IMPLEMENTATION OF SRI (SYSTEM OF RICE INTENSIFICATION) FOR INCREASING PADDY PRODUCTION AND SMALLHOLDER SELF SUFFICIENCY

Luh Putu Suciati[1] and Bambang Juanda[2]

Abstract

This study provides empirical evidence by analyzing SRI adoption in the small farm sector in Citarum river basin, West Java, upstream region represented by Cianjur while the downstream region is represented by Karawang. Rice production will increase by application of the SRI method although there are additional costs related to farm labor. At the same price of rice, in the short run, increasing in production will increase farmers' income and in the long run, maintain the ecological sustainability of land. Increased production and improved soil conditions will ensure self-sufficiency of small farmers. The root problem and key issues in the implementation of SRI method at Cianjur related with lack of incentives for farmers to implement new methods. As in Karawang, the root cause of application SRI method related with no guarantee of market and government policy-related market aspects.

Key words: *rice production, land management, System of Rice Intensification*

Introduction

The efforts to increase rice production associated with seed technology, the use of chemical fertilizers and pesticides which often exceed the dose. In the future, the excessive application of chemical inputs will lower soil productivity. One technology that could potentially improve rice production is rice cultivation system calls SRI (System of Rice Intensification). The practice of cropping pattern of SRI is emphasize the cultivation of land management, crop management and water through the empowerment of farmer groups and based on environmentally friendly.

System of Rice Intensification (SRI) is a method of intensive rice cultivation and efficient, with management of the root system based on soil and crop water management, while maintaining productivity and promoting ecological values. Ecological means the harmony and balance with the environment, both biotic and a biotic environment (Rochaedi, 2004; Disperta Tasikmalaya, 2007). In SRI method, the value of ecological is importance because there is a presumption that SRI should use the organic input of

[1] Agribusiness Department, Faculty of Agriculture, Jember University, Jember, East Java, Indonesia, e-mail : suciatiluhputu@yahoo.com.
[2] Regional and Rural Development Planning (PWD), Faculty of Economics Management (FEM), Bogor Agricultural University (IPB), Bogor, West Java, Indonesia, e-mail : bbjuanda@yahoo.com.

agricultural. SRI leads to the application components of existing technologies such as : (1) healthy soil processing and management of organic materials; (2) the optimal management of crop, and (3) good and orderly water management.

Based on the study of Anugerah et al (2008), the results of an implementation of SRI in kabupaten Garut and Ciamis show that (1) SRI method of paddy cultivation has been able to improve outcomes compared to conventional rice cultivation, (2) increase revenues, (3) efficiency of production and farming profit, (4) the market price of the product higher as organic rice. SRI methods have been done in various regions in Indonesia, although with varying name, for example in West Sumatra, the SRI method known with single planting (tanam padi sebatang), in Kendal, Central Java, introduced by planting goes ahead (penanaman berjalan maju), while in Pinrang, South Sulawesi, is known with the term organic SRI rice. Table 1 describes the differences in the implementation of SRI method cultivation and conventional in some areas of Indonesia.

Since its introduction in 1997 until today the development of SRI Paddy Cultivation in Indonesia was slow because it has not been fully adopted by farmers. These facts indicate that the application of SRI methods vary greatly in the use of production inputs (fertilizers and pesticides), water use and planting methods that still requires research on the application of the optimal pattern. In addition to saving water, rice cultivation methods need to be balanced with a price guaranteed and improvement of performance of irrigation management institutions both at primary, secondary and tertiary (farmers).

The efforts to set up an effective policy at present is still faced with the constraints of information generated from these SRI approaches have not been enough. Application of SRI method is still new, to the stage of demonstration plots. There are constraints of the application of food security policy while increasing the efficient use of irrigation water and need an accurate data based on the circumstances and experiences in the field.

