BUILDING EXPERIENCES WITH SRI DEVELOPMENT AND DISSEMINATION IN CAMBODIA(2000–2010)

by Yang Saing Koma (CEDAC/FNN)[1]

The System of Rice Intensification (SRI) is an agroecological innovation in rice cultivation used in Cambodia and in many parts of the world. SRI allows farmers to increase their rice production through a shift in the management of plant, water, soil and nutrients toward a more favorable environment for the growth of rice plants.

Cambodian farmers utilizing SRI techniques over the past ten years have experienced an increase in rice yields from 30 to 150 percent, depending on the farmers' levels of SRI implementation and productivity, and on natural conditions for rice farming. They are also are able to reduce the amount of seeds they use by 50 to 70 percent, and can lessen or end their dependence on chemical fertilizers and pesticides.

SRI was developed in Madagascar in the 1980s by a French Jesuit priest, Henri de Laulanié. CEDAC learned about SRI from the LEISA Newsletter in December 1999 (Rabenandrasana 1999). In 2000, CEDAC received more information on SRI from CIIFAD in the U.S. (Uphoff 1999 and 2000). The organization then introduced SRI ideas to farmers during the wet season of 2000. Twenty-eight farmers, who were initially skeptical, participated in the SRI experiment.

By 2010, due to the success of SRI and support from the national government, more than 130,000 farmers were using SRI concepts and methods. The Cambodian government officially endorsed SRI in 2005, and included it in the national strategy for agricultural development in 2006. The Ministry of Agriculture, Forestry and Fisheries (MAFF) set up a secretariat to coordinate and promote SRI in Cambodia.

This paper reviews the process, activities and experiences in SRI development and dissemination in the country, especially the experiences of CEDAC and its affiliated Farmer and Nature Net (FNN) in advocating for wider support and implementation of SRI as an agroecological innovation in Cambodia.

Data for this paper were from a review of experiences of CEDAC and FNN, and interviews with SRI farmer-pioneers in the villages and SRI promoters from government and NGOs.

Historical, socio-economic and political challenges in implementing agroecological approaches to food security

Around 65 percent (1.8 million families or 9 million individuals) of the Cambodian population depends mainly on rice farming for their livelihood. Most rice farmers are subsistence-oriented, i.e., rice is produced mainly for family consumption and only surplus is sold in the market. A 2009 CEDAC field survey revealed that on average, sixty percent of farmer families produced rice mainly for household consumption, while the rest produced rice surplus for the market.

On average, landholdings for rice farming are about 1.30 hectares, and based on official MAFF data, the national average yield was 2.9 tons per hectare in the 2009-10 season.

Rice productivity has increased in the past 10 years, resulting in the production of surplus rice at the national level. MAFF data reveal rice production increased from 3.82 million tons in 2002 to 7.97 million tons in 2009-10, with the average rice yield for both wet and dry seasons increasing from 1.91 tons to 2.90 tons per hectare. For wet season rice, on the other hand, the yield increase was from 2 tons to 2.5 tons per hectare in the same periods. This increase in rice productivity has been attributed to SRI (EIC, 2011).

With the increasing rice surplus, the government shifted some policies from an emphasis on national food security to potential export markets. The current goal is to export one million tons of milled rice by 2015.

Prior to SRI, the mainstream approach to rice intensification focused on the promotion and proper use of fertilizers, safe use of pesticides or the use of pesticides as a last resort, the use of improved seeds, and the promotion of integrated pest management (IPM). Development programs and projects carried out by MAFF, bilateral aid agencies and NGOs focused on training and advising farmers on the use fertilizers, making compost, and use of improved seeds from the Cambodia IRRI Australia Project (CIAP), Cambodia Agriculture Research and Development Institute (CARDI). This approach convinced farmers and other stakeholders that rice productivity could be increased quickly, reliably and profitably using these techniques. High external inputs with corresponding high outputs were widely accepted as the mainstream strategy for rice intensification.

The introduction of SRI gave small-scale farmers an alternative solution to the high cost of external inputs under the earlier approach. SRI allows farmers to increase their rice productivity at a lower external input cost, and to maintain ownership of local seeds, even as the system enhances soil fertility.

SRI challenges the existing belief about rice cultivation and intensification in two ways. First, many SRI practices are different from commonly accepted practices. Second, SRI is a high-output and low–external input system. It is more about improving knowledge and skills of farmers in managing plants, water, soil and nutrients.

The success of SRI has engendered a more favorable political environment towards its further development and dissemination. As mentioned, the government officially endorsed SRI in 2005. The challenge now is to ensure that SRI is adopted and practiced by as many farmers in different agro-ecosystems as possible.

