



Promoting the System of Rice Intensification

Lessons Learned from Trà Vinh Province, Viet Nam

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Abbreviations

AWD	Alternate Wetting and Drying
CG	Collaborative Group
CIIFAD	Cornell International Institute for Food, Agriculture and Development
DARD	Department of Agriculture and Rural Development
FAO	Food and Agriculture Organisation
FFS	Farmer Field School
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (until end of 2010: GTZ)
IFAD	International Fund for Agricultural Development
IMPP	Improving Market Participation of the Poor
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
MARD	Ministry of Agriculture and Rural Development
MKD	Mekong Delta
NGO	Non-Governmental Organisation
PARA	Poverty Alleviation in Rural Areas
SRI	System of Rice Intensification

Preface



Rice is the most important crop in Viet Nam's Mekong Delta.

Photo: ©GIZ/Nina Seib

Viet Nam's Mekong Delta is known as the rice bowl of Viet Nam because of its high importance to and intensity of rice production. Viet Nam recently emerged as the world's second largest rice exporter and has ambitions to become the first. At the same time, there is a clear mandate that rice production and agricultural development need to be more oriented towards quality production and need to contribute to the development of a Green Economy. Both of these goals face the challenge of increasing negative climate change impacts. Improving rice production must go hand in hand with the national poverty reduction strategy, as most rice producers are small-scale farmers operating on small sized plots, often with marginal economic returns. This set of circumstances demands new and innovative solutions.

Upgrading the rice value chain was one of the primary tasks of the German Government funded Project, "Poverty Alleviation in Rural Areas" (PARA), which was implemented in close cooperation with the International Fund for Agricultural Development (IFAD) funded project, "Improving Market Participation of the Poor" (IMPP). Project support initially focused on strengthening market linkages throughout the rice value chain. This led to the second phase, started in 2011, in which PARA introduced the System of Rice Intensification (SRI) to the Department of Agriculture and Rural Development (DARD) as a promising and innovative option for addressing the above challenges in connection with upgrading the rice value chain.

While SRI is being successfully practiced worldwide, it has triggered some stimulating scientific debates on rice production in general. Different methods like "One must do, five reductions" and "Alternate Wetting and Drying" (AWD) have emerged partly in response to SRI, and each incorporate one or more SRI principles. Today, the successes of SRI are acknowledged worldwide and are not confined to improved yields but extend to improving rural livelihoods. Farmers applying SRI have successfully benefitted from higher incomes, reduced resource use, social empowerment and increased adaptive capacities especially with regard to climate change impacts.

This document outlines the experiences of introducing SRI in Trà Vinh Province, Viet Nam, and draws upon lessons learned for wider dissemination. I wish the provincial leadership, DARD and the farmers all the best of success in further promoting SRI in Trà Vinh province.

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Trà Vinh, May 2013

1. Introduction

Rice plays a crucial role both as a source of income and as a staple food in Viet Nam. In 2011 Viet Nam was the fifth largest rice producer and the second largest rice exporter worldwide (FAOSTAT 2013). At the same time, rice consumption accounts for about 60% of daily per capita calorie intake (Hoang 2009). Hence, the Vietnamese rice sector is essential for national food security as well as political, economic, and social stability and development.

Located in the south-western part of Viet Nam, the Mekong Delta (MKD) is one of the most productive cultivated areas in Asia. Endowed with ample rainfall, tropical temperatures, fertile soils, and very good infrastructure, the MKD offers a nearly perfect environment for rice cultivation. With up to three rice crops per year, the MKD accounts for about 50% of the country's rice output and 90% of its rice exports (USDA 2012).

The MKD simultaneously faces the challenges of supporting global food security and maintaining its life-supporting ecosystems. Firstly, the intensive use of agrochemicals and antibiotics in agri- and aquaculture cause heavy water pollution, decreasing soil fertility and biodiversity loss. Secondly, the MKD is very susceptible to climate change impacts such as rising sea levels, more severe and frequent occurrences of extreme weather events, flooding and salinity intrusion, the latter being the one most felt by many farmers. Thirdly, prevailing rice production techniques rely on large amount of external inputs such as water, chemical fertilizers and pesticides. At the same time, fresh water resources are decreasing and input prices constantly rising. These challenges are not addressed by intensive rice farming methods that have been promoted to increase yields during the last decades.

Many people, especially farmers in the MKD, are very well aware and often directly affected by climate change impacts. However, they are much less aware of the negative side effects of intensive farming on their own health, the environment and the household economy. There is a need for alternatives that better combine economic and ecological benefits.

An increasingly acknowledged sustainable farming method is the System of Rice Intensification (SRI). SRI is a flexible set of farming practices that increases yields while at the same time reducing input requirements, especially seeds, agro-chemicals and water. It has positive economic and environmental impacts and fundamentally promotes pro-poor Green Growth.



The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) implemented the project “Poverty Alleviation in Rural Areas” (PARA) in close cooperation with the IFAD funded project “Improving Market Participation of the Poor” (IMPP) in Trà Vinh Province. With the common overall objective of poverty reduction in both projects, PARA supported sustainable, market-oriented agriculture along the rice value chain. In this context, PARA introduced SRI as one method to increase yields, to reduce dependency on external inputs and as a measure for climate change adaptation.

Against this background, this report aims to present SRI as a promising approach for facing agricultural challenges in the 21st century, to demonstrate the results of introducing SRI in the MKD, and to summarize lessons learned during its promotion and implementation.

The next chapter provides some historical background and challenges regarding rice farming in the MKD. Chapter three is dedicated to SRI and discusses its principles, features, as well as advantages and disadvantages. In chapter four, the promotion and implementation of SRI in Trà Vinh Province are presented. Economic, environmental, and social impacts of introducing SRI in Trà Vinh Province are demonstrated in chapter five. Chapter six reviews good practices and lessons learned from during the project. Finally, the report concludes with a summary of the report's most important points.

2. Rice farming in the Mekong Delta



Rice farmers spraying pesticides.

Photo: ©GIZ/Harald Franzen

2.1 Historical review

Rice has been grown in the MKD region for more than 6,000 years (Xuan 2010). In the past, farmers always adapted their growing methods to changing natural conditions. Rice farming practices included slash and burn agriculture, different types of transplanting, and growing floating rice in areas where water levels reached between one and three meters, among others.

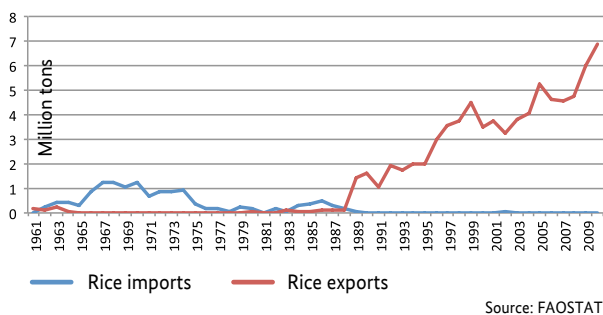
Under French colonial rule from the 1860s to the 1960s, cultivated rice areas in the MKD expanded significantly (420,000 ha in 1880 to 2,100,000 ha in 1930) as canals were built for drainage and transport (Xuan 2010). During this time, only one crop was grown per year by using varieties adapted to deep floods. Farmers even relied on flooding due to its supply of nutrient rich sediments (Jack Brunneris 2011).

