Adaptation of the System of Rice Intensification in SRI LANKA

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The ideas for SRI were introduced by Professor Norman Uphoff, Director of CIIFAD, at a farmer meeting in September 1998 in Gal Oya, a large irrigation settlement in a remote district in Sri Lanka. After this, communication continued and information was shared with the political and administrative leadership of the Ministry of Agriculture and Lands. This led to a visit in January 2000 by Joeli Barison, a Malagasy student at Cornell who had a good understanding of SRI, to provide more information directly to researchers, officials and farmers.

At that time I was Senior Assistant Secretary in the Agriculture Ministry. A Deputy Director in my office, U. G. Abeygunawardane, joined me in organizing the dissemination of SRI information. We had the support of the Deputy Minister of Agriculture and Lands (later the Minister of Lands, Land Development and Export Agriculture), the Hon. Salinda Dissanayake, who himself tried SRI methods on his own farm and got involved in promoting SRI countrywide because he saw its good results.

The Ecological Farming Center at Mellawalana operated by a farmer H. M. Premaratna, the Mihidiya Foundation for Research and Development, and several NGOs and farmer groups supported by a small team of officers in the Ministry of Agriculture continue to disseminate information on SRI. The first systematic testing to evaluate SRI was undertaken already in 1999 at the Ambepussa Agricultural Training Centre in the Western Province. SRI evaluation has now been undertaken by the Rice Research and Development Institute of the Department of Agriculture at Batalagoda.

Farmers knowledgeable about rice farming are investing their own resources and assuming any risks themselves to assess the productivity of their land, labor, capital and water inputs using SRI methods. They have sent records of crop yield and cost of production data to my office in the Division for Export Agriculture in the Ministry of Agriculture so that information on SRI can be accumulated and shared.

More than 3,000 farmers in 18 districts are now estimated to be practicing SRI in small plots, about 0.2 ha on average. SRI practice is most prominent in Kurunegala District where the Deputy Director of the Agricultural Development Authority collects information on SRI practice and continues observations. In other districts, officers of different agencies give leadership in disseminating information among farmers according to their own interest since there is no formal directive from the Ministry's extension service to undertake SRI promotion, extension or supervision.

Sri Lanka lies in two agroecological zones (AEZs): AEZ 2 is characterized as warm subhumid tropics, and AEZ 3 as warm humid tropics. It has a tropical monsoon climate, with two monsoons during the course of a year: a southwest monsoon from mid-May to September, and a northeast monsoon from December to February. There are two distinct rice-growing seasons, locally called *maha* (October to February) influenced by the monsoon starting in December, and *yala* (March to September) influenced by the monsoon that begins in May. The latter only covers the southwestern quadrant of the island, leaving the rest of the country mostly dry during this part of the year.

SRI is practiced in all three locally defined AEZs, the dry zone, the wet zone, and an intermediate zone. Average annual rainfall in the dry zone varies from 500 mm to 900 mm, from 900 mm to 2160 mm in the intermediate zone, and from 1260 to >3175 in the wet zone. Average temperatures range from 26 to 28° C in the plains and from 14 to 24° C in the hilly areas.

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The majority of irrigated and drought-prone rainfed lowlands are in the dry and intermediate zones. Ricelands in these zones are located mainly on floodplains and valley bottoms where soils are clayey and the water table is high. Rice is grown mainly in the low humic gley soils and in some parts of the wet zone in half boggy soils. In the wet zone, ricelands are situated mainly on terraced slopes and narrow inland valleys of the highly dissected middle peneplain.

Of the 860,000 ha of riceland, 321,000 ha (42%) are irrigated. The remainder are rain-fed lowlands, with about 25,000 ha of tidal rice along the southwestern coast. Approximately 17% of the rain-fed lowlands are of a favorable type, 74% are drought-prone, and 6% are submergence-prone or submergence-and drought-prone (www.riceweb.org).

Farmers have tried both improved varieties and traditional varieties under SRI. The highest yield recorded so far during the last three years came from the improved variety of BG-403, a four-month variety (15.8 mt/ha) and from *Rathhel*, a traditional variety (9.6 mt/ha).

SRI is not yet been formally accepted by the Department of Agriculture, which is now testing it in one of its agricultural research stations. The Ministry of Agriculture and Livestock takes the view that farmers can try SRI if they want and should decide upon continuation according to the results they achieve. The Ministry is awaiting evaluations from its research station. Meanwhile there is considerable farmer enthusiasm and experimentation. Other government agencies such as the Irrigation Department, Ministry of Lands, the Mahaweli Authority, Agricultural Development Authority, and Ceylon Electricity Board are cooperating in SRI trials throughout the country.