Contributions to the right to food, right to water, and food security

Interest in SRI among development professionals, researchers, policymakers and even students has increased since the introduction of the system in the country. As mentioned, the government established the SRI secretariat in 2005 to coordinate activities on SRI such as meetings, workshops, exchanges and information sharing through web-based systems.

SRI is highly beneficial to farmers with small landholdings who practice rain-fed agriculture. It promotes the use of local seeds and the management of available water resources more efficiently and productively. As farmers gradually increase seed selection from their own familiar and valued seeds, they can achieve higher yields, thus strengthening their ownership of such seeds.

Increased rice production results in improved access to food by farm households and improved farmers' net income. Table 1 presents a comparison of rice production before and after SRI. (Data came from 107 farmers in Takeo and Kampong Speu provinces).

Table 1: Comparison of rice production before and after SRI [2]

	Before SRI	With SRI (2010)	Remarks
Rice yield	1,921 kg/ha	3,100 kg/ha	61% increase; one farmer achieved a yield of 7 tons/ha
Amount of seeds used	79 kg/ha	37 kg/ha	53% decrease; some farmers still used 2-3 seedlings per clump
Amount of organic fertilizers used	2,260 kg/ha	4,182 kg/ha	85% increase
Amount of chemical fertilizers used	152 kg/ha	42 kg/ha	72 % decrease; 32 farmers stopped using chemical fertilizers

Source: Ung Vuthy (2011)

Rice yields continue to improve annually mainly due to the following factors:

- Improved farmer skills for planting and managing rice with SRI methods.
- Improved seed through continuous selection of good seeds (selecting good panicles and then the good seeds from the good panicles).
- Improved soil fertility through increased organic matter in the topsoil.
- Rice fields are gradually leveled better, contributing to improved on-farm water management.

Development of sustainable family-based rice farming

As mentioned, SRI is an agricultural innovation that relies on better use of natural resources, and on basic agronomic principles and biological processes to increase agricultural productivity while maintaining environmental sustainability, especially soil fertility and bio-diversity. It allows small-scale farmers to achieve higher production and incomes; it also contributes toward developing farmers' capacity and ownership of resources and technologies, and promoting cooperation and mutual help among farmers.
SRI also contributes to environmental sustainability and enhancing farmers' capabilities through:

- Use of local materials for the production of organic manure, including production and use of bio-slurry from cattle and pig manure.

- Growing green manure and trees to increase availability of organic materials (green leaf) for soil improvement.

- Using local seeds which can be improved by farmers on a continuous basis (through seed selection and purification).

- Using available rain water to ensure higher production by developing on-farm water-management systems (ponds and canals in the rice fields).

- Using local skills and knowledge to grow rice and manage soil and water.

Description of SRI approach

SRI aims to create optimal conditions for the growth of ***roots and tillers.*** As root growth increases, so also tillers and grains per plant increase. The basic SRI ideas or principles include:

- Growing healthy, vigorous and **younger seedlings** for transplanting by using **healthy, full-grained seeds** sown in **an upland nursery bed** (similar to that of a vegetable bed).

- **Wider spacing** between each rice plant, preferably with *one seedling per hill and with wider and equal spacing between each hill* in a square pattern.

- **Shallow** transplanting (just 1–2 cm deep).

- Improved **soil aeration** by avoiding continuous field saturation with flooded water.

- Frequent **weeding** to control weed competition and for active **soil aeration.**

- Increased **organic matter** in the soil through application of compost, which along with the soil aeration increases **soil biological activity.**

The recommended SRI practices include: *raised unflooded seedbeds; selecting only good seeds for sowing in the nursery and use of strong seedlings from the nursery for transplanting; using younger seedlings (preferably 8–15 days for the short-term variety, and 8–20 days for medium- or long-term variety) transplanted immediately after uprooting; fewer seedlings and preferably just one seedling per hill; shallow and careful transplanting; wider spacing between plants, preferably transplanting in a square pattern to expose plants more to the sun and air and to facilitate weeding; keeping minimum water levels in the field when transplanting and during the vegetative stage of rice growth; early and frequent weeding (to aerate the soil as well as to remove weeds); and application of compost, as much as possible*.
Some of the above-mentioned practices go against generally-accepted practices. For example, rice farmers are used to transplanting older seedlings (more than one month old), many seedlings per clump (more than five), placing the roots in very deeply when transplanting, and waiting for the field to be flooded with water before transplanting.

