The Practice of the System of Rice Intensification in SIERRA LEONE

Abu Yamah, World Vision/Sierra Leone[1]

Environmental degradation caused by the traditional practice of shifting cultivation in Sierra Leone has increasingly necessitated utilization of the lowlands, particularly the inland valley swamps, for rice production. Rice is the preferred staple food in Sierra Leone, but its production is inadequate as the current average lowland rice yield is just 1.5 t/ha. Most households do not have access to as much rice as they would like, so root crops are a major source of calories. Because of many years of domestic conflict, infrastructure and supply systems have been badly disrupted, and poverty and hunger are pervasive. A methodology for growing rice that can give increased production with no requirement for purchased inputs would thus be particularly beneficial to our food-insecure population.

SRI was introduced in 2001 to selected groups of farmers in eight communities in southern Sierra Leone as a production system that can give better utilization of land and water resources. This process was initiated by the late Hilton Lahai, a senior research coordinator for World Vision/Sierra Leone (WV/SL), who made a study tour to Madagascar in November 2000 to learn about SRI. There he was hosted by Association Tefy Saina (ATS), an NGO actively involved in the promotion of SRI.

Process of Introduction

On-farm demonstrations of SRI practice

Eight farming groups, each consisting of 20 members, were established for participation in on-farm demonstrations of the SRI methodology in southeastern Sierra Leone. Each of 8 groups worked alongside WV/SL field-based extension agents in establishing two inland valley rice plots. One plot was planted to SRI, with 10-day old seedlings, a single seedling per hill, and spaced 25 cm, while the other plot was planted using farmers' practices, with 30-day old seedlings, multiple seedlings per hill, and irregular spacing. Both local and improved varieties were used.

Both SRI and farmers' seedbeds were prepared with two passes of a field cultivator with an attached harrow. Both seedbeds were kept moist but not flooded throughout the vegetative period. After flowering, the fields were kept in saturated condition, but were again not flooded. The fields were gradually drained between the ripening and harvesting period. Weeds that emerged after transplanting were uprooted by hand and buried into the soil at 4 weeks after transplanting and at 7 weeks. No fertilizers were used. Rice yields were determined by harvesting sample areas of 5 x 5 m^2. Harvested grains were dried, cleaned, and weighed. Panicle counts from the culms with fertile panicles were taken from the harvested area.

Factorial trials

Treatment combinations varying the factors of seedling number per hill, seedling age, and plant population were also evaluated during 2001. Plots were planted in a randomized complete block design in multiple locations. The variety used was Suakoko 8, an iron toxicity-tolerant, medium-duration variety. Control treatments were the same as above.

Agronomic conditions for both the on-farm and factorial trials were representative of the often difficult conditions for growing rice in Sierra Leone. The major rice soils in southern Sierra Leone are:

- Sandy-loamy —valley bottom soils, with low water retention and common P deficiency .
- Loamy clay — valley bottom soils, relatively more fertile, with good production potential, and high water retention.

[1] *Agriculture Manager, World Vision Sierra Leone, PMB 59, Freetown, Sierra Leone. Email: abu_yamah@wvi.org*

- Peaty soil— high in organic matter, with iron toxicity and drainage problems.
- Organic silty clays — found on river flood plains, with high percolation rates, subject to annual flooding, characterized by high silt and humus deposition.

The main feature of the climate is the heavy rainfall, with total precipitation averaging 2,500 to 3,500 mm per annum. The rainy season is monomodal, lasting from April to November. Southern Sierra Leone is characterized by high temperatures throughout the year with a mean of about 27^0 c.

Results

The results of the on-farm demonstration of SRI practice are shown in Table 1. The average tiller number was 77% higher with SRI practices compared to tiller numbers with farmers' methods. Plant vigor was also noticeably higher with SRI than with farmers' practice. On some of the fields, up to 69 tillers were produced per hill with SRI. No significant difference was observed with SRI management in vegetative performance between the improved rice selection used (ROK 10) and local rice varieties (Wusui, Patae or Peipei).

With SRI, the average number of panicles produced per hill was three-fold, irrespective of the variety used. Grain yields were doubled with SRI compared with farmers' techniques even though no external inputs were used.

The results of the factorial trials at 11 locations are presented in Table 2. The full SRI plots had a comparatively higher tiller count per hill due to the combined factors of seedling age, number, and spacing.

Compare these results with the current average lowland rice yield obtained by farmers of 1.5 t/ha. With full SRI methods or a combination of single, young seedlings and wide spacing the yield was about 6.72 t/ha, a four-fold increase over farmers' traditional practices. With even partial SRI, there was almost a two-fold increase in grain yield over the national average.