Results

Wet zone (75% expectancy value of annual rainfall >1270 – >3175 mm)

The Agricultural Training Center at Ambepussa, as noted above, did the first trials to compare SRI and the conventional system using a three-month variety of local improved seed in the *yala* season 1999 and a four-month variety in *maha* season 1999/2000. The yala yield achieved was 4.2 t/ha under the conventional system using all prescribed inputs, and with SRI, a low-input methodology, it was 5.9 t/ha. The *maha* SRI yield was 6.2 t/ha, twice the average rice yield for the province under the conventional system, 3.0 t/ha.

In the wet zone district of Colombo where paddy farming has been declining due to low returns and high labor requirement, 135 farmers practiced SRI during maha 2000/2001 and only two farmers got yields lower than what they used to get under the conventional system (communication at a review meeting with data from the Deputy Director, Agricultural Development Authority, Colombo District). Data from a sample of 16 farmers showed the following results:

	Average Yield	Minimum	Maximum
Before adopting SRI	2.7	0.6	6.6
With adoption of SRI	4.7	0.6	13.1

Intermediate zone (75% expectancy value of annual rainfall >900– >2160 mm)

The first SRI yield recorded at the Mellawalana Ecological Farm operated by farmer H. M. Premaratna in yala 1999, using BG-403, a four-month improved variety from Batalagoda Research Station, was 15.8 t/ha. This encouraged him to begin training other farmers in this methodology because of its environmental as well as economic advantages.

Yields reported by 112 farmers in seven Agrarian Service Center Areas of Badulla district in the intermediate zone were as follows:

Average Yield	Minimum	Maximum
7.7 mt/ha	5.7 mt/ha	15.2 mt/ha

Dry zone (75% expectancy value of annual rainfall >500 – >775 mm)

The Agriculture Division of the Department of Census and Statistics confirmed the following results from a crop-cut survey on 10 SRI farm plots in Kurunegala District in the northwestern dry zone.

Table 1. Average yield with SRI system, Kurunegala District, Yala 2001 (N=10)

SCHEME	Average Yield	Std. Error	95% Confidence limit Lower	95% Confidence limit Upper	Sown Area (ha)
Major Irrigation	9.2	1.2	6.9	11.5	2.4

Agriculture Division, Department of Census and Statistics

Island-wide results

Reports from 17 farmers in five districts falling in all three agroecological zones (dry, intermediate and wet) during *yala* 2001 produced the results in Table 2.

For purposes of comparison, consider that the country's current average yield (2002) is 3.8 t/ha. Under major irrigation schemes in the Mahaweli System, average yields of 4.5 to 5 t/ha have been achieved.

Table 2. Anuradhapura, Polonnaruwa, Puttalam, Kegalle and Matara Districts (t/ha)

	Average Yield	Low	High
Before SRI	3.1	0.9	4.1
With SRI	7.6	4.1	11.4

Costs of Production

In Sri Lanka, the average cost of production of a kilogram of paddy in 2000 has been calculated as Rs. 10.58 with conventional practices, which include considerable application of inorganic fertilizers and agrochemicals. SRI farmers have reported that their cost of production is usually less than Rs. 5 per kilo. Some of the savings come from using less seed paddy (10 kg/ha, instead of 100 to 250 kg/ha with conventional practices), from not having to plaster their bunds to retain water (a saving of Rs. 4,200/ha), and from not applying biocides, either weedicides or insecticides, a very costly operation. Their extra cost of hired labor for SRI was compensated by these other cost savings.

In 2000-2001, a group of farmers at Namalthalawa in the rice growing area of the Eastern Province did measurements and calculations comparing their observed SRI performance with that of alternative cultivation methods. With their usual practices, the yield was 2.9 t/ha; with the government recommended package of practices, utilizing new varieties and fertilizers, 4.7 t/ha, and with SRI, 8.5 t/ha. The average depth of rooting they measured as 2, 3 and 9 inches for rice grown under the three systems, respectively. Their costs of production per kilogram of rice were calculated to be 6 Rs. for usual practice, Rs. 5.65 with the government package, and Rs. 3.00 with SRI. A farmer in Kurunegala District compared his costs of production and found that with SRI they were Rs. 4.35/kg, while they were 9.35 Rs/kg with the conventional system.

Since the **quality** of paddy under SRI grown without biocides is considered higher, using much less chemical fertilizer and with a higher filled-grain ratio, farmers have reported that they can sell their paddy as seed which fetches a higher price. Recently, we have reports that millers are offering a higher price per bushel for SRI paddy and some are even offering to buy a SRI crop while still standing in the field. A recent development is that farmers adopting SRI are using traditional seed varieties of rice which have better taste and aroma and also red rice with bran for export to Europe as "eco-rice." These farmers report receiving Rs. 40 to 60 per kg of rice, compared to the current market price (wholesale) for rice of Rs. 25-30/kg.