Table 2: Key differences between traditional and SRI practices[2]

	Key Practices	Traditional	SRI
1	Nursery preparation	Lowland, it can be flooded	Upland, not allowed to be flooded
2	Density of seed in nursery beds	High seed density	Low seed density
3	Quality of seedling for transplanting	Mixture of all kinds of seedlings	Only thick and healthy seedling are uprooted and transplanted
4	Age of seedlings	Older seedlings, generally more than 30 days	Younger seedlings, younger than 15–20 days, even 8–12 days old
5	Number of seedlings per clump	Many, more than 5 or even 10, mixing strong and weak seedlings	Only 1 seedling as a rule, 2 seedlings are also possible
6	Spacing	Triangular, not equal spacing, close spacing	Equal spacing or planting in rows, with wider spacing
7	Depth of planting	Very deep, more than 3 cm	Very shallow rooted, less than 3 cm, and preferably 1–2 cm
8	Water management	Try to maintain water standing in the field during planting and tillering stages	Maintaining only a minimum water level or keeping the soil moist during planting and tillering stages

The implementation of SRI ideas should be on a step-by-step basis. Generally, farmers implement the following two approaches:

1. Properly implement SRI ideas on a smaller plot to evaluate the results, and yearly expand the size of the field.
2. Implement only simplest and most practical ideas first, then include more ideas or practices. The most common practical ideas farmers initially apply are selecting only good seedlings for transplanting, transplanting only 1–3 seedlings, and shallow transplanting.

SRI ideas are applied not only for transplanted rice, but for direct-seeded rice as well. The process of adaption of SRI ideas to direct-seeded rice is summarized as follows:

For upland rice

Reduce the number of seeds per planting hole to only a few seeds from more than 10 seeds, and shallower planting, plus adding a small amount of compost, and mulching between the planting holes. Rattanakiri and Pursat provinces recorded yield improvements of 25–50 percent under the upland conditions.

For paddy rice

Reduce the amount of seeds from more than 100 kg/ha to less than 60 kg/ha, or change from direct seeding to direct planting of seeds with wider spacing (20–30 cm, depending on variety, timing, and soil fertility). CEDAC is now working on developing SRI under direct-seeded conditions to find out the appropriate amount of seeds to combine with other good practices in a direct-seeded system.

Strategies and activities undertaken to mainstream SRI

In 2000, CEDAC initially introduced SRI to one farmer-innovator; later in the same season, twenty-seven more farmer-innovators participated in the experimentation. The success of this experimentation influenced other farmers in the same village and in neighboring villages to adopt and adapt SRI. It also attracted the interest of local government authorities and officials in SRI. Table 3 presents the progress of SRI adoption/adaption by farmers from 2000 to 2002.

Table 3: Progress of SRI adoption/adaption by farmers in 2000–02

(Yang Saing Koma and Suon Siny, 2004)

	2000	2001	2002
Number of farmers	28	500	3,000
Number of villages	18	122	350
Number of provinces	4	7	11
Average yield (t/ha)	5.0	3.2	3.5*
Average area used for SRI (ha/family)	0.06	0.07	0.30
Total areas under SRI	1.6	28.7	900

Note: Based on the results of a survey of 171 SRI farmers

After three years of experimentation (2000–02), CEDAC was able to get more farmers to test SRI. Also, CEDAC supported and trained selected farmers to become key SRI farmers and farmer-promoters. These farmers played an important role in demonstrating and advising other farmers and other stakeholders on SRI. CEDAC field staff, on the other hand, gained more confidence in introducing SRI to other farmers.

To enable more farmers to use SRI and expand its circle of influence, CEDAC organized SRI farmers into groups and associations, and introduced collective saving to bind them together. These associations linked together to form local networks and a national network, known as **Farmer and Nature Net (FNN)**. FNN played an important role in promoting SRI and farmer interest, especially at the local level.

CEDAC conducted an evaluation study tracking the experience of 120 farmers using SRI for three years (CEDAC, 2004). The data provided a solid foundation for CEDAC advocacy work on SRI. Also, it paved the way for SRI to gain support from the GTZ (German development agency)-funded national food security program, resulting in the commissioning of an external evaluation on SRI (Anthofer, 2004).

CEDAC has been proactive in organizing field visits for high-ranking government officials, including senior officials (e.g., chairperson, vice president and general secretary) of the Council of Agriculture and Rural Development (CARD, chaired by Prime Minister Hun Sen) and the Minister of Agriculture to SRI farms in Tramkok District. The Agriculture Minister learned about SRI prior to the official field visit through the deputy director of the Provincial Department of Agriculture (PDA) in Takeo. Meanwhile, CEDAC was able to get the support of the director of PDA in Kampong Thom and the deputy director of PDA in Takeo for SRI within the ministry.