Methods

A. Location, Data Collection and Sampling

Location of research conducted in several areas of padi fields throughout the Citarum river basin, upstream region represented by kabupaten Cianjur while the downstream region is represented by the Kabupaten Karawang. The study was conducted using secondary data supported a variety of literature. Primary data was done through interview with questionnaire and FGD (Focus Group Discussion) with a sample of farmers from the

two irrigation systems (upstream and downstream). The number of respondents was 30 farmers in each Daerah Irigasi (DI) selected by snowball sampling method. Purposive sampling is a sampling based on several considerations and specific purpose

B. Analysis Method

Optimization analysis used to determine the optimum cropping pattern of rice cultivation using different variations. The general objective of farmer is to maximize the profits of farming with land constraints, productivity, water resources, and man power. The demand for water is one of the constraints given the uncertain availability of water, while agricultural commodities require amounts of water and certain time. Therefore the use of water by farmers for variation methods application of rice cultivation should not exceed the water supply. Optimization analysis performed using the Quantitative Methods Program for Windows (QM for Windows) with the following formulation:

Max $\pi = \sum_i J_i Hj_i + G_i Hg_i + K_i Hk_i - C_i X_i$

Subject to

Land: $\sum_i^6 X_i \leq L$

Production of SRI pure 1 : $J_1 + G_1 + K_1 - P_1X_1 \leq 0$
Production of SRI pure 2 : $J_2 + G_2 + K_2 - P_2X_2 \leq 0$
Production of SRI without a single planting $J_3 + G_3 + K_3 - P_3X_3 \leq 0$
production from SRI a mixture 1: $J_4 + G_4 + K_4 - P_4X_4 \leq 0$
Production from SRI mixture 2 : $J_5 + G_5 + K_5 - P_5X_5 \leq 0$
Conventional production: $J_6 + G_6 + K_6 - P_6X_6 \leq 0$

Irrigation Water : $\sum_i^6 a_i X_i \leq A$

Labor : $\sum_i^6 t_i X_i \leq TK$

Note :
π : farmer benefit per season (Rp).
X_i : method of land management to i (ha).
L : raw acreage in the tertiary channel (ha).
P_i : production of rice cultivation method i (kg/ha).
a_i : irrigation water demand for method i (m^3/ha).
A : irrigation water supply (m^3).
t_i : labor requirement for each rice cultivation method i (person days/ha).
TK : Availability of agricultural labor in the region (person days).
J_i : Production sold in the form GKP on method i (kg).

G_i : Production sold in the form GKG on method i (kg).
K_i : Production sold in the form rice on method i (kg).
Hj_i : GKP price on method i (Rp/kg).
Hg_i : GKG price on method i (Rp/kg).
Hk_i : rice proce on method i (Rp/kg).
C_i : average production cost of method i (Rp/ha).
i : method of rice cultivation of i, where
i = 1 for SRI pure 1;
i = 2 for SRI pure 2;
i = 3 for SRI without a single planting;
i = 4 for SRI mixture 1;
i = 5 for SRI mixture 2 and;
i = 6 for conventional cultivation

LFA (logical framework analysis) and descriptive methods are used to identify problems in the application of SRI in Cianjur and Karawang. Qualitative methods of Logical Framework Analysis (LFA) is used to find the root of problem and key issues in the application of SRI method. Descriptive method aims to create a systematic, factual and accurate discription and information about the facts, the nature and relationships among the phenomena investigated.

Results

A. Benefit for Adopting SRI Method

SRI technique is environmentally friendly farming methods, returning to nature, producing products that are free of chemical elements, the quantity and quality of results is also better, but unfortunately has not received a positive response from farmers, because although the results are very promising, but very troublesome farmers in its cultivation. SRI method requires less water and less agricultural inputs but provide a higher yield (The SRI Group, 2006; Ikisan, 2000). Through the method of rice cultivation which is ecological expected to avoid the threat of food security and increasing farmer self sufficiency. Application of SRI method by farmer in the field were highly variation, there are four variations of SRI techniques, namely

a. Using a pure SRI i.e. use of organic fertilizers and pesticides, the application of water and arrangements of single planting

b. SRI without a single plant that is using organic fertilizers and pesticides, the application of water regulation and not a single plant

c. SRI mixture 1 i.e. a mixture of fertilizer and organic and inorganic pesticides, water management and without single planting

d. SRI mixture 2 is using a mixture of fertilizer and organic and inorganic pesticides, without water and without single planting

In-depth interviews conducted with farmers as respondents to know the cost structure, production levels and prices of rice in Cianjur and Falkirk. The analysis showed that the production of rice using the SRI method is higher than the conventional method, although the consequences of high cost. The amount of costs, production and net selling price of rice for each method of management of the rice plant can be seen in Table 2 and 3. at the same price level, the increase in production will increase farmers' income, so that the expected additional costs will be offset by increased production.