In the 1970s, IRRI started to support intensive rice farming methods by promoting high yielding varieties, inorganic fertilizers, pesticides, mechanization, and irrigation. Gradually, direct sowing replaced the transplanting method of rice cultivation. National policies supported intensive farming practices in order to boost production and exports with a focus on the MKD as Viet Nam's "rice bowl". By intensifying the production system, two crops per year became a common practice. Dykes built in the 1980s and 1990s which limit flooding of the Mekong River started to allow for even a third crop within one year (Jack Brunneris 2011).

In 1986, the nationwide economic reform 'Doi Moi' was initiated with the goal of creating a socialist-oriented-market economy. The private sector began to play a greater role and agricultural production responsibilities were decentralized from collectives to individual farm households (Nielsen 2003). Economic liberalization slowly transformed the peasant economy into a market driven system.

The introduction of intensive rice farming in combination with economic liberalization increased agricultural productivity significantly. From being a chronic rice importer in the 1970s and 1980s (see figure 1), Viet Nam transformed itself with a yearly production of about 40 million tons and exports of about 7 million tons into the second largest rice exporter worldwide (FAOSTAT 2013). This success is admirable but should be analysed for its ecological and smallholder livelihood implications as well.

Figure 1 Rice imports and exports in Viet Nam



2.2 The need for more sustainable agriculture

The Green Revolution, which started in the 1970s, contributed significantly to overcoming hunger for millions of people across the world. Food security was improved mainly through a 50% decline in relative real food prices over a four decade period (Uphoff 2012). Economic, climate and demographic conditions have, however, changed since these achievements. Food prices are rising again and agriculture faces new challenges: arable land per capita is decreasing, water is becoming scarce, energy costs are rising, adverse environmental externalities are becoming more apparent, climate change is hampering production and threatening livelihoods mainly of the poor, and the fiscal capacities of governments are stretched (Uphoff 2012). Increasing the quantity and quality of food production doubtlessly has had a major role to play in nourishing a fast growing population, in addition to political trends and consumer behaviour. The challenge is to increase productivity while making agriculture more sustainable, and this must happen in the context of climate change.

The past achievements of intensive rice farming in the MKD have come at some costs, too. Challenges to food production and the environment are significant and include:

- **Decreasing soil fertility:** Soil fertility is decreasing due to the use of agrochemicals, a lack of a crop rotation, dykes that prevent the supply of nutrient-rich sediment, and three yearly crop seasons that do not give the soil enough time to rest.
- **Adverse impacts on the environment:** High external input rice farming pollutes ground and surface water, harms the soil's bio-system, reduces biodiversity, increases pest outbreaks and could intensify the problem of salinity intrusion. All these environmental effects will result in substantial economic costs in the future.
- **High reliance on natural resources:** Intensive rice farming relies on large amounts of water and other resources.
- **Adverse effects on public health:** The use of fertilizers and pesticides has negative impacts on public health. A World Bank study from 2005 revealed that rice farmers in the MKD suffer alarmingly from pesticide poisoning (Dasgupta et al. 2005).

Moreover, the impacts of intensive rice farming on poverty reduction were unsatisfactory. Despite producing three crops per year, most rice growing smallholders remain poor due to low paddy prices, high input costs, and weak bargaining positions. Input suppliers and large exporting companies seem to be the bigger winners under intensive rice farming.

Box 1 Sustainable food production

Sustainable food production can be characterized by four key principles (Royal Society 2011):

1. **Persistency**, i.e. the capacity to deliver desired outputs over long periods of time.
2. **Resilience**, i.e. the capacity to absorb external shocks.
3. **Autarchy**, i.e. the capacity to deliver desired outputs without relying on inputs outside the key system boundaries.
4. **Benevolence**, i.e. the capacity to produce desired outputs while sustaining the functioning of ecosystem services

Being aware of the adverse effects of intensive rice farming and the need for more sustainable farming practices, the Vietnamese Ministry of Agriculture and Rural Development (MARD) together with IRRI proclaimed the “One must do, five reductions” campaign in the MKD’s An Giang province in 2009. The one “must do” refers to using certified rice seeds; the five reductions concern efforts to reduce the amount of seeds, pesticides, fertilizers, water, and post-harvest losses. IRRI’s Annual Report 2011 mentions the programme’s initial economic and environmental benefits (IRRI: 2012).

In addition to the “One must do, five reductions” programme, the promotion of the Alternate Wetting and Drying (AWD) method became popular in the MKD recently. AWD shares water management characteristics with SRI.

The System of Rice Intensification had been quite successfully introduced as a sustainable and yield increasing farming method in the North and parts of Central Viet Nam. In 2009, the MARD acknowledged the potential of SRI in a statement by its Vice Minister, Dr. Bui Ba Bong, saying:

“We now have a degree of experience in SRI application in Viet Nam. It is evident that SRI increases economic returns and has potential to adapt to climate change. Both researchers and farmers need to work together to explore this potential”

The next chapter introduces and describes SRI showing its promising features for climate smart, sustainable rice production.

Box 2 Alternate Wetting and Drying

AWD is a water management system that aims to reduce the water use in irrigated rice fields without lowering productivity. Under AWD, rice fields are alternately flooded and un-flooded rather than kept continuously submerged like under conventional rice farming. A ‘field water tube’ is used to monitor the depth of water. Once the water has dropped below 15 cm of the soil’s surface, re-flooding is recommended. The numbers of non-flooded days between irrigation vary between one and ten days depending on the plant’s development stage and water availability. Water savings from AWD fluctuate between 15% - 30%. The AWD system was invented and is promoted by IRRI (IRRI 2009).



SRI plot (right) and control plot (left) after a storm. SRI plants are more resilient towards extreme weather conditions.

Photo: ©GIZ/Ngo Vinh Hung

3. The System of Rice Intensification



SRI farmers preparing the nursery tray. The seedling media is a mix of coconut humus and mud. Rice seeds are spread evenly and covered with coconut fiber.
Photo: ©GIZ/Ngo Vinh Hung

3.1 The System of Rice Intensification

The System of Rice Intensification is an innovative agro-ecological methodology that aims to increase yields and farmer's profits by creating the most suitable environment for the rice plant to grow. SRI is based on a set of rice cultivation principles and therefore is not a cultivation technology in the conventional sense. It should thus be understood as a menu rather than a recipe or prescription. SRI principles deal with soil, plant and water management. In more practical terms, SRI makes recommendations with regard to seed preparation, seedling and nursery preparation, transplanting, soil aeration, organic fertilization and water management. SRI substantially changes traditional and conventional cultivation practices that rice farmers have used for centuries.

In contrast to fossil fuel dependent methods, SRI is a low external input method. This is partly achieved by the different concept of feeding the soil rather than the plant we look at in the field, as is practiced using the leaf colour chart and other tools. Promoting organic fertilizer such as compost will reduce the use of chemical fertilizers. Healthy soil provides the optimum environment for root growth and produces a strong and productive plant. A strong and healthy rice plant withstands pests more easily and the use of pesticides will be strongly reduced.

Increasing yields with less rather than more inputs is in contrast to what farmers and agro-economists learned during the Green Revolution when higher output was achieved with greater external inputs. This is why SRI requires a paradigm shift in the way agricultural production is commonly understood.

