INDONESIA

3 Years Experiences of SRI (System of Rice Intensification) under SSIMP-DISIMP in Eastern Indonesia*

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Introduction

The System of Rice Intensification (SRI) is an innovative paddy cultivation method to attain high paddy yields with low re source utilization of inputs, such as water and fertilizers. In recommending simple changes in cultivation practices only, such as planting single, younger seedling at wider spacing, with intermittent irrigation and without impounding, the SRI method sounds too good to be true.

However, increasing evidences from field tests and practices suggested that SRI was as productive and as beneficial as its claims[1]. Though the SRI method has already produced remarkable results in many countries, it is still not well known yet.

Since 2002, SRI method has been tested and demonstrated in irrigation schemes of the former Small Scale Irrigation Management Project (SSIMP-I to-III) and the SSIMP's current successor Decentralized Irrigation System Improvement Project in Eastern Region of Indonesia (DISIMP- SSIMP-IV). Japan Bank for International Cooperation (JBIC) helped finance the project.

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1. Uphoff, 2004

In order to contribute to a better understanding of SRI, this report presents general introductory information on the SRI method and reviews field level practices based on the experiences in SSIMP-DISIMP areas from 2002 to 2005. It will be followed in the future with a more detailed review and assessment of possible approaches to extending the SRI methodologies in other irrigation settings and SRI implications on irrigation organization and management.

Outline of SRI

General

SRI was developed initially during the 1980s by French priest, Fr. Henri de Laulanié, S.J. in Madagascar in 1961. SRI or "systeme de riziculture intensive" first appeared in his paper in the journal *Tropicultura* in 1993. SRI became popular in the world through the efforts of Norman Uphoff, Director of Cornell International Institute for Food, Agriculture and Development. In 1997, Uphoff made a presentation on SRI in Indonesia. It was the first opportunity that SRI was presented outside Madagascar. In 1999, SRI was first practiced in China and Indonesia. Today great results of SRI practice have been confirmed in about 20 countries with paddy yields averaging at 7-10 tons/hectare.

Paddy yields of SRI as reported in 12 countries are shown below.

Table 1. Paddy Yields of SRI Comparing with Non SRI by Country (Uphoff 2004)

Country	Yield t/ha	Country	Yield t/ha	Country	Yield t/ha	Country	Yield t/ha
Bangladesh	6.3 (4.9)	Cambodia	4.8 (2.7)	China	12.4 (10.9)	Cuba	7.4 (4.3)
India	8.0 (4.0)	Indonesia	7.4 (5.0)	Madagascar	7.2 (2.6)	Myanmar	5.4 (2.0)
Nepal	8.5 (4.2)	Philippines	6.0 (3.0)	Sierra Leone	5.3 (2.5)	Sri Lanka	7.8 (3.6)

Basic SRI Concepts

The basic concepts of SRI are unique transplanting method using a single young seedling with wide spacing and water management through intermittent irrigation and no impounding.

Transplanting method:

In order to create healthy and strong transplanted seedlings with multiple tillers of 30 to 50 per seedling and having larger and more numerous panicles, the following practices are recommended:

- Transplant seedlings at a younger age or before 14 days after seeding using only 2 or 2.5 leaves. This preserves the potential of original seeds nourishment by around 40-50 percent and thereby, optimizes the potential for tillering and root growth.
- Transplant single seedling at each location.
- Widen the space interval of transplanting at 30 cm x 30 cm or more to provide room for enhanced root and tiller growth. This also maximizes the capacity of the plant to develop soil fertility and absorb nutrients from the sun.

Water management:

Apply intermittent irrigation to keep the soil moist and aerated periodically, at least during the vegetative growth period. Aeration of soil allows aerobic and anaerobic bacteria to contribute to plant growth. Consequently, the growing paddy is durable against wind and pests and irrigation demand decreases by about 40 percent on the average.

Application of organic matter or compost materials to the soil is recommended to help achieve sustainable SRI cultivation practices. Organic matter be any decomposed biomass like rice straw and weeds.

Research on Young Seedling and Mechanized Transplanting in Japan

Since 1970s, a lot of field tests and researches on young seedlings in Japan were done to reduce labor requirements and costs for nursery preparation and transplanting of paddy.

Table 2. Definition of Rice Seedlings in Japan

Nursling	Young		Middle	Matured
Number of leaf (age)	1.5 - 2.5	3.0 - 3.5	4.5 - 5.0	5.5 - 6.5
Height of seedling (cm)	7 - 9	10 - 13	13 - 15	15 - 18
Remaining nutrition in albumen (%)	±50%	< 10%	0	0
Days after seeding (days)	5 - 7	20 - 22	33 - 35	45 - 50

Note: The names of Nursling Seedlings were defined by the Ministry of Agriculture of Japan in 1990.