Water Use

Water use with SRI is quite evidently less, and most farmers report it to be less than 50% of the conventional system. A group of farmers in Moneragala District reported that the SRI plot experimented used only 13 irrigation turns of water while the farmers using conventional practices needed 26 turns of water.

Labor

Farmers use more labor days in certain operations with SRI, mainly in transplanting and weeding at the beginning of their adoption. However, they use less labor with SRI once they get experienced with these operations. Transplanting fewer seedlings, even carefully, can take less time than standard transplanting practice once farmers have gained skill and confidence in SRI techniques. One farmer who tried both systems recorded his experience during yala 2001 as follows:

	Conventional System		SRI	
	Labor (days)	Cost (Rs.)	Labor (days)	Cost (Rs.)
Raising bunds and plastering	5	1000	-	-
Transplanting	15	2250	15	2250
Weeding	15	2250	16	3200
Total	35	5500	31	5450

If one counts the saving of labor from not having to spray agrochemicals (as many as four sprayings a season when following recommended practice), the difference becomes greater. His returns to labor become much greater with SRI. With the conventional system, his production was 2,205 kg of paddy, valued at Rs. 28,665, whereas his production with SRI was 3750 kg, valued at Rs. 49,140. The increased labor cost for the main SRI operations was 14%, but the total return from SRI was 71% higher than with conventional practice.

Farmers' own data has shown that by adopting SRI in Sri Lanka, there are potential increases in roots, tillers, nutrient uptake, plant growth, plant resistance (less attractiveness to pests), grain filling, and higher yield under a broad range of agro-ecological conditions compared to what they can produce with the conventional system. How SRI could be practiced on a larger scale is to be demonstrated by farmers who have gained experience with the methods.

Information extracted from data collected from 135 farmers adopting SRI on small plots in 18 districts during *yala* 2000 revealed that they are planning to extend the area under cultivation in 2001 in all but one district. The land that these farmers had under SRI in *yala* season was 51.4 ha; they planned to put 80.1 ha under SRI in *maha* 2001/2002. This indicates that SRI has become attractive and practical to those farmers who practiced it on small parcels of land on a voluntary experimental basis.

SRI evaluations in Sri Lanka have come mostly from farmers since the research stations would not undertake systematic evaluations of SRI in the absence of a formal directive. Dissemination of SRI has accordingly been through farmer-to-farmer communication and promotional work by a small team of officials working with farmers for development communication. This team has been well supported by numerous officers at various levels in the districts and sub-districts who have seen the benefits achieved by farmers who practiced SRI.

Learning

Since there was no formal extension service supporting SRI in the districts, the biggest difficulty that SRI farmers report is **obtaining weeders** at the time they need to weed. Although more than 1,000 weeders have been produced and distributed, some farmers who adopted SRI using information from a newspaper article or pamphlet experienced difficulties in using it correctly. However, farmers now report getting over such difficulties by practice. Two farmer companies and local craftsmen are producing and distributing weeders at present.

A new weeder design developed by H. M. Premaratna is producing an implement that can weed much more quickly. A hectare can be weeded in as little as 2.5-4 days, instead of 20 days or more, because it does not get clogged with mud and can be simply pushed down the rows, not requiring a pushing and pulling movement. This could be a technology advance that will make SRI much more adoptable by farmers of all sizes.

A second problem of farmers who cultivate in major irrigation schemes is **inadequate time for land preparation** and to raise seedlings due to the short notice they are given on water issues from the irrigation system. Getting adjusted to the agreed irrigation interval, however, has not been a problem for them.

Some farmers who cultivate under rain-fed conditions experience **difficulties in following the required water management practices**. They tend to be reluctant not to take as much water as possible when it is available, feeling uncertain about future water availability. Over the past four seasons, however, farmers have found their own solutions to these problems.

Farmers' own solutions show that SRI can be adapted by them to the conditions under which they operate. These changes include **direct seeding** where time and labor was thought to be a problem; **changing plant spacing** depending on their ability to drain their fields as required; the **type of seed** used; using **various combinations of chemical fertilizer and compost**; and the using various **preparations of plant extracts to repel pests**. The latter cost less and are better for the environment and human health by avoiding synthetic chemical applications. In general, farmers who practiced SRI have tried to follow the principles to the extent possible.

