Economic Performance of System of Rice Intensification (SRI) in Malang Regency, Indonesia

Setiyo Yuli Handono, Moch. Muslich Mustadjab

1Department of Socioeconomic, University of Brawijaya (UB)
Malang City, Indonesia
handono@ub.ac.id, muslich@ub.ac.id

Somboon Charernjiratragul
2Department of Agricultural Economics, Prince of Songkla University (PSU)
Hatayi City, Thailand

Abstract—Rice has been widely known as a basic commodity for Indonesian people as a source of energy and carbohydrate. Indonesian institution for agricultural research and development is Indonesian government institution whose program is to increase rice production and keep up food security, especially with the use technological innovation. One of the environment friendly technology innovations is through System of Rice Intensification (SRI). The objectives of this study are analyze the net profit and the level of the farmers’ practice in SRI project, analyze the correlation between the level of practice and the net profit in SRI project, and analyze the problems and obstacles of SRI project in the practice. Descriptive statistics such as: mean, frequency, and percentage to know the net profit and the level of the farmers’ practice in SRI project. Quantitative analysis is correlation analysis by Rank Spearman Correlation Coefficient to analyze the correlation between the level of practice and the net profit in SRI project.

The result of the study revealed that the net profit of rice farming obtained by SRI farmers is IDR 16,045,593 per hectare. While that Q-SRI farmers is IDR 9,321,610 per hectare. So that, the net profit of SRI farmers higher than Q-SRI farmers around 40 percent per hectare. The high level of practice such as: seeds selection with salt water, make the seedbed before cultivating, transplant seedlings at young age - 7 to 12 days old, transplanting one-two seeds per hole, transplanting wide spacing, and practicing the intermittent irrigation. The result of the correlation between the level of practice and the net profit in SRI project is relatively high. This implies that the higher the level of practice of the SRI projects principles, the higher of the positive correlation with the net profit.

Data analysis finding indicated that the problems and obstacles of the SRI project in the practice included farmers difficulty in transplanting young seedlings, farmers difficulty of finding employment or laborers, farmers difficulty of transplanting the seeds with wide spacing, most of farmers prefer to use chemical fertilizers, and farmers difficulty to controlling pests and diseases.

Keywords: SRI project, net profit, the level of practice, problems, and obstacles

I. INTRODUCTION

Rice has been widely known as a basic commodity for Indonesian people as a source of energy, and carbohydrate. The increase in rice production in Indonesia is assumed to have an amount as Indonesian population density for now or in the future. In this case, to increase the rice production the use of science and technology, through research and projects is needed to help maximize the rice production and increase the farmers’ welfare.

In 2007, International Rice Research Institute (IRRI) reported that Indonesia is the third largest rice producer, and consumer in the world. As compared to other foods and cereals, rice has been the staple food for Indonesian people (above 95%) with 133 kilogram of rice being consumption per person, per year. Regarding this phenomenon, the rice diversification failure is due to the fact that most of the Indonesian people believe that the definition of eating is eating rice, and in spite of carbohydrate needs to meet the energy requirements being fulfilled by eating other sorts of meals, Indonesian people still think they need to eat rice [1].

The Central Bureau of Statistics of Indonesia reported that the Indonesian population growth rate from 2005 to 2010 is estimated to reach 1.3%, 1.18% in 2011-2015, and 0.82% in 2025-2030. In addition, The National Development Planning Agency (Bappenas) Indonesia reported that the Indonesian population density is estimated to reach 450 million people in 2045. This means that referring to the fact that rice consumption per capita of the Indonesian people is 133 kilogram per year, the domestic demand of rice will be more than 61.5 million tons per year. In 2006, the total rice consumption per annum was about 30.3 million tons, while in 2030 total rice consumptions will reached around 75 million tons [2].

During 2009 to 2010, Indonesia imported 1.15 million tons of rice and 1.2 million tons of corn. In order to maintain a rice minimal stock, The Indonesian National Logistic Department (BULOG) supplies 1.5 million tons of rice. Furthermore, in 2010 Bulog imported another 1.5 million tons of rice including 0.8 million tons from Thailand and 0.7 million tons from Vietnam to maintain the national minimum stock of rice (market operation and to alleviate the potential rise of rice commodity in domestic markets [3].

