, the rice industry would be OK. But having IRRI involved has many benefits. It helps us network with neighbouring countries and international agencies, and it gives us a broad overview that keeps things moving along smoothly.”

*Dr. Monthathip Chanpengsay,
Deputy Director of Research, NAFRI*



CONCLUSION



The collaboration between NAFRI, SDC and IRRI has helped Lao PDR take big steps toward achieving the twin objectives of national self-sufficiency in rice and the establishment of a fully functional rice research system. Rice production increased at 7.3% per year in 1996–2004. Modern rice varieties have spread rapidly and now cover almost 70% of the country's the rice area. Lao modern varieties are well-adapted to Lao conditions and have a significant yield advantage. As rice production is a major economic activity, future increases are likely to generate additional employment and income in other sectors.

Many other factors have also contributed to the increased rice productivity in Lao PDR including the Lao Government's commitment to increasing production, changes implemented in the national agricultural research systems that are conducive to research, the introduction of supportive agricultural policies, and investments in irrigation. These factors have facilitated the diffusion of the developed technologies.

A fully functional rice research system is now a reality in Lao PDR. This includes the establishment of a network of research stations and a well-trained pool of research scientists and managers. These people are now providing scientific and management leadership to the country's agricultural research system, which has developed to a stage where it can fully participate in regional research initiatives and networks.

The net present value of investment in the support is estimated to be US\$60 million. The benefit-cost ratio is 7:1 – for every dollar invested in the project, the Lao economy is reaping a benefit of US\$7 – an excellent return by any standards. Assuming a rice price of US\$115 per ton and that the benefits of the project continue until 2020, the annual rate of return is estimated at an impressive rate of 26%.

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