Box 3 SRI principles

SRI comprises of three major principles containing several interrelated practices:

- 1. Soil management:** The use of organic matter to improve soil quality. Performing weeding at least two, ideally three times will aerate the soil, stimulate soil biota and strengthen the nutrient fixation in the soil. This is effectively done by using a mechanical rotary weeder.
- 2. Plant management:** Provide optimum space and conditions for seedlings and plants to enhance their potential for root development and tillering. This is achieved by sliding single young seedlings (between 8-12 days old) carefully, gently and horizontally into the soil. In contrast to plunging clumps vertically into the soil with the root tips pointing upwards, this 'L-shape' method allows the root to grow downwards quickly. Transplanted seedlings should be spaced at least 20 cm apart, depending on the type of soil. A grid-marker is a very helpful tool to easily ensure consistent transplanting distances. Different practices, for example single seeding, can be applied in order to follow the principles in direct seeding.
- 3. Water management:** Keep the soil moist but not continuously flooded during the plants' vegetative growth phase, until the stage of flowering and grain production.

Another key feature of SRI is its flexibility beyond some core principles. There is no unique or fixed set of SRI practices, thus SRI is not 'one package'. Farmers are encouraged to experiment in their own fields to find the best practices suitable to their specific conditions when implementing the principles. Indeed, farmers have developed many different ways to plant nurseries, mark fields for transplanting, establish crops, and control for weeds (Uphoff 2007).

Based on its flexibility, SRI has successfully been applied in areas with distinct climates, on different scales, and is now even applied to other crops. The adaptation of SRI experiences and principles to other crops is referred to as the System of Crop Intensification (SCI). It has been practiced with wheat, maize, finger millet, sugarcane, mustard, several legumes, and vegetables such as tomatoes, chillies

and eggplants (Latham 2012; Farming Matters 2013). This shows that, although SRI was initially developed in the context of transplanted rice, SRI principles can also be applied to other rice systems and for cultivating other crops.

SRI is different from most agricultural technologies in that it is a civil society innovation. SRI tuned to local conditions originated from farmers rather than from research institutions, and it has been farmers who contributed significantly to the spread of SRI (Uphoff 2007). This is in contrast to the typical process of agricultural innovation. Usually, scientific agricultural findings are transformed into technological packages which are disseminated by the private sector and the government to farmers. This represents a top-down approach and several challenges face the adoption of scientific agricultural knowledge (Glover 2009). SRI continues to develop through a contrasting approach: practitioners precede scientists. This is one of the underlying causes for the controversial scientific debate over SRI (see next chapter).



SRI farmer drawing grids on a muddy surface to ease transplanting.
Photo: ©GIZ/Ngo Vinh Hung

Box 4 History and spread of SRI

SRI was originally developed by the French priest Henri de Laulanié in the highlands of Madagascar during the 1970s and 1980s. De Laulanié tested unusual rice farming practices with the objective of improving the livelihoods of small-scale rice farmers. In 1994, the Cornell International Institute for Food, Agriculture and Development (CIIFAD) started to work with de Laulanié and his NGO, Association Tefy Saina. Seeing the success of his recommended farming principles called SRI in Madagascar, Norman Uphoff, CIIFAD director from 1990 to 2005, supported the spread of SRI from Madagascar around the world.

Today, the number of farmers practicing some or all SRI principles is steadily increasing. In 2013, SRI methods have been validated in 51 countries with many governments planning to expand SRI (Gujja and Uphoff 2013). In Viet Nam, the application of SRI principles expanded from 10,000 ha in 2007 to 1.3 million ha in 2012 (Gujja and Uphoff 2013). Almost 400 papers have been published assessing the benefits of SRI, including yield increases, decreased use of water, seeds, and agrochemicals, as well as increases in farmers' incomes (Farming Matters 2013).

SRI has a range of advocates, among which are international and national NGOs such as Africare, CEDAC, Oxfam and WWF. The EU, FAO and IFAD have even included SRI in their development agenda. The World Bank's toolkit "SRI- Achieving More with Less: A New Way of Rice Cultivation" and CIIFAD activities such as conferences, workshops and maintaining an SRI webpage are also key in promoting SRI. The research, development, and promotion of SRI have so far proceeded without significant support from IRRI, which in the past has either opposed it or declared it to be nothing new (e.g. IRRI 2004, Bouman 2012). This stance is changing, however, and IRRI now maintains an SRI page on its website and publicly recognizes some of its benefits.



Group training in transplanting. Single seedlings are transplanted shallow with wide spacing. Photo: ©GIZ/Ngo Vinh Hung

3.2 Pros and cons of SRI

SRI presents a categorical problem for agricultural science, in particular when thinking of an agricultural method as a discrete technical package (Glover 2009). Claims of the benefits of SRI have resulted in controversial and sometimes heated debates in the international scientific community. Opponents argue that evidence of SRI benefits lacks scientific rigour and accuracy of measurements. Its flexibility also does not allow for comparing it to other methods. Some claim that a well-defined set of practices is required to distinguish it from best management practices (Bouman 2012). For example, higher yields could not be confirmed on station trials at IRRI. Moreover, SRI is said to be labour intensive and therefore not an option in many contexts of rice cultivation. On the other hand, proponents refer to SRI as a methodology with a high degree of flexibility, making SRI difficult to evaluate along standard scientific practices. In addition to claims of higher productivity, proponents stress that SRI provides a range of environmental and social benefits. Table 1 summarizes the most important arguments of opponents and proponents.

Table 1 Debating pros and cons of SRI

Aspect	Arguments of proponents	Arguments of opponents
Economic	<p>Higher yields: Yield increases range from 20% to 200% of conventional rice farming yields.</p>	<p>Difficulties in proving higher yields: High cited yields are difficult to replicate, partly because SRI is an adaptive methodology rather than a technology.</p>
	<p>Lower production costs: SRI requires fewer seeds (up to 90% less), less water (25%–50% less) and less pesticides and chemical fertilizers (both up to 100% less). SRI is only initially labour intensive and can be labour-neutral and even labour-saving. Total input costs are reduced.</p>	<p>Labour intensity: SRI is more labour intensive, and therefore is only suitable for small land sizes.</p>
	<p>Reduced risk of crop failure: SRI produces robust plants with strong tillers and healthy root systems. The crop is more resilient to pests and diseases and more robust under extreme temperatures, storms and droughts which are increasing in the context of climate change.</p>	<p>Increased risk: Transplanting single, very young seedlings bears a high risk of snails, crabs and rats eating the plants. Also, heavy rainfall easily destroys the transplanted seedlings.</p>
	<p>Higher prices: SRI rice is of higher quality and is likely to receive a premium price. For example, SRI can often be sold as more expensive seed-rice → Higher yields, less inputs, fewer crop failures, and higher prices increase small-scale farmer's profits and contribute to food security.</p>	
Environmental	<p>Market opportunities: Demand is strong and growing for agricultural production methods that produce food without chemical inputs, have human health benefits and which increase the quality of soil and water affected.</p>	<p>Adoption: If farmers do not adopt SRI easily, it may not be beneficial for them.</p>
	<p>Better soil quality: Practising SRI results in a greater abundance, activity and diversity of soil organisms, and thereby improves its quality</p>	<p>Organic matter: There will not be enough organic matter available to practice SRI on a large scale.</p>
	<p>Prevention of water pollution: Practicing SRI reduces adverse effects on water quality from rice farming.</p>	
	<p>Natural resources: SRI contributes to saving water. Moreover, the production of chemical fertilizers relies on oil and other natural resources, in contrast to organic fertilizers promoted by SRI.</p>	
Social	<p>Climate change mitigation: SRI plots are likely to have lower methane gas emissions than conventional plots.</p>	<p>Climate change: SRI plots emit more nitrous oxide than conventional rice plots, which has adverse effects on climate change.</p>
	<p>Agro-Biodiversity: SRI directly contributes to a diversity of soil biota and to a diversity of animals and plants in and around the paddy field, mainly due to lower use of agrochemical inputs. Because SRI works with all varieties of rice, it can contribute to maintaining a diversity of rice varieties.</p>	<p>Varieties: High yielding varieties are necessary to feed the growing world population.</p>
	<p>Social empowerment: Farmers are encouraged to experiment and to engage in participatory technology development. Through this, they can build up adaptive capacities.</p>	
	<p>Positive impacts on human health: Several factors contribute to human health, for example, improved water quality and less physical contact with chemicals.</p>	
Methodology	<p>Upscaling: There is a high potential to upscale SRI because it can be applied in a variety of areas, on different scales and even with different crops. However, upscaling requires pro-active farmers, motivated extension staff and convincing political support.</p>	<p>Difficulties to evaluate SRI scientifically: SRI is not standardized. There is no uniform definition as the principles can be applied partially and flexibly. Hence, the concept of SRI is too vague and difficult to evaluate, hence it is basically the same as what is known as “best management practices” (BMP). Dissemination: Farmers like to get clear recommendations to follow.</p>

4. Promoting SRI in Trà Vinh Province



SRI farmer weeding and aerating the soil with a hand weeder. Weeding is combined with fertilizer application during the crop cycle.