In 2010, rice was mainly grown in an area of 13.12 million hectare, with the average production being 65.98 million tons. In 2010, the Indonesian population was about 237.60 million people [4]. At the current rate of population
growth, the Indonesian government should produce more than 100 million tons of rice by 2025 for food commodity. Thus, there is a demand as a challenging task for policy makers, researchers, and other stakeholders, to provide the targeted rice demand.

An agricultural intensification program in farming was started in 1960s, known as the green revolution. In Indonesia, this intensification program was on trial in 1937 before the Indonesian in-dependency. This program was aimed to increase rice production without changing the rural social structure. The basic assumption was that rice crop production should increase. The result of the green revolution was supported by several programs such as; rehabilitation of drainage, financial support programs, and so on [5].

In 1950s, the government’s efforts to increase rice production were emphasized with the land-crop expansion and the construction of irrigation systems. The expansion of farming areas was successful due to the conversion of sugar cane areas into rice crop areas. The average rice production in 1956-1960 was approximately two tons per hectare [6]. Rice “self-supporting” was the main program by the government in 1960, as the government tried to increase rice production to meet the increase in the population. The agricultural intensification program was designed to increase rice production through social counseling programs. It had five main activities (pance usaha tanah) involving technological innovation; (1) the use of high-yield varieties, (2) the use of fertilizer, (3) integrated pest management, (4) irrigation and (5) soil management.

The Indonesian institution for agricultural research and development is The Indonesian government institution (Department of Agriculture) whose program is to increase rice production, and keep up food security, especially with the use of technological innovation. Dealing with the fact that most of the farming areas in Indonesia have been classified as less fertilized lands, an environment friendly technology innovation is badly needed. One of the environment friendly technology innovations is through the System of Rice Intensification (SRI).

The SRI program is an effort to overcome the problems of less fertilized land, and to maximize rice crop productivity. In addition, SRI is a set of farming practices which have been developed continuously based on the principle of the environment friendly act, efficient inputs, and it also aims to produce rice with a large and deep root system that is better at resisting drought, storms and heavy rains. SRI is also to implement the principles of an agricultural system ability, economic, social, and environmental sustainability [7].

East Java is one of the provinces on Java Island, which is a big contribution of the rice supply in Java. The rice production in East Java in 2010 was 9.14 million tons. Rice production in the Malang Regency was around the last three years, increasing from 366,271 tons of dried rice in 2008 to 368,509 tons in 2009 and 416,396 tons in 2010 [4]. The head of the Agricultural Department in Ngantang sub-district of Malang, Wahadi, said that there was an increase in rice production from, 6-7 tons per hectare in 2009 to 8-9 tons per hectare in the following year.

In 2007, The Department of Agriculture Malang Regency implemented the SRI project in the Village of Clumpit (30 farmers), Kademangan (25 farmers), Kanigoro (25 farmers), Karangsuko (30 farmers), Pagelaran Sub-District, Malang Regency. In detail, there were several training lessons about the SRI project covering land preparation until harvesting. SRI projects were implemented in four villages with as many as 110 farmers. At first they were skeptical about this project as it was different than conventional methods, yet they carried it out and successfully produced rice crops with an average of 7-10 tons per hectare or even more than this with 15 tons per hectare.

However, in 2011 most of the farmers quit the SRI project, 85 farmers quit the SRI project (Q-SRI farmers). Only 25 farmers are still practicing this project (SRI farmers). These fact show that farmers have problems, and obstacles with the SRI project in the practice, and why those farmers quit the SRI project even though they already knew the advantages of this project towards the increase of rice production.

This fact certainly attracts critical questions as to what extent SRI projects contribute to a farmers welfare, and the reasons why they not practicing it any longer. This research is important to answer these issues. The following are the research questions of the study.
1. How the net profit and the level of the farmers’ practice in SRI project?
2. How the correlation between level of practice and net profit in SRI project?
3. What are the problems and obstacles of SRI project in the practice?