The results of optimization calculation in Karawang and Cianjur regency, can be seen in Table 4. It was concluded that the optimal solution would be obtained if using SRI methods. In the Karawang, the use of SRI with 2 growing season can be increased to three planting seasons, because of the availability of water is still possible. By using three planting seasons, the value of income per season will same with income for two seasons, so the total profit of one year will increase by 50 percent. Potential additional advantages can be done by adding the labor, since land and water resources that are available have not been fully exploited. The amount of additional profit potential work force is about 100 thousand rupiahs.

In Cihea irrigated areas, kabupaten Cianjur, the optimal solution is obtained by performing SRI method with two planting seasons. The use of SRI methods with three seasons still need to be studied further, especially the application for the planting season III. Gains dropped dramatically due to limited of land use in season III. The main cause is the limited volume of water in Cihea irrigated areas at the growing season III Therefore in the Cihea currently in season III, rice cultivation is not done, but replaced with palawija. Meanwhile, in Ciraden Leuwi Lengsir irrigated areas, at Cianjur, the optimal solution is obtained by performing SRI method of rice cultivation with three planting seasons. Profits earned in the third planting season with planting seasons I and II. With 3 seasons, all land in Ciraden Leuwi Lengsir irrigated areas can be utilized but still do not utilize the entire water supply. Excess water can be utilized for other purposes, such as for fisheries and industry. Thus, the optimal solution for both districts was obtained by using SRI methods.

B. Implementation of SRI Method

The application of SRI cultivation techniques in Cianjur begins with the socialization of water-saving innovations made by the Director General of Public Works (PU). This program is not getting a response because kabupaten Cianjur known with abundant water. The strategy to promote SRI cultivation techniques carried out through the ICM (Integrated Crop Management) which can result in higher production, through the application of organic farming, water efficiency and a single planting. Socialization is then followed up by the Ministry of Agriculture Directorate of Land Management, the Directorate General of Land and Water Management (PLA) to perform a Field Guide Training of Trainers (TOT-PL SRI), Implementation of SRI Field Schools (SL-SRI) .

In Cianjur, Farmer has not been fully implemented since SRI methods have not achieved the maximum production as promised. Therefore, the implementation of the SRI conducted with some adjustments such as the adoption of planting a single seed, seedling seed at a young age, semi-organic fertilizer application. LFA results in Cianjur show that focus issues of SRI method implementation is family factors associated with risk, because of lack incentives for farmers to implement new methods. Root causes for the problem implementation of SRI method is information not yet complete, for example on how to seedlings in the ground, a single planting, fertilizer, provision of water and the associated risks prospects of the results to be obtained when applying SRI method. In addition, many SRI method requires modification, because the basic idea of SRI should be adjusted to the conditions in Indonesia, related to differences in agro-ecological and cultural conditions of the farmers. Figure 1 shows the results of the analysis of LFA in Cianjur.

Generally, farmers need guarantee of production if there is a new innovation, related to provide family food, because the experience of farmers at the beginning implementation, higher labor costs and production would fall by between 20-35%. If the cost increase and decrease in production is not offset by improved pricing and improved quality of land, the farmers will lose finansial benefit.

The early purpose of application of SRI cultivation techniques in Karawang is minimize some of the major pest of rice like an aphis, mice, stem borer and the golden apple snail using bio pesticides and natural way. One of the pilot project application of organic SRI method in the Karawang, in Kecamatan Talagasari, Cariumulya village, some farmers are applying SRI argues that production method of organic SRI at the beginning of

the application may result in higher production (between 6 to 7 tons/ha/ planting season than the conventional method (between 4 to 5 tons/ha/ planting season).

Socialization of SRI method application in Karawang made to improve the soil structure (soil ecology) because the soil is sticky and dry. it shows organic matter is low (less than 2%), soil organic matter should contain about 5%. Another issue is the possibility of plenty use of water, because of limited water is often a constraint. Therefore, since 2010 the government through the ADB loan, through the Director-General of Budget PLA (Land and Water Management) conducted intensive rice cultivation is environmentally friendly, efficient water use and less agricultural inputs.