The most important gain from SRI as farmers have understood and used it has been its **resilience to the vagaries of weather** that farmers have to face every season. Under drought conditions as well as under flooded conditions, farmers have found that SRI gives them at least some production even when rice fields cultivated conventionally fail due to the deeper root structure that SRI practices promote, absorbing moisture and nutrients from a much larger rhizosphere. A comparison of SRI and non-SRI fields side by side during a period of drought dramatically favors the former. Recently, two farmers have demonstrated the possibility of saving SRI crops under drought conditions by using sprinklers with a small volume of water.

By weeding and aerating the soil, SRI allows farmers to give a boost to plant growth and tillering. Farmers also see the advantage of maintaining biodiversity in their fields, increasing predator populations so that the use of biocides can be avoided and the use of chemical fertilizer can be reduced. A healthy plant gives a healthier, cleaner product, something that farmers now believe that they can achieve with SRI.

If there is formal recognition and approval by the Department of Agriculture, dissemination of SRI can be accelerated several-fold in the country. At present,

dissemination is carried out with few resources, depending mostly on farmers' own resources. This has made it difficult to undertake systematic evaluation on certain aspects of SRI relevant to scaling up production with these methods.

Prospects

Rice is the staple food of Sri Lankans, and the country has been importing a declining quantity every year to meet food security needs. Rice production provides livelihood to thousands of farm families who make up the 40% of the population engaged in agriculture. The annual per capita consumption of rice is about 100 kg, which represents 75% of total grain consumption. Some 40% of total calories are derived from rice. Rice farmers derive about 50% of their total income from rice cultivation.

Yield stagnation and the high cost of external inputs have made rice production an unattractive venture to be engaged in full-time. There is need for practices that reduce costly inputs and increase the productivity of land and water so that paddy can be grown profitably. SRI addresses these needs by demonstrating to farmers that they can increase the productivity of their water, land, labor and capital simultaneously without sacrificing any one factor to gain from another. Also, farmers have realized that by using SRI, they can increase the yields of traditional varieties of high quality for which there is an increasing export market. SRI farmers in Sri Lanka have already started exploiting this market. This will help to maintain the biodiversity of rice species within the country.

Information on SRI practices of Madagascar farmers, and later by Sri Lankan farmers in different agro-ecological regions, has been presented as part of development comunication efforts through pamphlets, through the Ministry's newspaper publication distributed in 18 districts, and through live telecast in national TV twice and live broadcast over national radio twice. Call-in radio shows have been most interesting medium for communication as SRI users have spoken out very strongly in its favor.

The most effective means of communication have been presentations of the principles and practices of SRI using multi-media presentations at farmer meetings and farmer-to-farmer interactions promoted mainly through the Ecological Farm of H. M. Premaratna who has provided training on SRI to more than 3,000 farmers.

Support of the political leadership was gained from a realization of the benefits farmers could get from SRI. It was presented to the scientific community through several national-level seminars and national newspapers. Premaratna's Ecological Farm was provided with display equipment for information dissemination and my efforts with Mihidiya Foundation for conducting a national seminar on SRI were supported by CIIFAD.

In January 2002, the Sri Lanka Association of Advancement of Science (SLAAS) conducted a national seminar on SRI sponsored by its Agriculture Division. A large number of public officials are working closely with farmers on a voluntary basis to support information dissemination and to provide assistance within their capacities. Several NGOs and farmer groups continue to share information and experience among farmers. The Mellawalana Farm takes the lead in this.

The present Minister of Agriculture and Livestock has recognized that the continued adoption of SRI by small farmers will increase productivity on small plots and supports farmer efforts with emphasis on producing organically grown traditional rice ("wild rice" or "eco-rice") for export. The Ministers of Lands and Irrigation and of Mahaweli Development have also been supportive.

Since there is no formal approval for SRI yet from the Department of Agriculture (DOA) and since the Department is the agency responsible for any effects of such recommendations, there is no officially supported extension effort yet. The DOA is awaiting a recommendation from its Rice Research Institute. This institute takes the position that SRI would not be practical for farmers due to its water management requirements for intermittent wetting and drying during the growth period which could cause difficulties to farmers given uncertainty in the rainfall pattern. It also holds that SRI is not practical due to the high labor requirements for transplanting, weeding, and crop care.

These are empirical questions, however. They will be answered ultimately with experience gained by farmers on their own fields. New methods for gaining control over water are being devised by farmers, and some are now finding that once they master its techniques, SRI can be a labor-saving methodology. The biggest impediment at present is a lack of support to undertake participatory action research that systematically evaluates SRI in farmers' fields and that documents results so that more projections and adaptations can be made for SRI in Sri Lanka.