II. OBJECTIVES

The general objective of this study is to examine the contribution of SRI project to the economic aspect of the farmers. The general objective can be broken down to three more specific objectives that would together achieve the overall goal of the research as follows;
1. To analyze net profit and level of practice in SRI project
2. To analyze correlation between level of practice and net profit,
3. To identify the problems and obstacles of SRI project in the practice, and

III. DATA ANALYSIS

Descriptive Analysis

Descriptive statistics such as mean, frequency, and percentage of collected data in order to know net profit and level of practice in SRI project. Besides, this study also employed qualitative approach, by which the research that was impossible to get by statistical procedures or by other means of quantifications. It means that this is a descriptive study. It so as this study is intended to know the problem faced in practicing SRI projects.
Quantitative Analysis

Using t-statistic to analyse the relationship between the level of practice in SRI (X) and net profit from rice farming (Y). t-statistic and correlation (r) can be formulated as follows:

\[ t = \sqrt{\frac{n-2}{\frac{SS}{\overline{X} - \overline{Y}}}} \]

\[ r = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sqrt{\left(\sum X^2 - \frac{\sum X^2}{n}\right) \left(\sum Y^2 - \frac{\sum Y^2}{n}\right)}} \]

\[ t_y = \frac{S_y}{S} \]

The steps of hypothesis testing are done as follows:
(a) Determining the hypothesis, Ho: \( \rho = 0 \), Ha : \( \rho \neq 0 \),
(b) Setting a or type I error (Significance Level) at \( \alpha = 0.05 \),
(c) Computing \( t \) – statistic and \( r \) with application software,
(d) Computing P-value with application software, and
(e) Concluding if P-value \( \leq \alpha \), it implies that the alternative hypothesis of correlation between of X and Y is accepted.

Then, If P-value \( > \alpha \), it implies that the null hypothesis of no correlation between of X and Y is accepted.

IV. RESULTS AND DISCUSSION

1. Net profit in SRI project

The results of the research revealed that farmers did not record and calculate cost and return of rice farming because they feel is not necessary. However, in rice farming it is necessary to know costs, revenues, and profits. This analysis is divided in to three parts; total cost (total variable cost, and total fixed cost), total revenue (rice production, and rice price), and net profit.

Table 1 shows that the total cost of the SRI farmers is IDR 10,874,055.83 per hectare. The total variable cost and total fixed cost are 87.06% and 12.94% of total cost. Labor costs are the highest (59.18%) of total costs. Next, the chemical fertilizer cost is the second highest (8.61%) of total cost. Conversely, the seed cost is the lowest cost (0.79%) of total the cost. Likewise, the organic pesticides cost is the second lowest (1.94%) of total cost. Furthermore, other cost such as; organic fertilizer (2.07%), chemical pesticides (2.01%), compost (7.71%), irrigation fee (2.76%), and opportunity costs (2%) are moderate relatively. Similarly, land rent cost and depreciation costs are 6.81% and 6.13% of the total cost.

Labor cost is the highest cost in rice farming because, SRI farmers need a lot of steps in the process of cultivation; it includes land preparation, transplanting, weeding, harvesting and others. This indicator implies that rice farming in SRI Project (SRI farmers) is more labor intensive than Q-SRI farmers.

Table 1 shows that total revenue of SRI farmers is IDR 26,919,648.15 per hectare. Furthermore, yield obtained is more than 8.29 ton/ha for SRI farmers. Rice’s price is IDR 3,245.83 per kilogram. In addition, net return and net profit are IDR 16,045,593.11 and IDR 17,452,259.78. The last, net profit of rice per kilogram is IDR 1,934.69.

Table 1 shows that the total cost of Q-SRI farmers is IDR 9,507,075.57 per hectare. The total variable costs and total fixed costs are 85.54% and 14.46% of total costs. The labor cost is the highest cost (54.27%) of total costs. Furthermore, the chemical fertilizer cost is the second highest cost (19.83%) of total costs. Conversely, the organic fertilizer cost is the lowest cost (0.00%) of total costs. Likewise, the organic pesticides cost is the second lowest (0.07%) of total costs. Other cost such as; seeds (2.82%), chemical pesticides (2.75%), compost (0.75%), irrigation fees (3.16%), and opportunity costs (1.90%) are moderate relatively. Similarly, land rent costs and depreciation costs are 8.61% and 5.84% of total costs.