Japan's research on the characteristics of nursery seedlings started in 1940 and continued in 1990. The results of the research on nursery seedlings proved that the SRI practice is a correct way to maximize plant development and achieve optimum yield and quality of rice.

General Results Associated with SRI

Benefits

SRI reduced the water requirements by about half since paddies need not be flooded during the entire crop cycle. Water was reduced even more during the vegetative growth phase and only a minimum water level was kept in the field during the reproductive phase. The need to economize water use will become increasingly important in the agricultural sector.

The other benefits of SRI were reduced lodging, fewer pest and disease attacks and lower or zero expenditures for agro-chemicals, savings on seeds because the farmers do not need to purchase new seeds. The farmers had lower production costs, reduced the risks on rice plants, higher farm productivity therefore, higher profitability in SRI.[2]

Problems

SRI implementation also had its challenges and potentially adverse impact on the farmers.

Proper and efficient water management required increase in labor input. Careful control of water spill into the farm was necessary to ensure desirable wet condition of the plot. Controlled overspill onto the next plot required additional work in farms with plot-to-plot irrigation. Heavy rainfall during the drying period of the wet and dry irrigation cycle required special.

Weeding required more labor burden as well because SRI needs more intensive weeding. The plots need to have alternating wet and dry periods to create better conditions for grass and weed growth.

Production of organic fertilizer entailed additional work. The organic fertilizers made of stalks will prevent soil depletion with some additional compost.

2. ibid

SRI and non-SRI rice

On the other hand, these labor requirements provided job opportunities in the rural areas. In particular, organic fertilizer production will create new livelihoods as SRI is spreading out and widely being practiced.

SRI in Indonesia

The Agency for Agricultural Research and Development (AARD) began to test and evaluate SRI at its rice center in Sukamandi, West Java in 1999. The paddy yield was reported as 6.2 tons/hectare while the control yield was only 4.1 tons/hectare. The following wet season yielded 8.2 tons/hectare on the average with one plot reaching as high as 9.2 tons/hectare[3].

In 2002-2004, the Ministry of Agriculture promoted a new program, "Improvement of Farm Intensification Quality (PMI)" for 200 locations with one in each Kabupaten in 29 provinces. It aimed to increase farmers' income and strengthen farmer group activities. Its work included provision of farm inputs, hand tractors, and farming capital as a revolving credit fund to the farmers' groups.

The program also introduced new farming technology under the Integrated Crop Management and Development Program (PTT) with

3. Gani, A., 2004

the SRI method as a core technology. The 200 locations of PMI implementation covered 500 hectares per site. The PTT involving full support of farm inputs was carried out only in 5 hectares of each location.

The project's final report has not been submitted yet. However, according to interviews with the staff involved in implementing PTT in South Sulawesi and NTB, SRI failed to live up to its expected results due to insufficient technical guidance on the farmers. In fact, the PTT program was done without any coordination with the local extension offices in its target locations.

Leading agronomist/farmers in Kabupaten Ciamis, West Java first practiced SRI in 2000. The efforts of the group made the planting areas of SRI expanding steadily in the West Java province. In 2004, the total area of SRI reached to 402 hectares involving 3,000 farmers. The entire SRI areas in West Java used only organic manures.

SRI implementation in other areas in Java is still in limited, small scale. The consultants of SSIMP-DISIMP promoted SRI cultivation since 2002.

Table 3 shows comparison of rice cultivation method of SRI and Non SRI in Indonesia and Japan.

Table 3. Comparison of Rice Cultivation Method

Description	Conventional		SRI or BST Japan	
	Indonesia	Japan	SRI	NST
Transplanting method	Manual	Mechanized	Manual	Mechanized
Seedling				
a. Days after seeding (day)	25 - 30	21	8 - 14	5 - 7
b. Number of leaves (no.)	5	3 - 4	2.0 - 2.5	1.5 - 2.0
c. Height of seedling (cm)	25 - 30	12 - 15	10 - 12	7 - 9
Number of seedlings by location (no.)	4 - 5	4 - 5	1	3 - 4
Spacing				
a. Row (cm)	25	30	30	30
b. Line (cm)	20	18	30	18
c. Density of seedlings (nos/sq.meter)	20.0	18.5	11.1	18.5
Water management	Ponding	Intermittent	Intermitt-ent	Intermittent
Unit yield of paddy (t/ha)*	4 - 5	7 - 9	7 - 9	7 - 9