The average yield obtained with multiple, older seedlings at wide spacing — but grown in soil kept weed-free and moist but not flooded throughout the vegetative phase — was higher than usual yields in Sierra Leone where there is less effort made to control weeds and no efforts to have aerated soil. Thus simply adopting the soil and water management practices of SRI could give a definite improvement in yield. The plant management practices add even more. For evidence of the synergistic effects of SRI practices used together, see Table 3.

Learning

With SRI there was about a 25% reduction is the quantity of seeds used to plant a given area. Farmers can thus make substantial savings in seed needed, and seed wastage can be minimized. However, more man-hours are required for handling and transplanting tiny, fragile SRI seedlings. As one farmer observed "planting only one seedling and [having] several tillers emerge from that seedling is magic. I would love to see how much rice would be obtained from this plot."

Table 1. Yield and yield components of rice grown with SRI and farmers' practice, Sierra Leone, 2001

	SRI techniques (N=8)[1]		Farmers' techniques (N=8)	
	Mean	Range	Mean	Range
No of hills/m^2	16	10–25	52	42–64
No of tillers/ hill	38.1	20–69	8.6	8–9
Panicles/hill	28	20–45	6.5	6–7
Spikes/panicle	122	118–149	95	83–120
Yields (t/ha)	5.3	4.9–7.4	2.5	1.9–3.2

[1]*These data are from the reports from eight groups, each having 20 members.*

Table 2. Rice yields (t/ha) in response to production techniques, Sierra Leone, 2001

Combinations of production techniques	Average grain yield (t/ha)
Single seedling, 10 days old, 25 cm spacing	6.72
Single seedling, 10 days old, farmers' spacing	4.56
Single seedling, 21 days old, 25 cm spacing	4.42
Single seedling, 21 days old, farmers' spacing	4.09
Multiple seedlings, 10 days old, 25 cm spacing	4.35
Multiple seedlings, 10 days old, farmers' spacing	4.37
Multiple seedlings, 21 days old, 25 cm spacing	4.39
Multiple seedlings, 21 days old, farmers' spacing	3.97

Table 3. Increments achieved with combinations of SRI practices
(SRI practices in **boldface**; yield and comparisons in t/ha)

	Practices			Yield	Comparison
Traditional practice	MS	21	FS	3.97	0.00
One SRI practice	**SS**	21	FS	4.09	+0.12
	MS	**10**	FS	4.37	+0.40
	MS	21	**25**	4.39	+0.42
Average				4.28	+0.31
Two SRI practices	MS	**10**	**25**	4.35	+0.38
	SS	21	**25**	4.42	+0.45
	SS	**10**	FS	4.56	+0.59
Average				4.44	+0.47
All SRI practices	SS	**10**	**25**	6.72	+2.75

Key: MS=Multiple seedlings/hill; SS= Single seedling/hill; 21=21-day-old seedling; 10=10-day-old seedlings; FS=Farmer spacing; 25=25x25 cm spacing.

Note: Water control was maintained as best as possible for all plots; Weeding also was not a variable in these conditions.

The performance of the seedlings in the SRI plots was very good when tiller production and other yield attributes are considered. Lower tiller production on the farmers' practice plots was probably because the older seedlings may have spent part of their tiller production phase in the nursery.

Maintaining water in the rice plots at less than saturation level enhances tiller production and ensures plant nutrient uptake and utilization.

Weed re-growth was higher in the SRI plots compared to those farmers' practice. Weed infestation was minimal in the farmers' plots because they remained submerged under flooded water. Two or more weeding regimes were required in the SRI plots.

Most farmers in Sierra Leone plant late, weed late, or sometimes do not weed at all. Farmers experience labor bottlenecks during critical periods of farm operations like transplanting and weeding. The use of a rotary weeder could help to ease labor shortage during weeding.

Prospects

There is now some, albeit limited, understanding of SRI practice in Sierra Leone. Some of the farmers who participated in the demonstrations have shown interest in this innovation, but are worried about weed infestation in the SRI plots. There is need therefore to understand the timeliness and frequency of weeding with a view to identifying the critical weeding times for SRI. There is need to also promote the local fabrication and use of mechanical hand weeders.

The farmers observed that many hands were needed to perform critical operations like transplanting and weeding. Better training to help farmers perform these operations more quickly and easily will be important for SRI's spread. There is need further to investigate the economics of rice production with SRI so that farmers can know just how much benefit can be obtained from these practices.

The higher yields reported from the SRI plots were under the native fertility of the soil. A next step will be to work on improving soil fertility by adding nutrients from organic and/or inorganic sources. Farmers are eager to know whether or not there is a difference with SRI results when fertilizer is added and when it is not. If yes, they would like to know what is the economic rate of application? Improved understanding is needed of the effects of organic and inorganic fertilizers on SRI yield.