Table 1 shows that the total revenue of Q-SRI farmers is IDR 18,828,685.64 per hectare. Yield obtain is more than 8.29 ton/ha for Q-SRI farmers. Rice price is IDR 3,141.57 per kilogram. Furthermore, net return and net profit are IDR 10,695,989.16 and IDR 9,321,610.07. Net profit (dry rice per kilogram) is IDR 1,555.31.

Table 1 shows that SRI farmers are better than Q-SRI farmers. The SRI methods have multiple benefits. The quantity of seeds used for cultivation through this method is considerably less. Furthermore, expenditure levels of SRI farmers is lower than Q-SRI farmers.

Comparison of total costs between SRI farmers and Q-SRI farmers found that SRI farmers are higher (12.57%) than Q-SRI farmers. Table 4.16 shows that several cost of SRI farmers are lower than Q-SRI farmers, such as; organic fertilizer (99.79%), organic pesticides (96.88%), compost (91.52%), labor (19.83%), and opportunity costs (16.86%). The high cost of labor for the SRI farmers for weeding. Labor requirement (weeding) of SRI farmers (50 man-days per hectare) higher than Q-SRI farmers (23 man-days per hectare).

Table 1 also shows that several costs of SRI farmers are lower than Q-SRI farmers, such as; seed (213.99%), chemical fertilizers (101.39%), and chemical pesticides (19.14%). In addition, the seed requirements of SRI farmers (69 kilogram per hectare) lower than Q-SRI farmers (70 kilogram per hectare). The fact that there is a drastic reduction in seed. Likewise, chemical fertilizer requirements of the SRI fertilizer (313 kilogram per hectare) is lower than Q-SRI farmers (532 kilogram per hectare).

Table 1 revealed that the yield of the SRI farmers higher than the Q-SRI farmers by around 27.73% per hectare. Net profit of the SRI farmers is higher than the Q-SRI farmers by around 41.91 percent per hectare. Likewise, net return of SRI farmers is higher than Q-SRI farmers by around 38.71% per hectare. The total revenue of SRI farmers is higher than Q-SRI farmers by around 30.06% per hectare.
practice of appropriate harvesting system. The level of rice farming an integrated pest diseases control and (10) practicing an appropriate harvesting system. The level of rice farming practice of the SRI farmers is presented in Table 2.

Moreover, net profit (IDR per kilogram) of SRI farmers is higher than Q-SRI farmers by around 19.61%. These results imply that rice productivity of SRI farmers is higher than Q-SRI farmers, and SRI project (SRI farmer) better yield performance than conventional methods (Q-SRI farmers). It can be concluded that the SRI project is a more efficient at production and yields obtained are higher by practicing improved technology.

2. Level of practice in SRI project

In general, the level of practice in SRI principles includes: (1) selecting seeds with salt water, (2) managing fields and practicing organic fertilizers to the field, (3) planting seeds at a young age (7-15 days), (4) transplanting one or two seeds per hole, (5) setting the planting distance at 30 cm x 30 cm, (6) frequent weedings 3-4 times, at least three times using “kokrok or weeder” and doing of manually, (7) practicing organic fertilizers, (8) practicing intermittent irrigation, (9) practicing an integrated pest-diseases control and (10) practicing an appropriate harvesting system. The level of rice farming practice of the SRI farmers is presented in Table 2.

### Table 2: The Level of Rice Farming Practice Score of the SRI Farmers

<table>
<thead>
<tr>
<th>Category</th>
<th>Average Score (X)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>4.16</td>
<td>High</td>
</tr>
<tr>
<td>Moderate</td>
<td>2.60</td>
<td>Moderate</td>
</tr>
<tr>
<td>High</td>
<td>3.52</td>
<td>High</td>
</tr>
<tr>
<td>High</td>
<td>3.56</td>
<td>High</td>
</tr>
<tr>
<td>High</td>
<td>3.68</td>
<td>High</td>
</tr>
<tr>
<td>High</td>
<td>3.84</td>
<td>High</td>
</tr>
<tr>
<td>Moderate</td>
<td>2.72</td>
<td>Moderate</td>
</tr>
<tr>
<td>Moderate</td>
<td>3.68</td>
<td>High</td>
</tr>
<tr>
<td>Moderate</td>
<td>3.28</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