Photo: ©GIZ/Ngo Vinh Hung

4.1 Strategy and SRI implementation process in Trà Vinh

PARA promoted and supported the implementation of SRI farming practices in Trà Vinh Province during four crop seasons between late 2011 and early 2013. Although SRI had already been successfully introduced in Central and Northern Viet Nam before 2009, it remained more or less unknown in the MKD. The strategy for introducing and promoting SRI in Trà Vinh took into account the conditions of rice production in the Mekong Delta as described in chapter two. The strategy to promote and implement SRI can be described as follows:

- **Awareness creation:** Awareness was created among staff from the provincial Department of Agriculture and Rural Development (DARD) for SRI by holding several presentations and discussions in November 2011. Selected staff were sent for one week to the SRI training centre in Java/Indonesia.
- **Staff development:** DARD staff were trained on the technical aspects of SRI and prepared to run a Farmer Field School (FFS) on SRI. Two DARD officers became particularly knowledgeable and interested in implementing SRI. Along with GIZ staff, they developed the contents for 14 modules explaining a complete rice crop season under the SRI method. The full process of introducing SRI is presented in table 2, which compares basic technical features of SRI introduction with row sowing and conventional practices in the MKD.

Table 2 Comparison of direct sowing, conventional transplanting, and SRI

	Direct Sowing	Conventional Transplanting	SRI
Soil preparation	Normal leveling Drainage around the field	Normal leveling Drainage around the field	Better leveling Drainage in and around the field Field division with a grid marker for even transplanting distance
Seed preparation	Soak seeds in water for pre-germination	Select a few good seeds with salt water test Soak seeds in water for pre-germination	Select a few good seeds with salt water test Soak seeds in water for pre-germination
Seedling preparation		Grow seedlings in one corner of the field for subsequent transplanting	Prepare a mat nursery in the field or a tray nursery at the house
Transplanting	Direct hand sowing (150 – 200 kg/ ha) or row sowing (100-120 kg/ha)	Transplant 15-20 day old seedlings (30kg/ha) 2-3 seedlings per hill vertical	Transplant 8-12 day old seedlings (5-10 kg/ha) One seedling per hill. Shallow L-shape
Weed and pest control	Herbicides Pesticides	Herbicides Pesticides	Manual weeder Integrated Pest Management
Water management	Keep field flooded Drain for pesticide and herbicide spraying Keep drained 7-10 days before harvesting	Keep field flooded Drain for pesticide and herbicide spraying Keep drained 7-10 days before harvesting	Intermittent irrigation Retain moist soil without flooding for most days Flood 1-2 cm once a week only
Fertilization	Chemical fertilizer	Chemical fertilizer	Organic matter recommended

Box 5 Farmer Field School

The FFS can be considered an innovative approach to adult education. It was developed as an alternative to the conventional top-down extension programmes popular through the late 1980s. In sharp contrast to the agricultural extension approach in which farmers were expected to adopt recommendations by specialists from outside the community, the FFS enables farmers to develop solutions to their own individual problems.

During a FFS, a group of farmers and one trained facilitator meet weekly in one of the farmers' fields. For at least one entire production cycle, farmers learn to observe, analyse and experiment with their crops to increase their understanding of the agro-ecology of their fields. They check crops, soils, diseases and conduct practical learning-by-doing field exercises. Results are discussed between participants.

A key feature of a FFS is its emphasis on empowerment and participatory group learning. Farmers are expected to change their practices only when they do their own observations and analysis. The overall objective of a FFS is to allow farmers to make their own decisions in the field.

The first FFS was conducted in Indonesia and dealt with Integrated Pest Management (IPM). Today, FFSs deal with a wide range of sustainable land management problems, such as soil productivity and surface runoff. The FFS approach is promoted by the Food and Agriculture Organisation (FAO) and other development organisations.

- **Identifying and training farmers:** Farmers who were interested to try SRI for at least two crop seasons were identified and trained through a FFS by DARD staff. It was important that farmers have a comparison plot for the first season or until they feel confident enough with the SRI method. In the beginning, farmers should not use more than 0.1 ha for practicing SRI. During the first four crop seasons, the number of rice farmers applying SRI principles increased from 5 to 43 and the area cultivated with SRI practices increased from 0.5 ha to 23 ha. A large increase in the area cultivated took place during the third (6 ha) and fourth (23 ha) crop seasons, despite an insignificant increase of SRI Farmers (from 40 to 43). The development of the number of SRI farmers, hectares cultivated with SRI practices, as well as technical aspects of SRI in Trà Vinh are summarized in table 3.
- **Ongoing analysis and adjustments:** SRI implementation was analysed and adjusted jointly by DARD staff and farmers. It proved important to keep farmers actively involved, and SRI practices were modified incrementally from one crop to the next in order to adjust to each field's specific conditions. For example, the spacing distance between plants was reduced from 25cmx25cm to 17x17cm because of better yield performances of plots with smaller spacing. This was the farmers' wish although this spacing is below SRI recommendations.

- **Funding for SRI implementation:** As for the introduction of any innovation, there has to be some financial support for SRI in the initial phase. The project financed and supported the piloting phase, but DARD has now allocated funds for scaling SRI up in their overall budget for 2013. At the same time, DARD is approaching new donors and projects in the province to find support for further SRI dissemination.
- **Dissemination of results:** Results were presented to other potential supporters of SRI both inside and outside the province. The results of the application of SRI through four crop seasons are documented in a poster, a video, and in this report. They were presented at several local, national and international events, thereby further contributing to the dissemination of SRI locally and regionally.

Box 6 PARA support for SRI farmers

SRI farmers received the following support from PARA:

1. **Weekly advice and trainings** on SRI for new SRI farmers through the Farmer Field School. The training comprised of 14 modules, including theory and praxis in the field (e.g. seeding and monitoring). DARD staff have also provided regular advice to farmers.
2. **Provision** of hand weeders, seeds, bio fertilizer (only 1st and 2nd crop seasons), fungi and transplanting labour costs (1st and 2nd crop seasons 100%, 3rd and 4th seasons only 50%).
3. **Compensation** for any negative differences between yields in SRI and control plots during the first two crop seasons.