Highlights of strategies and activities towards the mainstreaming of SRI into national agriculture development policies and strategies include:

- Initial success of SRI experimentation with 28 farmers in 2000.

- PRASAC II, Cambodia Agriculture Sector Support Program (a project funded by the European Union, and implemented by GTZ) engaged CEDAC in introducing SRI in its project area in 2001–03.

- SRI workshop in Prey Veng in January in 2003 with the first visit of Professor Norman Uphoff (CIIFAD) in Cambodia.

- Field visits by senior officials of CARD in 2004.

- CEDAC evaluation study on SRI impacts in 2001–03 with farmers with three years experience.

- Independent evaluation in 2004 funded by GTZ based on random selection of 500 SRI and non-SRI farmers in five provinces (Anthofer, 2004).

- SRI workshop organized by CARD and funded by GTZ in 2004, especially to present and discuss the result of SRI evaluation.

- Establishment of SRI Secretariat in 2005 at MAFF, with CEDAC providing technical assistance and GTZ (now GIZ) providing initial funding support, later on Oxfam America also provided funding support.

- Official exposure trip to SRI in Tamkok district, Takeo, led by the Minister of Agriculture in 2005 after an official endorsement of SRI by the Prime Minister. Since then, the Minister of Agriculture has officially instructed all PDAs to promote SRI throughout Cambodia.

- SRI promotion by the Minister of Environment after the SRI SEED awards by UNDP/IUCN in 2005.

- In 2006, SRI was introduced in the National Social Development Program 2006–10.

- The Minister of Agriculture produced and distributed a booklet on SRI in 2006.

CEDAC was involved in coordinating and facilitating two networks contributing to the promotion of SRI development and dissemination in Cambodia: Promoting Local Innovation Network (Prolinnova), and Network for the Ecological Agriculture Development in Cambodia (NEDC). NEDC is an NGO network. Prolinnova, on the other hand, consists of different stakeholders, including provincial departments of agriculture, agricultural education institutions, NGOs, and Farmer and Nature Net (FNN).

Challenges and responses

There are technical, political and implementation challenges to the adoption of SRI, including:

1. Technological / technical challenges

- **Weeding** CEDAC has been working with farmers and experts to develop simple tools for weeding. It assists farmers to make decisions on investing in weeding through cost and benefit analyses of weeding, i.e., to assess if cost of investment in labor is justified by the expected increase in yield. Mulching can also be a very good solution, as it helps to suppress weeds and covers the soil with the decomposed material adding nutrients to the plant. Field experimentation revealed that mulching could increase yields from 20 to 30 percent over SRI fields without weeding. The difference is bigger under drought conditions, as mulching helps to maintain soil moisture in the field. However, there is still a need to compare SRI fields with weeding to SRI fields with mulching on a wider basis. For mulching, the challenge is how to find sufficient organic materials such as rice straw, rice husks, green leaf and other agricultural residues. Farmers are encouraged to collect these agricultural residues and to grow fast-growing trees and plants to cut the leaves for mulching their fields. It is worthwhile to invest time and labor to collect agricultural residues and to cut green plant materials to mulch the field.

- **Water management** How to ensure that soil has sufficient moisture, when not continuously flooded, is a main challenge, especially as most farmers are growing rain-fed rice. To address this issue, farmers dig canal and furrow systems which can be linked to a pond. During heavy rains, rain water drains into the furrows and canals; in the dry season, farmers can irrigate water from the canals to the rice fields. Such measure requires substantial investments in labor and allocating part of the rice field to be used for water reservoir and dikes. Farmers lose about 15 percent of their rice land for canals and ponds, but their total yield is higher than without the systems. Also, farmers can collect fish and other aquatic vegetables (e.g., kangkon and water lily) from these systems. Raised beds are also possible solutions, as with raised beds the fields can avoid continuous flooding, and water remains available for the roots in between the beds.

- Or**ganic fertilizers** Initially, farmers complained about lack of materials for organic fertilizers and the difficulty of transporting organic matter to their remote fields. Many options are available for farmers to increase the availability of organic fertilizers. These options include the cultivation of green manure, cultivation of fast-

growing trees, increase of awareness on the use of organic matter, maintaning rice stubble rather than burning it and use of bio-slurry.