*Meaning: Average (X) Category 4.50-5.00 Very high level of practice Average (X) Category 4.00-4.49 High level of practice Average (X) Category 3.50-3.99 Moderate level of practice Average (X) Category 3.00-3.49 Low level of practice Average (X) Category 2.50-2.99 Very low level of practice Average (X) Category 2.00-2.49 Negligible level of practice*
kg/ha. In making a seedling, the following principles are
planting the seeds. A standardized practice of organic fertilizers.
Therefore, on average the SRI farmers show organic fertilizers to their land at about 1
very high. Based on the research result according to the given standard, the level of the practice is (the SRI farmers) is less than 3%. If they practice them 10 tons per hectare, since organic matter contains in their land tools until no water puddles are found. In each land the land leveling is made using organic fertilization before transplanting. A good land farmers management of land (using plows) and practiced shown that most embryo appears. On the basis of the research results, it is shown that most SRI farmers applied this selection method, and its applicability is high (4.16).

Manage of land and organic fertilizers means that the SRI farmers selected seeds in a water and salt solution using an indicator i.e; if an egg entered into the solution floats, then the solution can separate good and bad seeds. If the seeds are drowned, they are good, and can be seeded. After the seeds are selected in the solution, they are then washed with clean water and rinsed well, then soaked in water for about 24 hours or until an embryo appears. On the basis of the research results, it is shown that most SRI farmers applied this selection method, and its applicability is high (4.16).

Based on data analysis found two categories the level of practice (SRI farmers) such as; moderate (2.50-3.49) and high (3.50-4.49) level of practice. The high level of practice such as; seeds selection with salt water, make the seedbed before cultivating, transplant seedlings at young age - 7 to 12 days old, transplanting one-two seeds per hole, transplanting using wide spacing, and practicing the intermittent irrigation.

Furthermore, the moderate level of practice such as; manage of land and organic fertilizers, frequency of weeding, practicing organic fertilizers, practicing Integrated Pest Management (IPM), and harvesting management.

Table 2 shows that SRI farmers have the high level (3.50-4.49) of rice farming practice in the SRI project such as; seed selection with salt water, making the seedbed before cultivating, transplant seedlings at a young age (7 to 12 days old), transplanting one seed per hole, transplanting with a wider spacing 30 cm x 30 cm with regular distance, and practicing the intermittent irrigation with a wet-dry cycle, and little standing water (± 2 cm) in the wet period.

Seed selection with salt water means that the SRI farmers selected seeds in a water and salt solution using an indicator i.e; if an egg entered into the solution floats, then the solution can separate good and bad seeds. If the seeds are drowned, they are good, and can be seeded. After the seeds are selected in the solution, they are then washed with clean water and rinsed well, then soaked in water for about 24 hours or until an embryo appears. On the basis of the research results, it is shown that most SRI farmers applied this selection method, and its applicability is high (4.16).

Manage of land and organic fertilizers means that the SRI farmers management of land (using plows) and practiced organic fertilization before transplanting. A good land management is plowed using tractors or cows (ngeluku) and the land leveling is made using deboig (banana stalk) or other tools until no water puddles are found. In each land compartment a ditch is made. Before transplanting, organic fertilizers are used on the land with the standard amount of 7-10 tons per hectare, since organic matter contains in their land (the SRI farmers) is less than 3%. If they practice them according to the given standard, the level of the practice is very high. Based on the research results, it is known that not all SRI farmers practiced them in line with the standard given by the field elucidation staff, for instance they merely gave organic fertilizers to their land at about 1-2 tons per hectare. Therefore, on average the SRI farmers showed a moderate practice level of 2.60 in management of their land and the practice of organic fertilizers.

Making the seedbed before cultivating means that the SRI farmers made seedlings in trays or house terraces before planting the seeds. A standardized need for seeds is 6-10 kg/ha. In making a seedling, the following principles are practiced. The thickness of the planting media in the seedlings is 1cm to 1.5 cm functioning to facilitate the planting process and the media consist of a mixture of bokashi (organic fertilizer) so that the seeds are easy to grow. Each morning and afternoon the seeds should be watered and the place of the seedling should get direct sun. It is known that most of the SRI farmers make the seedbed before cultivating, and its applicability is high (3.52).