Table 3 Development of SRI in Trà Vinh Province

	Winter-spring crop 2011/2012	Summer-autumn crop 2012	Autumn-winter crop 2012	Winter-spring crop 2012/2013
Districts	Tieu Can	Tieu Can, Cau Ke	Tieu Can, Cau Ke, Cau Ngang	Tieu Can, Cau Ke, Cau Ngang
No. of SRI farmers	5	20	40	43
SRI cultivation area*	0.5 ha (0.5 ha)	2 ha (2 ha)	6 ha (6 ha)	23 ha (4 ha)
Seed varieties**	2 different local improved varieties	4 different local improved varieties	4 different local improved varieties	4 different local improved varieties
Seeding rate in nursery	15kg/ha	15kg/ha	15kg/ha	15kg/ha
Age and number of seedlings transplanted	10-14 days/ single seedling	10-12 days/ single seedling	9-12 days/ single seedling	9-12 days/ single seedling
Transplanting distance	25x25 cm	25x25 cm 20x20 cm	17x17 cm	17x17 cm
Water management	Keep soil moist but not flooded	Keep soil moist but not flooded	Keep soil moist but not flooded	Keep soil moist but not flooded
No of weeding applications per crop	1 to 2	1 to 2	1 to 2	1 to 2
No. of pesticide sprayings***	2 to 3	2 to 3	2 to 3	2 to 3
No. of fertilizer applications****	50% of DARD recommendation	50% of DARD recommendation	50% of DARD recommendation	50% of DARD recommendation

* In brackets is the area supported by PARA

** Variety names: big grains, fragrant = OM4900; small grains, soft cooked = OM5451;
small grains but high yield = IR50404; big grains,
soft cooked = OM10636

*** Pesticides used were 'Fuan' and 'Amistar Top'

**** 50 kg of Diammonphosphate, 100kg of Urea nitrate, and 40 kg of potassium

4.2 Monitoring and evaluation

Data monitoring was conducted by DARD in close collaboration with farmers. The objective was to document the progress and results of SRI and control plots as well as to develop farmers' capacities in analysing field status, recording financial expenses and considering options for improvements. Since participating farmers cultivated SRI and control plots on their field, comparing results of SRI with those of conventional methods accounted for individual household differences.

In the following section, SRI monitoring results are divided into technical, financial, and greenhouse gas (GHG) data.

Technical data

Performance of crops was monitored with a set of standard indicators including number of plants, tillers and panicles per square meter, number of good grains per panicle, as well as yields. As soon as rice plants were transplanted, farmers were asked to randomly mark three places in their fields with a stick. The area of 20x20cm around this marker stick served as the basis for measuring technical parameters. Farmers observed the number of tillers per panicles and pest appearance during weekly FFS sessions. In this way, farmers could continuously compare growth speed and size between plots. The number of plants and tillers were recorded when rice plants entered the initial flowering phase.

Final data was collected and analysed by farmers and DARD staff during crop cuts about one week before harvesting. During the crop cut, five square meters were harvested. Data was projected to yields per hectare based on weight and humidity. While performing the crop cuts, DARD staff explained to farmers the relevance of each indicator and how it contributes to yield performance.

Financial data

At the beginning of each crop season, farmers received a form developed by PARA to record inputs and costs. This allowed for comparing various economic parameters between SRI and control plots. Moreover, it familiarized farmers with considering not only yields but also input costs for their rice cultivation. Currently, farmers in the MKD tend to disregard input expenditures when making business decisions.

Inputs used by farmers include seeds, fertilizers, agro-chemicals for plant protection, water and labour. To assist farmers in recording data, farmers were asked to bring their forms to every FFS session. The DARD official holding the FFS reviewed the field work done during the previous week and supported farmers in case of any uncertainties. At the end of the crop, all sheets were collected and given to PARA for analysis.

Greenhouse gas emissions

During the last crop season, PARA arranged with DARD and the Mekong Delta Rice Research Institute to install equipment for performing GHG measurements in SRI and comparison plots. DARD staff were trained in taking crop samples, which were sent directly to the Mekong Delta Research Institute for gas-chromatographic analysis. Twenty-three samples were taken with three replications each throughout the crop season.

Box 7 Data recorded by farmers

Farmers recorded the following data during the crop season:

- Date, costs and number of ploughing and soil preparation
- Date, type and costs of fertilizer application
- Date, type and costs of pesticide application
- Date and type of weedings
- Type and costs of labour, machinery and services
- Date and type of transplanting
- Yield estimation through crop cuts
- Date of harvesting and yield harvested
- Price and quantity of paddy rice sold

5. Results of SRI in Trà Vinh



DARD and PARA staff measuring the greenhouse gas emissions in SRI and control plots.

Photo: ©GIZ/Ngo Vinh Hung

This chapter describes the impacts of SRI during four crop seasons on single plants as well as in economic, ecological and social terms.

5.1 Plant performance

Table 4 compares single plant performance under SRI with conventionally cultivated rice plants in the three districts implementing SRI. The number of tillers per plant was between four and five times more under SRI than conventional cultivation, and the number of panicles per plant between six and eight times greater for SRI plants. Furthermore, the number of good grains per panicle was between 50% and 100% higher. The roots of SRI plants

looked strong and healthy, in contrast to the weaker roots from control plots.

Strong and healthy SRI plants are more resilient to pests, disease, and extreme weather conditions (e.g. storms), thus the risk of crop failure is reduced. This higher resilience is an important feature of climate change adaptation. Moreover, strong plants are an indication of lively and fertile soil and a robust root system.

Farmers were very impressed by the single plant performance from the first crop season on. This was an important reason for their participation and for the increase in SRI uptake.

Table 4 Plant performance*

	Tieu Can (n = 14)		Cau Ke (n = 12)		Cau Ngang (n = 17)	
	SRI	Control	SRI	Control	SRI	Control
No. of tillers/plant	12.5	2.5	11.0	2.6	12.4	2.3
No. of panicles/plant	9.9	1.5	8.0	1.4	9.6	1.1
No. of good grains/panicle	103.0	65.0	108.0	52.0	90.0	53.0
Pest and disease infestation	clearly visible	minor	clearly visible	minor	clearly visible	minor

* Data presented are from the last crop season, winter-spring 2012/2013.



*“When my neighbours saw my robust plants in the SRI plot, they stopped to examine them and asked me a lot of questions about how I managed this”
(SRI farmer, Tra Vinh Province, 2012).*

SRI farmer holding up a single SRI plant on the left and a ‘regular’ plant on the right. SRI plants have much more tillers and panicles per plant.
Photo: ©GIZ/Ngo Vinh Hung

5.2 Economic impacts

Farmer’s profits

Farmer’s profits can be measured through contribution margins, i.e. the difference between revenues and variable costs. Table 5 shows the contribution margins from SRI and control plots during the last PARA supported winter – spring crop season 2012 / 2013. Contribution margins per hectare of SRI plot were, on average, 1,558 US-\$, compared to those of control plots, which were only 611 US-\$. Hence farmers could increase profits through SRI by an average of 155%.

Increased profits from SRI indicate its great potential for poverty reduction. They are the result of higher revenues and lower input costs. Both of these are discussed in more detail in the following subchapters.

Yields and revenues

Figure 2 compares the development of yields between SRI and conventional plots over four seasons. Yield averages on SRI plots ranged from 5.6 and 7.4 tons per hectare,

and on control plots from 5.4 and 6.5 tons per hectare. During all four crop seasons, SRI plot yields were higher than those of the control plots (up to 18% higher). Yield increases from switching to SRI were good, but lower than expected. One likely reason for this is that farmers have yet to implement all SRI principles strictly. Another explanation might be that the saturated soils of the MKD constrain the development of ‘helpful’ soil biota. Another reason is that yields in the MKD are already very high and that SRI has to compete with highly intensive and increasingly mechanized rice production systems.