Based on the analysis of the LFA, the root cause of application of the SRI method is high risk and no guarantee of market and government policy-related market aspects. Focus issue of the application of SRI methods are farmers feel sufficient in rice production and do not need to increase production. Farmers willing to adopt SRI method if there are other examples of successful farmers. Figure 2 explains the focus on the problems and root causes of the application of SRI.

Conclusions and Policies

Application of the SRI method of rice production will increase even if there are additional costs related to farm labor. Application of the SRI method variation in kabupaten Karawang, which provide the optimum solution is a mixture of two methods of SRI (SRI method without a single planting use chemical and organic fertilizer mix). As for at kabupaten Cianjur, from application of five variations of SRI methods, the optimum solution obtained from the SRI without a single planting but using organic fertilizer.

SRI implementation in the early stages are generally decline in production. The application of SRI cultivation techniques having some problems because it has not reached maximum production eventually became one of the reasons many farmers who refuse to implement SRI. Faced with various obstacles, the SRI method in its implementation, performed by several engineering, for example by the application of planting two seeds, and then switch to a single seed associated with the risk of farming. Based on the focus on issues and root causes of the application of SRI method related with system of incentives for farmers and marketing collateral at favorable prices.

Some policies that should be done to encourage adoption of SRI method are :

1. Dissemination strategy should be formulated of water-saving rice cultivation (intermittent) and saving input so that farmers can adopt innovations to improve production and income.
2. It needs a suitable system of price guarantees and production for farmers to implement the technology in order to optimal adoption
3. Institutional empowerment of farmer groups or P3A Mitra Cai through various patterns of incentives that encourage increased economic enterprises as well as participatory irrigation management.

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Table 1. Production and R/C ratio of SRI method of Paddy Cultivation, and Conventional in Several Provinces in Indonesia during the rainy season (W) and drought (D),year 2001 to 2002

Province/Location	SRI Yield (ton/ha) (R/C in brackets)	Conventional Yield (ton/ha) (R/C in brackets)	Production increase (%)
West Sumatera / Pakandangan (W)	5.3 (2.98)	3.5 (1.71)	51.4
Central Java / Kliwonan (2nd D)	8.0 (na)	7.6 (na)	5.3
East Java / Gunung Rejo (2nd D)	7.6 (2.06)	6.8 (1.91)	11.8
Tembalang (2nd D)	8.4 (2.59)	5.7 (2.08)	47.4
Bali			
Petiga (2nd D)	7.6 (2.59)	5.7 (2.08)	33.3
Tunjuk (D)	6.9 (na)	5.7 (na)	21.1
West Nusa Tenggara			
Tanjung (W)	7.6 (2.59)	5.7 (3.42)	24.6
Balo (D)	5.9 (2.92)	4.3 (2.22)	37.2
North Sulawesi			
Pinrang (D)	8.0 (3.00)	6.5 (3.08)	23.1

Source : Gani Anischan *et al*. 2002

Figure 1. LFA (Logical Framework Analysis) of SRI Method Application problem in Cianjur