Transplant seedlings at a young age (7 to 12 days old). Based on the research, on average, the SRI farmers planted young seeds (the age of 7-12 days old or maximum 15 days old). It is different with a conventional transplanting system where the age of the seed is 23-30 days old. Table 2 shows that the level of its practice is moderate (3.18).

Transplanting one seed per hole. Means that the farmers or the laborers planted one or two seeds in each hole. The seeds are shallowly placed, with a depth of 2-3 cm, shifting in a horizontal movement (forming the L letter), instead of being pressed into the soil at a depth of 4-6 cm. The rice roots form the U letter so that the roots have difficulty growing. Moreover, such a horizontal movement, forming the L letter, facilitates the roots to spread and look for optimum nutrients, organic matter, oxygen, and sun. The rice plants therefore will optimally grow. The research suggested that SRI farmers showed that the level of this practice is high (3.68).

Transplanting with a spacing of 30 cm x 30 cm with regular distance means that the farmers or laborers planting the seeds with a wide spacing of around 25 cm x 25 cm or 30 cm x 30 cm or 35 cm x 35 cm. Such a wide spacing helps to improve the amount of rice offspring, and facilitates the photosynthesis processes, to insure the availability of nutrients or organic matter. Table 2 shows that the SRI farmers showed a high practice of transplanting wide spacing with a value of 3.84.

Frequency weeding in farmer’s land means that the SRI farmers needed 3-4 weeding times during a rice planting season. The results showed that they weeded their rice 2-4 times, once in ten days. There were few farmers weeding 4 times for cost saving reasons. Their level of practice concerning weeding is moderate, with a value of 2.72.

Practicing organic fertilizers. SRI farmers practice of organic fertilizers was about 10 tons per hectare in line with the standard application in the SRI project. Moreover, the farmers also used leave or fruit fertilizers naturally known as leaves and fruits MOL (Local Micro Organism). Table 2 shows that the level of its practice was moderate (2.60).

Practicing the intermittent irrigation with a wet-dry cycle, and little standing water (± 2 cm) in the wet period means that the SRI farmers practiced an intermittent irrigation with a wetdry system. It is different from the Q-SRI farmers, or a conventional method, that continually inundates the field for 60-70 days after planting. Table 2 shows that the SRI farmers showed a high practice of practicing the intermittent irrigation with a value of 3.68.

Practicing Integrated Pest Management (IPM) by utilizing the available natural resources (organic matter or natural). Means that the SRI farmers practiced Integrated Pest Management (IPM). It is one of the approaches to controlling pests and diseases comprehensively, in that it not only relies
on chemical substances but, also on an organically-combined approach, for instance, by using pahitian leaves (Tithonia diversifolia) to prevent caterpillars or using natural enemies such as owl to prevent rat pests. From the research results, the SRI farmers showed a high practice in this respect, with a value of 3.28.

Harvesting management means that the SRI farmers managed their harvesting activities according to the existing standard, for example, by applying certain criteria, whether the age of the rice is in line with the variety, whether the variety has a short or normal age, in terms of color, whether the color of the rice is yellow and the grain is hard enough. If the rice is harvested to early its yield is bad, if too late the grains will drop off resulting in a reduced yield. From Table 2 it is shown that the level of practice by the SRI farmers in this respect is high (3.32). However, the technology adopted either by the SRI or the Q-SRI farmers is manual. Therefore, effective technology mechanization should be adopted in the future. So as to save laborers and to minimalist the loss of rice grains.

3. The Correlation between Level of Practice and Net Profit

There is a correlation between the level of practice and the net profit with the level of significance of 0.01 ($r = 0.73$) (Table 3). This correlation is relatively high, meaning that the higher the level of practice (in the SRI project) the higher the net profit also from the rice farming in the SRI project.

<table>
<thead>
<tr>
<th>List</th>
<th>Practice X</th>
<th>Net Profit Y</th>
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</thead>
<tbody>
<tr>
<td>Spearman's rho</td>
<td>Correlation Coefficient</td>
<td>.730(***).000</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>N</td>
<td>25</td>
</tr>
</tbody>
</table>

The results of the calculation showed that the level of significance between the level of practice and the net profit in rice framing in the SRI project is relatively high. This implies that the higher the level of practice of the SRI project principles, the higher the positive correlation with the net profit. If the level of practice in the SRI project principles in the land preparation, seed preparation, planting, weeding, up to the harvesting is high, so then is the net profit from the rice farming.