Prices for SRI and conventional rice were the same during the first two crop seasons. But, in the third and fourth crop seasons, farmers managed to receive a 20% higher price for SRI rice. This was due to the fine quality of SRI rice, which allowed it to be sold at a higher price as rice seed. Higher yields on SRI plots and higher prices for SRI rice resulted in an overall revenue increase of between 30% and 40% during the third and fourth crop seasons.

Table 5 Economic comparison of SRI and control plots*

Aspect	Indicator	SRI Plots (n = 33)	Control Plots (n = 33)	Difference between SRI and control plots (%)
Revenue	Yield (t/ha)	7.8	6.5	20%
	Price of paddy (US-\$/kg)	0.3	0.25	20%
	Total revenue (US-\$/ha)	2,340	1,625	44%
Input Costs	Seeds (US-\$/ha)	18	60	-70%
	Fertilizers (US-\$/ha)	203.5	312.5	-35%
	Plant protection drugs (US-\$/ha)	26	198.5	-87%
	Hired services (US-\$/ha)**	227	205.5	10%
	Labour costs (US-\$/ha)***	307.5	237.5	29%
	Total input costs (US-\$/ha)	782	1,014	-23%
Profit	Contribution margin (US-\$/ha)	1,558	611	155%

* Data presented are from the last crop season, winter-spring 2012/2013.

For currency conversion the exchange rate of 20,000 Vietnamese Dong /US-\$ was used.

** Hired services include plough, levelling, digging drainage, pumping water, harvesting.

*** Family labour costs were calculated at 5 US-\$/8h.

Input costs

Figure 3 illustrates the average variable input costs required for SRI and conventional farming practices. These costs cover expenditures on seeds, fertilizers, plant protection drugs, hired services, and labour, including family labour. The figure reveals a significant difference: total input costs for SRI farmers were between 18% and 27% lower than those of conventional farmers. For example, during the fourth crop season, farmers spent on average of 782 US-\$ per ha on inputs to SRI rice production, in contrast with 1.014 US-\$ per hectare on conventional rice production. This difference can be attributed to the use of fewer seeds (70%-90% lower costs), fertilizers (35% - 40% lower costs), and almost no pesticides (80% - 90% lower costs).

Opponents of SRI often point out the higher labour requirements for SRI practices. Table 6 (see next page) displays the labour used per hectare on SRI and control plots during the fourth crop season. SRI plots required about 30% more labour, mainly due to transplanting and manual weeding. However, these labour costs could be offset by reductions in other inputs, so that total input costs were still significantly lower for SRI than for conventional farming.

In addition to lower total input costs, the reduction of inputs reduces farmers' dependency on input suppliers. There was no need for SRI farmers to rely on credit from suppliers and therefore they lowered the risk of indebtedness. Dependency on suppliers further decreases when farmers start to make their own organic compost and slowly decrease their area under conventional cultivation.

Figure 2 Yield comparison

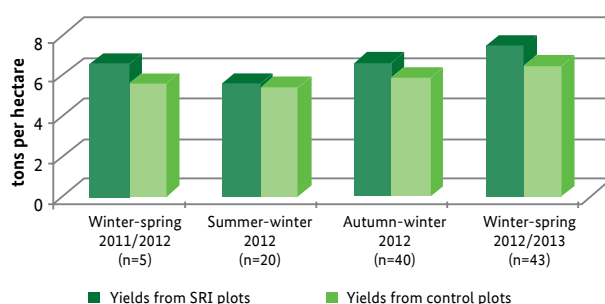


Figure 3 Input costs comparison

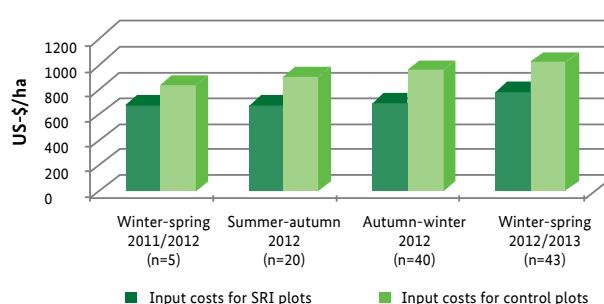


Table 6 Labour requirements per hectare*

Field work	SRI (days)	Conventional (days)
Nursery preparation	6.5	0
Transplanting	30	0
Re-transplanting	5	12.5
Weeding/aeration	10	5
Fertilizer application	7.5	15
Pesticide application	2.5	15
Total	61.5	47.5

* Data are from the last crop season, winter-spring 2012/2013.

5.3 Environmental and social impacts

SRI has several positive ecological and social impacts. These are often not considered when production and investment decisions are made. Nonetheless, ecological and social impacts should be taken into more serious consideration when comparing other rice cultivation methods with SRI.

Soil fertility

Applying Dasvila (a microbiological culture used to stimulate the growth of nitrogen fixing bacteria), reducing chemical fertilizers, avoiding the use of pesticides and

herbicides, and aerating the soil regularly, are all practices which increase the quantity and diversity of soil biota and thus improve biological soil fertility. In SRI, the focus is on biological soil fertility, whereas other production approaches mainly concentrate on chemical and physical soil parameters. It is obvious, that the effect on soil fertility becomes significant only over a longer period of time, and as farmers improve their skills in applying SRI principles.

Water pollution

Most chemical fertilizers and pesticides are not biodegradable. If used in greater doses or concentration than recommended (as is often the case), nitrate residuals remain in ground and surface water and have adverse effects on water quality. Lower chemical fertilizer and pesticide use typically results in improvements in water quality. Increased use of organic fertilizers, as with advanced SRI application, should also contribute to improving water quality.

Biodiversity

SRI contributes to the diversity of soil biota and agrobiodiversity. Soil biota are living micro-organisms in the soil and can be considered a measurement of the quality of biological soil fertility. Its diversity increases with the



DARD staff and farmers while exchanging experiences on SRI during the Farmer Field School.

Photo: ©GIZ/Ngo Vinh Hung



DARD staff cut the crop one week before harvesting.

Photo: ©GIZ/Ngo Vinh Hung

addition of organic matter, as well as the reduction of poisonous agro-chemicals. Improved biodiversity could also be observed in the paddy field, in particular through beneficial insects that are otherwise adversely affected by conventional fertilizers and pesticides.

Increased agrobiodiversity allows for the diversification of production. For example, a rice-fish-duck integrated farming system, i.e. raising fish and ducks in rice fields while rice is produced, is possible with SRI. Diversification of production will be more important as climate change impacts become more severe.

Last but not least, SRI can contribute to maintain a genetic variety of rice, as SRI principles may also be applied to cultivating old and traditional rice varieties, as well as hybrids.

Resource efficiency

The application of SRI considerably reduced the use of natural resources. First of all, SRI plots required between 40% and 60% less water. Because of numerous upstream dams, less freshwater is available in the MKD and agricultural methods that rely less on water are becoming more important. The reduced availability of freshwater also allows salinity intrusion to advance further inland, a major concern in the MKD.

Secondly, farmers hardly used pesticides and substantially reduced the amount of chemical fertilizers applied to SRI plots. As the production of chemical fertilizer is highly dependent on fossil fuels, reduced use contributes indirectly to safeguarding natural resources.