2. Political and governance challenges

Political and governance challenges center more on the financial support the government provides towards SRI development and dissemination. The lack of budgetary support cuts across all government agricultural extension programs, including SRI, at the national and local levels. The establishment of an SRI Secretariat within MAFF is seen as an important mechanism to mobilize resources and to coordinate the activities to support SRI implementation. Local governments have access to resources, but there is a need to ensure that these governments allocate budget for the training of farmers in SRI. Strong farmers' organizations and networks can play an important role to influence the government at the national and local levels to allocate more resources to support SRI development and dissemination.

3. Implementation challenges

Challenges in implementation center on making people understand SRI ideas and practices and ensuring that SRI opportunities are accessible to a maximum number of farmers. Listening to and reading success stories of SRI farmers are not enough to convince other farmers to engage in the system. Field visits to SRI farms are a more effective strategy.

The main challenges in SRI implementation and dissemination include:

- Identifying pioneering farmer-innovators willing and able to experiment with SRI in a particular community.
- Encouraging a sufficient number of good SRI farmers to be trained to work as SRI farmer-promoters.
- Finding resources to support farmer-to-farmer exchange and cross visits.
- Maintaining support to a community for three to five years before innovation can be widely disseminated to the majority of farmers therein and SRI can develop as a commonly accepted practice among farmers.

Conclusion: Towards a more effective SRI dissemination and implementation

The following lessons from SRI experiences are relevant for future advocacy:

- SRI opens possibilities and options to increase rice production; with SRI, traditional/local varieties can produce more yields than previously thought.
- A group of genuinely interested farmers should be encouraged to participate in the process of innovation development, and regular meetings among farmer-innovators should be conducted to allow farmers to share their experiences and inspire one another. SRI farmers should be associated and form a wider network at the local and national levels in order to expand their circle of influence.
- Good development facilitators who are skilled in assisting farmers to make well-informed decision on the adoption/adaption of new innovation are needed. In the case of SRI, the analysis of improvement options and of the benefits from implementation of such improvements will help farmers to make decisions on the gradual adoption/adaptation of SRI practices and the size of the field to be devoted to SRI.
- In order to influence change at the higher level, there should be a critical number of SRI or ecological farmers in different locations that will develop and apply the innovations successfully. SRI farmers are the best advocates

for policy and strategy changes, as they have firsthand knowledge and experience of the benefits of the innovation.

■■Exposing government decision-makers to farm innovations through field visits and engaging them to meet with farmer-innovators are important.

■■Proactive critical analysis of the impact of the innovation, through internal and external evaluation studies, is also important.

■■Engaging mass media to cover the experiences of SRI farmers can contribute to bringing the message to the wider public.

■■Conducting independent evaluations and widely sharing the results of which in order to reach government decision-makers and funding agencies is needed.

■■Supporting network of like-minded people inside government agencies and CSOs should be done.

■■Support of local governments to SRI is crucial.

Endnotes

1. Dr. Yang Saing Koma is the President of CEDAC (the Center for Studies and Development of Cambodian Agriculture). CEDAC supports the efforts of the Farmer and Nature Net (FNN),which has more than 40,000 members in 1,100 village farm associations. FNN, in turn, is a member of the Asian Farmers Association for Sustainable Development and La Via Campesina.

2. 107 SRI farmers were interviewed in June 2011, who on average had been implementing SRI for five years.

Bibliography

Anthofer, Juergen (2004). Potential of the System of Rice Intensification (SRI) for Cambodia: Consultancy Report for GTZ, Phnom Penh/Spaichingen, April 2004.

CEDAC (2004). Ecological System of Rice Intensification (SRI) Impact Assessment (2001-2003), CEDAC field document, Phnom Penh, May, 2004.

Rabenandrasana, Justin (1999). Revolution in rice intensification in Madagascar. ILEIA: Newsletter for Low External Input and Sustainable Agriculture, 15:3-4, 48-49.

Rafaralahy, Sesbastien (2002). An overview of the system of rice intensification (SRI) in Madagascar. Country report for the International Conference on the System of Rice Intensfication (SRI), Sanya, China, April 1-4, 2002.

Uphoff, Norman. (1999). How to help rice plants grow better and produce more: Teach yourself and others. CIIFAD, Cornell University, Ithaca, NY.

Uphoff, Norman. (2000). Questions and answers about SRI. CIIFAD, Cornell University, Ithaca, NY.

Yang Saing Koma and Suon Siny (2004). An Assessment of Ecological System of Rice Intensification (SRI) in Cambodia in Wet Season 2002, CEDAC Field Document, Phnom Penh, January 2004.

Ung Vuthy (2011). The change of rice production systems with SRI in Takeo and Kampong Speu, CEDAC field document, Phnom Penh, July, 2011 (in Khmer).