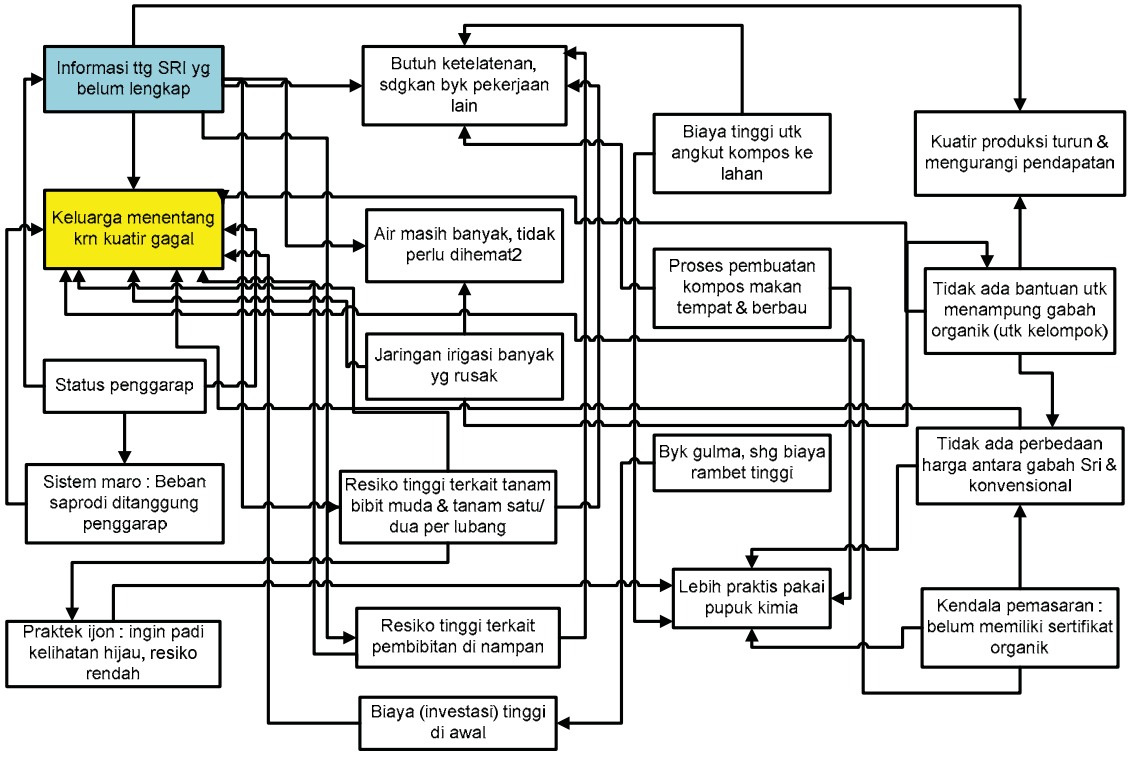

Figure 2. LFA (Logical Framework Analysis) of SRI Method Application Problem in Karawang