Climate change mitigation

Table 7 shows the results of GHG measurements during the fourth crop season, which suggest that the SRI

method contributed to GHG mitigation. On average, the methane gas emission per hour per square meter was 1.9 mg/h*m² on SRI plots and 2.4 mg/h*m² on control plots. The two-sample t-test of equality of means confirms that this represents a highly significant difference in methane emissions ($p < 0.01$). Nitrous oxide emissions, however, were not significantly different between SRI and conventional plots ($p > 0.1$). These results must be interpreted with caution, as they do not fully take into consideration various external parameters, such as the amount, type and time of fertilizer application, or the amount of water on the field during sampling. Nevertheless, the data appears to confirm findings from other studies that SRI contributes to mitigating methane gas emissions from rice production (e.g. Africare et al. 2010; Ly et al. 2012; Nguyen et al. 2007).

Social empowerment

SRI has shown positive effects on social empowerment. SRI farmers experimented with their farming practices, practiced 'rotating labour' in transplanting and exchanged experiences intensively. Communication within participating communities increased. These changes allow farmers to build up their adaptive capacities in agricultural production.

Public health

Pesticides are well known to cause negative health effects. These range from skin irritation to more serious diseases, including cancer. Avoiding the use of pesticides can help to reduce negative impacts on human health. Though health effects could not be measured during this project, a 2005 World Bank study extensively documents the adverse effects of pesticides on human health (Dasgupta et al. 2005). The more farmers in the MKD using toxic pesticides, the higher the incidence of poisoning has been.

Table 7 Greenhouse gas emissions

Variable	Plot Type	Observations	Mean	Std. Dev.
Methane emissions in mg/h*m ²	SRI	253	1.8991 ¹	1.869
	Control	255	2.3761 ¹	2.160
Nitrous oxide emissions in mg/h*m ²	SRI	246	1.411 ²	1.298
	Control	248	1.431 ²	1.320

¹ two-sample t-test on equality of means, $p < 0.01$

² two-sample t-test on equality of means, $p > 0.1$

6. Good practices and lessons learned



DARD and GIZ staff in a SRI field.

Photo: ©GIZ/Ngo Vinh Hung

This chapter summarizes selected good practices and lessons learned during the promotion and implementation of SRI.

6.1 Awareness creation and identification of SRI promoters

Challenges

Although SRI is increasingly practiced around the world, its promotion faces numerous challenges. Introducing SRI is more challenging than most agricultural innovations since it departs so significantly from common cultivation principles, methods and behaviours. Indeed, it represents a paradigm shift which confronts accepted conventions of rice production (Chambers 2012). The inherent flexibility of SRI and the difficulty of comparing it to alternative production techniques requires an open mind and a critical reconsideration of what mainstream science has taught us in the past. The fact that the development of SRI has always been farmer driven rather than science based also raises scepticism. SRI is thus not easily introduced, and there is not one single successful strategy for its introduction across all contexts.

What was done?

Firstly, PARA provided comprehensive overviews of SRI to its partners and relevant stakeholders. This included sending a core team of three persons to a one-week training session at the SRI training centre in Indonesia. Fortunately, some participants from DARD quickly recognized SRI as a promising production method. This included one Vice-Directive, as well as a key member of the extension unit. The latter became an “SRI Champion”, or a devoted proponent of SRI, and has been instrumental in the implementation of field demonstrations and in training additional DARD staff on SRI. Towards the end of the project, the DARD integrated SRI into its action plan and established an SRI budget allocation.

What was learned?

- Raising awareness and advocating for SRI is more easily said than done. It requires both patience and persistence. Still, awareness rising proved to be an important factor in the project’s success.
- Involving line agencies from the start was a key element to ensure that SRI will be promoted beyond the GIZ PARA project.
- Having a “SRI champion” who promoted SRI both within DARD and in the field was highly beneficial.

6.2 Convincing farmers

Challenges

SRI fundamentally changes rice farming practices. Transplanting very young, single seedlings, as well as not flooding paddy fields, significantly contrasts the methods rice farmers have used for centuries. Therefore, switching to SRI requires a major behavioural change and a change in mindset.

Most importantly, farmers will not take up an innovation if they have no economic incentives to do so. Unfortunately, farmers often do not keep track of input costs, but look rather at their own labour opportunity costs and at the cash revenues from final yields only. Especially with advanced levels of mechanization, they often consider hired labour an unnecessary additional cost. Since farmers are reluctant to spend money hiring labour, labour requirements for transplanting could discourage farmers from applying SRI principles, even though the total input costs are reduced. On the other hand transplanting is a key feature of SRI, making it central to the understanding of SRI principles. Introducing SRI principles to farmers who practice direct seeding remains a challenge.

What was done?

The DARD Extension Centre identified five farmers who were interested and volunteered to try SRI on a small plot of their field (0.1 ha). The number of participating farmers increased with every crop season. Each season, farmers became more and more convinced that SRI improves plant performance and they began to trust the new farming techniques. SRI benefits such as lower input costs and sustainable soil treatment were not clearly apparent to farmers, but these benefits were communicated and demonstrated to farmers regularly in the context of the FFS.

With the PARA project's support, the DARD produced a set of TV movies to promote SRI. These were broadcasted in the regular provincial agriculture series of Trà Vinh. A comprehensive summary movie was compiled on DVD with English subtitles and was used for further dissemination of SRI.

What was learned?

- When developing SRI, de Laulanié proved that most traditional and common rice farming practices were not ideal. Although traditional knowledge is often underuti-



SRI farmer and DARD staff threshing the grain after the crop cut.
Photo: ©GIZ/Ngo Vinh Hung

lized, it is also true that some long practiced approaches are not necessarily. The same goes for scientific findings, which should be critically examined on a regular basis.

- Introducing SRI means overturning strong traditional beliefs. To do so requires a qualified and motivated extension approach like the FFS. Trust building with farmers was an important success factor.

6.3 Facing scientific and political headwinds

Challenges

Agronomists often challenge the notion that fewer inputs can produce more outputs. Moreover, many scientists and decision makers contest the scientific validity of farmers' experiences with SRI. Finally, private companies supplying agricultural inputs do not favour SRI since it reduces demand for their products. This headwind from scientists, decision makers and agro-chemical supply companies was strongly felt in the MKD.

What was done?

PARA, together with the DARD, presented SRI and its advantages in many workshops and seminars. Spread-printed materials and scientific reports on SRI was



A group of farmers being trained in making organic compost.

Photo: ©GIZ/Ngo Vinh Hung

another way to overcome scepticism among a range of audiences. Last but not least, PARA and DARD invited many actors to the open SRI harvest events, where results were presented with critical self-reflection. Conducting joint trials, as with the IRRI's CLUES project at the MKD on GHG measurements, is another effective way to show the advantages of SRI.¹

What was learned?

- Although one faces many opposing arguments when promoting SRI, especially in the MKD, those arguments might often be helpful to assure a high quality of SRI implementation. Answering queries helps to boost one's own confidence in the SRI dialogue. Finally, with some perseverance, one can successfully convince people on SRI.
- PARA has not been able to involve private agro-chemical companies yet, but the fact that some SRI farmers are also working as sales agents for those companies could be a promising entry point in the future.

6.4 Adjusting SRI to local conditions

Challenges

Experiences with and results from SRI vary significantly between regions. The reason for this is that changes are achieved from biological processes rather than genetic blueprints or material inputs (Uphoff 2012). Although SRI can be applied everywhere that rice is being grown, it was found to be most beneficial in areas that have a sufficient degree of water control, relatively low yields, and are characterized by small scale production.

What was done?

SRI principles were steadily adjusted to farmer's feedback and demands. Therefore, certain compromises had to be made with regard to fertilizer application, transplanting distance and water management. While the application of chemical fertilizer was reduced to half the standard amount recommended, no organic fertilizer was used yet. Instead, a microbiological culture (Dasvila) was applied to simulate bacteria growth in the soil. PARA introduced compost making parallel with the fourth crop season. Farmers responded very well to this and have even started to sell the compost.