* Dried un-husked rice with 14 percent moisture content

SRI under DISIMP

General

DISIMP started introducing SRI in 2002 as a substantive measure help promote irrigation improvements and strengthen farmers' groups. The first selected locations were the Awo Weir Irrigation scheme (SSIMP-II) in South Sulawesi, with a trial plot of 0.2 hectare, and the Tiu Kulit Dam Irrigation scheme (SSIMP-I) in West Nusa Tenggara, with a trial plot of 1.5 hectares. During the 2004-2005 cropping season, the SRI trial areas expanded to 327.4 hectares in South Sulawesi and up to 34.5 hectares in West Nusa Tenggara. These areas are continuing to expand to cover a larger area and more irrigation schemes.

DISIMP adopted SRI practices and conditions as demonstrated below.

Farm plot: Plot-to-plot irrigation farm within DISIMP covered areas Rice varieties: IR-64, Ciliwung, Ciherang and Membramo

Transplanting method: Single planting of young seedling, 8-14 days after seeding with a spacing of 30 cm x 30 cm between seedlings

Water management: Intermittent irrigation without standing water. Wet-dry cycle was different according to location's soil type, shape and size of lot, amount of rainfall, and availability of irrigation water.

Land preparation: Several practices were adopted for puddling and leveling of the plot. Small ditches were dug by farmers along the ridges and center of the plots for efficient intermittent irrigation and draining

Fertilization: Organic material was not applied yet and chemical fertilizers continued to be utilized

Weeding: Weeding was conducted two to three times per crop season.

Table 4. SRI Practice in DISIMP Schemes for 2004-2005 Cropping Season

DISIMP Irrigation Scheme		Transplanting		Water Management		Weeding (times)	Fertilizer Application (kg/ha)				TOTAL
		Seedling (day)	Spacing (cm)	Moist (day)	Dry (day)		Urea	TSP	KCL	ZA	
South Sulawesi											
1	Awo	10-13	30 x 30	7	4	3	200	50	50	50	350
2	Salomekko	10	30 x 30	10	3	3	250	0	0	50	300
3	Kelara Karalloe	10-14	30 x 30	10	3	2	175	62	50	50	337
4	Kiru Kiru	10	30 x 30	10	3	3	200	75	50	75	400
5	Sadang	9-10	30 x 30	10	3	2-3	225	60	50	50	385
6	Lanrae	10	30 x 30	10	3	3	200	75	50	75	400
West Nusa Tenggara											
1	Tiu Kulit	8-12	30 x 30	6	12	2	210	83	0	0	293
2	Batu Bulan	8-12	30 x 30	5-6	10-13	2	150	80	0	0	230
3	Mamak	8-12	30 x 30	4	6	2	200	50	0	0	250
4	Jurang Sate Hulu	8-12	30 x 30	3	7	3	250	100	25	100	475
5	Jurang Baru	8-12	30 x 30	3	7	3	250	100	25	100	475

Note: TSP-Triple Super Phosphate, KCL-Kalium Chloride , ZA-Ammonium Sulphate

Results of SRI Practice

The paddy yields in dried un-husked rice of the SRI practice in SSIMP-DISIMP areas are shown in Table 5 (next page).

The yield-enhancing capacity of the SRI cultivation method was highly successful and achieved an average paddy yield of 9.6 tons/hectare in South Sulawesi province, and 8.53 tons/hectare in West Nusa Tenggara province. The average yield increments of SRI areas compared to adjacent non-SRI irrigated fields was 4.67 tons/hectare in South Sulawesi and 4.52 tons/hectare in West Nusa Tenggara. These showed an average enhancement of rice productivity of 93 percent.

However, the yield figures of farmers using SRI in the two provinces cited above were similar to the average yield of non-SRI practitioners across the different provinces of Indonesia. Thus, the merits of SRI appeared to be almost the same across the country.