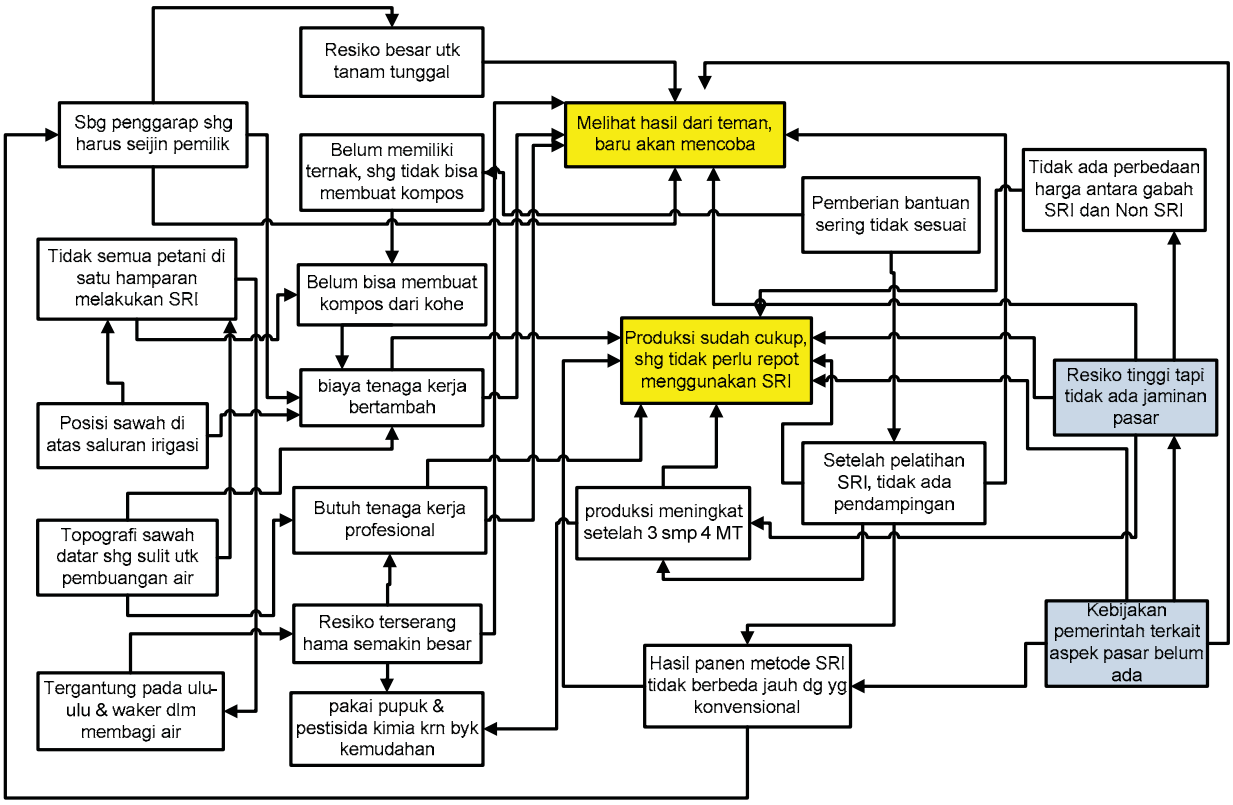

Table 2 Cost, Production and Rice Price Net Sales In Kabupaten Cianjur

Method	Production costs (Rp/ planting season)	Production GKP (kg/ha)	Net Selling Price (Rp per Kg)*)		
			GKP	GKG	Beras
Pure SRI	7.387.154	7.521	3.000	3.069	4.793
SRI without a single plant	6.615.754	7.531	3.000	3.069	4.793
SRI mixture 1	6.006.130	7.167	3.000	3.069	4.793
SRI mixture 2	8.034.782	7.369	3.000	3.069	4.793
Conventional	5.321.321	5.360	3.000	3.069	4.793

Note: *) Net selling price is the selling price by calculating the cost of the GKP (Gabah Kering Panen) to GKG (gabah kering giling) or rice

Table 3. Cost, Production And Rice Price Net Sales In Kabupaten Karawang

Method	Production costs (Rp/ planting season)	Production GKP (kg per ha)	Net Selling Price (Rp/ Kg)*)		
			GKP	GKG	Beras
SRI mixture 1	7.592.167	5.751	3.000	3.069	4.793
SRI mixture 2	7.425.000	8.030	3.000	3.069	4.793
Conventional	5.970.565	5.643	3.000	3.069	4.793

Note: *) Net selling price is the selling price by calculating the cost of the GKP (Gabah Kering Panen) to GKG (gabah kering giling) or rice

Table 4. Optimization Results at Kabupaten Cianjur and Karawang

Detailed	**SRI**		**conventional**	
	2 seasons	**3 seasons**	**2 seasons**	**3 seasons**
Kabupaten Karawang				
1. profit (billion rupiah)	1.227,03	1.227,03	726,80	485,96
2. acreage (Ha)	73.628,91	73.628,91	80.926,83	53.950,79
3. Land shadow price (Rp/Ha)	0,00	0,00	0,00	0,00
4. Water shadow price (Rp/m^3)	0,00	0,00	1.138,17	1.138,17
5. Labor shadow price (Rp/ person days)	100.391,60	100.391,60	351,93	351,93
Kabupaten Cianjur				
A. **Cihea irrigated Area**				
1. profit (billion rupiah)	87,62	42,82	48,92	13,49
2. acreage (Ha)	5.484,00	2.679,87	5.484,00	1.470,44
3. Land shadow price (Rp/Ha)	15.977.250,00	0,00	8.827.971,00	0,00
4. Water shadow price (Rp/m^3)	0,00	3.712,19	0,00	1.125,44
5. Labor shadow price (Rp/ person days)	0,00	0,00	351,93	351,93
B. **Ciraden irrigated Area**				
1. profit (billion rupiah)	12,93	12,93	7,22	7,22
2. acreage (Ha)	809,00	809,00	809,00	809,00
3. Land shadow price (Rp/Ha)	15.977.250,00	15.977.250,00	8.827.971,00	8.827.971,00
4. Water shadow price (Rp/m^3)	0,00	0,00	0,00	0,00
5. Labor shadow price (Rp/person days)	0,00	0,00	351,93	351,93