Farmers reverted partly to less than 20cm transplanting distance, feeling this gave the best results under their soil conditions. Water management couldn't always be performed as planned and recommended, mainly because sluice gates are operated by the district authorities and farmers have to adjust accordingly.

What was learned?

- SRI needs to be introduced step-by-step, but some key practices such as transplanting single seedlings with more space between them must be done from the beginning so that differences from the control plot can be observed.
- Improving the quality of SRI implementation has to go hand-in-hand with farmers' learning experiences.
- A high amount of SRI experience is required in areas where yields are already high because it takes more skilled SRI application in order to further increase yields.

¹ The CLUES project 'Climate Change affecting Land Use in the Mekong Delta: Adaptation of Rice-based Cropping Systems' is a joint research project between six research institutions commissioned by IRRI. The project aims to increase the adaptive capacity of rice production systems in the MKD and to provide farmers and management agencies with technologies and knowledge.

6.5 Considering labour issues

Challenges

Labour is probably the most intensively debated issue with regard to SRI dissemination. While many farmers and SRI opponents complain of higher labour requirements with SRI, there are many instances where more advanced SRI farmers need less labour inputs as labour requirements depend to a great extent on the cultivation method. With the direct sowing cultivation method, as is widely practised in the MKD, the labour requirement is usually much lower than with the transplanting method. Another factor is the difference between own and hired labour, and whether the farming household is willing to invest in additional labour.

The availability of labour is also an important factor. The argument limited labour availability where farmers have alternative employment opportunities often does not take into consideration that transplanting is done by female labourers exclusively. Therefore, the actual labour demand for SRI depends greatly on the local context.

What was done?

PARA was aware of the labour situation in the implementation sites from the project's start, and therefore agreed to pay for transplanting labour costs in demonstration fields. The support to transplanting labour costs was later reduced to half, as the farmers realized the economic benefits from SRI.

Focusing on seed producers was another strategy for overcoming the labour issue, as they are used to transplanting because they are well aware of its benefits for grain quality.

What was learned?

- Although profits seem to be clearly higher with SRI, the labour aspect remains critical for large scale adoption of SRI in the MKD. It was also observed that 'modern' farmers might be reluctant to spend more time in the field, even though they know that this will result in economic benefits. Higher labour demands in the beginning of SRI introduction can definitely be an obstacle to SRI adoption.
- The labour issue with SRI is multifaceted and needs to be addressed according to the specific situation. For ex-

ample, the fact that transplanting still takes place under direct sowing approaches is often not accounted for in economic comparisons.

- Transplanting requires careful work and hiring labour for transplanting might result in undesired results. Therefore, establishing and training transplanting teams for SRI should be considered in future SRI dissemination.

6.6 Establishing market linkages

Challenges

Rice production, like any other farming activity in the MKD, is geared towards market production. Therefore, marketing is a very important aspect for farmers. While the introduction of SRI can produce significantly higher yields, this is not easily achieved in the MKD where the level of intensive production, averaging about 5 mt/ha, is fairly high already. Therefore, different strategies are needed to exploit the advantages of SRI. Although SRI rice has clear environmental and social benefits, those are not of primary interest to the market-oriented producer.

What was done?

Noticing that SRI rice is of a high quality, SRI farmers decided to pursue systematic seed-rice production from the third crop season on. Seed-rice can usually be sold for a higher price than food rice, and the higher quality and purity of seed-rice is achieved through transplanting. In this context, SRI farmers formed a collective group and DARD trained its members on seed purification. The DARD also successfully facilitated the linkage of the group to seed buyers.

What was learned?

- Looking for market linkages for SRI rice should be addressed from the beginning, rather than concentrating on the SRI method in the field only. Stronger market links can be of great benefit to the overall SRI dissemination strategy.
- Economic advantages, such as better quality grain and a higher farm gate price, need to be explored further. SRI rice branding and certification could be long term strategies to receive a higher price in comparison to conventionally grown rice.

7. Conclusion

During the past few decades, agricultural production in Viet Nam was accompanied by adverse impacts on the environment and unsatisfactory results regarding poverty reduction. An increasing population, national agricultural production targets, advanced levels of soil degradation, diminishing economic returns for farmers, increasing water and land scarcity, and climate change effects have all contributed to the enormous pressure now placed on rice cultivators in the MKD. Hence, there is a need for alternative and more sustainable rice production methods.

From the introduction of SRI in Trà Vinh Province, it can be concluded that SRI offers multiple benefits with respect to the above challenges. SRI provides direct economic benefits to the producer through increased yields and profitability. Reducing irrigation water requirements and the need for chemical fertilizer and pesticide inputs constitutes a positive contribution of SRI to environmental management and has helped to reduce pressures on vulnerable ecological systems. The introduction of SRI has also clearly enhanced the resilience of rice cultivation systems against climate risks as it produces healthier and more robust rice plants with deeper, more vigorous root systems. Finally, social empowerment among both farmers and all staff involved was observed. Participating farmers, especially, improved upon their adaptive capacity noticeably as they were encouraged to experiment, evaluate, innovate and share experiences.

The introduction and promotion of SRI in Trà Vinh did not, however, proceed without hurdles to overcome. Most of these hurdles related to a paradigm shift which is fundamental to the understanding of SRI. Introducing and promoting SRI often requires farmers, staff, scientists, and decision makers to re-think current methods, practices and knowledge. Therefore, when farmers adopt SRI for the first time, they benefited greatly from some 'hand-holding' support at each step throughout the crop season as was provided with the FFS. This requires the field staff to be adequately qualified in convincingly explaining and guiding farmers in the SRI method. For them to do so, systematic staff development is necessary, and it is of great help if one or more SRI champions evolve from this process. For those champions to work effectively, political will and support from decision makers is equally important.

Apart from having farmers, staff, and decision makers in place, further conclusions for dissemination and up-



Healthy and large SRI plants.

Photo: ©GIZ/Ngo Vinh Hung

scaling can be drawn. One key constraint to introducing and up-scaling SRI is the high labour requirement during certain steps of the cultivation cycle. This is even higher if direct seeding is already a common practice. Although the future for SRI promotion in the MKD is probably to be implemented in combination with direct sowing, it seems from this project's experience that introducing SRI with transplanting is important to provide a clear understanding of SRI principles. Subsidizing transplanting labour in the beginning reduces the labour burden felt by farmers. Once farmers are confident with SRI, subsidies could be reduced. Depending on the labour situation and considering that transplanting is usually done by women, the establishment of 'SRI transplanting teams' as service providers are a viable option.

SRI promotion seems to be more effective when it is paralleled with trainings on organic farming inputs, like compost and organic pesticides. PARA supported compost making at the end of its project phase and farmers were very enthusiastic about it. Even if they could not produce their own organic pesticides yet, the use of organic pesticides could be a good entry point to getting agro-chemical companies involved.

The Farmer Field School, field harvesting events, as well as many presentations on regional and national events proved excellent opportunities to share and spread SRI experiences among farmers and to outsiders. In the case of SRI in Trà Vinh, this has helped tremendously to bring SRI to the national agenda of improving rice production in the future.

It can be concluded that the promotion of SRI in Trà Vinh Province was an iterative process which exemplified the farmer-led, adaptive approach fundamental to SRI. The experiences in Trà Vinh thus speak to SRI's high potential for application across the MKD.

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