Table 5 Average Paddy Yield with SRI and without SRI in DISIMP Schemes

DISIMP Irrigation Scheme Number of leaf (age)	SRI Area		Cropping Season	Variety of Rice	Paddy Yield (tons/hectare)		
	Area (ha)	Farmers			SRI	non-SRI	Ratio
South Sulawesi (Sulsel)							
1 Awo - 1	0.20	3	DS 02/03	Ciliwung	7.15	4.35	164%
Awo - 2	5.00	18	DS 04/05	Ciliwung	7.40	4.25	174%
2 Salomekko - 1	0.20	1	DS 02/03	Ciliwung	7.92	3.32	239%
Salomekko - 2	5.00	7	WS 2004	Ciliwung	7.28	4.31	169%
Salomekko - 3	5.00	10	DS 04/05	Ciliwung	7.87	4.09	192%
3 Kelara Keralloe - 1	4.30	6	WS 03/04	Membrano	8.76	5.18	169%
Kelara Keralloe - 2	2.00	1	DS 2004	Membrano	8.18	4.17	196%
Kelara Keralloe - 3	217.90	145	WS 04/05	Membrano	9.56	4.79	200%
4 Kiru Kiru - 1	1.00	1	WS 03/04	Ciliwung	8.76	3.19	275%
Kiru Kiru - 2	1.00	1	WS 04/05	Ciliwung	8.00	4.15	193%
5 Sadang - 1	5.00	12	WS 2004	Ciliwung	8.11	4.55	178%
Sadang - 2	77.79	106	DS 04/05	Ciliwung	10.39	5.55	187%
6 Lanrae - 1	3.00	4	WS 04/05	Ciliwung	8.00	4.80	167%
Total/Weighted Average	327.39	314			9.60	4.93	195%
West Nusa Tenggara							
1 Tiu Kulit - 1	1.50	2	WS 02/03	IR-64	7.84	5.43	144%
Tiu Kulit - 2	2.62	10	WS 04/05	Ciherang	9.57	4.77	201%
2 Muer - 1	1.50	6	WS 02/03	IR-64	7.85	4.97	158%
3 Batu Bulan - 1	0.16	1	DS 2003	IR-64	8.93	4.97	180%
Batu Bulan - 2	0.32	1	WS 03/04	IR-64	9.63	4.60	209%
Batu Bulan - 3	0.16	1	DS 2004	IR-64	8.53	4.80	178%
Batu Bulan - 4	11.38	42	WS 04/05	Ciherang	8.99	5.03	179%
5 Mamak -1	7.40	14	WS 04/05	Ciherang	8.82	3.56	248%
6 Jurang Sate -1	4.37	11	WS 04/05	Ciherang	8.63	6.77	128%
7 Jurang Baru - 1	5.06	12	WS 04/05	Ciherang	6.78	5.07	134%
Total/Weighted Average	34.47	100			8.53	4.93	173%
Grand Total Weighted Average	**361.86**	**414**			**9.50**	**4.93**	**193%**

Note: WS - Wet Season, DS - Dry Season * Dried un-husked rice (moisture content 14%)

Nevertheless, the areas under SRI in Indonesia have been rapidly increasing. The farmers were taking their own initiative to adopt SRI on their own fields after learning of the trial results in the DISIMP areas. The farm production costs decreased by about 20 percent and the on-farm, irrigation water demand decreased by about 40 percent.

SRI provided a strong incentive for farmers and stimulated active local participation in agricultural and irrigation improvements. The next stage of development for SRI within DISIMP is to expand its adoption to larger contiguous areas.

Lessons learned from SRI implementation under DISIMP

General

- SRI method resulted in high paddy yield with low production costs on seeds.
- The labor burden is greater with SRI but the farmers were able to compensate this with higher productivity of paddy cultivation.
- The use of organic fertilizers is preferable, but not a "must" for SRI. However, high yield was obtained even with reduced application of chemical fertilizers. Requiring the use of organic fertilizers may hamper SRI expansion in the future.
- SRI is water saving and attained about 40 percent reduction in water use due to intermittent irrigation. This however, depended on the soil and field conditions. The farmers' adoption of SRI still depended on a reliable water source. Therefore, SRI is best introduced in an irrigation area in an upstream location.
- Successful introduction of SRI necessitated involvement of local government offices and experts to provide technical support and advice.

Future Extension of SRI

Improvement of SRI method is continuously evolving through the trials and lessons learned in each location. The experts should conduct systematic researches on SRI implementation with emphasis on the following key issues:

- Fertilizer application program that includes the type of fertilizer, quantity to be used and timing of application based on the soil condition and rice variety used.
- Intermittent irrigation method on wet-dry interval according to the soil type and field conditions
- Water management method for one tertiary system
- System planning and design suitable for intermittent irrigation
- Development of effective and low-cost weeding methods

and

The government program to promote SRI should include the following:

- Establishment of a national information network for SRI
- Systematic training program on SRI including organic fertilizer preparation
- Continuous supply of animal manure or animal-raising program for farmers to enhance the production of organic fertilizers
- Integration of SRI training program including demonstration farms in the scope of work of all irrigation projects to generate real benefits for farmers and strengthen farmers' group activities.