It is necessary to note that a positive correlation between the level of practice of the rice cultivation in the SRI project and the net profit deals with the Field Extension Officer, and the chair of the farmers groups that motivates to improve the practice of the SRI method. Although there were some obstacles the farmers or the Extension Officer faced, at the end the farmers could carry out the program and got an economic profit. The Extension Officers were able to motivate the conventional farmers to do the SRI project.

Referring to the research hypothesis that the higher the level of practice the farmers made in the SRI project the higher their net profit. The results of the analysis is relevant with the hypothesis. The correlation between the levels of practice of the SRI farmers and the net profits from the rice farming showed a spearmen rank correlation coefficient ($r$) of 0.730 from the total 25 respondents, and this suggests that the correlation between the two variables is completely significant ($p=0.000$). This is reinforced by the findings in the field that the SRI farmers really wanted to improve their net profits, by practicing the SRI principles accurately in the hope that their rice production would be optimum and they will get a economic benefit as maximum as possible.

On the basis of the results of interviews with the leaders of the farmers groups, farmers figures, and also the extension officers, ways to succeed the SRI project are through training and guidance, motivation, direction, and physical assistance (e.g. seeds, tractors, and others), including a persuasive approach by the extension officers to the farmers, especially those who once got the SRI training. Although in fact some of the people joining in the training quitted practicing the SRI, the extension officers always gave them training on anything the farmers needed.

4. Problems and Obstacles of SRI Project in the Practice

Problems and obstacles of farmers in doing the SRI project included difficulty in transplanting young seedlings, difficulty to finding employment or labor, difficulty in transplanting the seeds with wide spacing, the majority of respondents prefer to use chemical fertilizers, difficulty in controlling pests and diseases. The summary of the problems and obstacles of the SRI project is presented in Table 4.

Table 4 shows that most of the Q-SRI farmers (98.82%) and 48.00% of the SRI farmers faced difficulties in transplanting young seedlings. SRI farmers (52%) and Q-SRI farmers (96.47%) had difficulty in finding employment or labor. Moreover, 40.00% of SRI farmers and most of the Q-SRI farmers (90.59%) had difficulty in transplanting the seedlings with a wide spacing, and one or two seeds per hole. Most of Q-SRI farmers (94.12%) prefer to use chemical fertilizer, on the contrary, 44% of the SRI farmers are still using chemical fertilizers. The last, 48.00% of the SRI farmers, and most of the Q-SRI farmers (91.76%) had difficulty in controlling pest and disease. For a detailed explain per problems and obstacles on the next discussion.

1. Difficulty to transplanting young seedlings

One of key success of the SRI project is to plant young seeds, at the age of 7-15 days. If farmers plant older seeds – 3, 4, 5 or 6 weeks – they will lose same potency in producing a large amount of plant offspring. The way to plant young seeds is that when the seeds are pulled under the soil, the movement should be shifted forming the L letter in order to reduce the tension of the plant roots and to facilitate the plants continuation of growth.
It is one of the obstacles the laborers experienced since they are used to planting seeds conventionally by pulling them into the soil at a depth of 4-6 cm. And planting such young seeds is a special obstacle for the laborers.

One of the reasons to plant young seeds by shifting movement is that the growth of the plant roots will be good, since the rice plant roots grow from their tips. If the tips lead upward, they should change their position in the soil in order to make the tips lead downward before continued growing. This needs a lot of energy and effort from the small roots which are still weak after being planted, especially if the roots are dry due to late planting. It is a high risk transplanting young seeds.

Based on the results of in-depth interviews, most farmers who quit practicing the SRI reasoned that they had difficulties in planting activities, especially in finding laborers ready to plant young seeds. If the laborers are ready, there is a consequence, it needs a lot of funds. It is this problem that caused some farmers to quit the SRI.

<table>
<thead>
<tr>
<th>THE PROBLEMS AND OBSTACLES OF SRI PROJECT IN THE PRACTICE</th>
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<tbody>
<tr>
<td>Problems and obstacles</td>
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<tr>
<td></td>
</tr>
<tr>
<td>1. Difficulty to transplanting young seedlings.</td>
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<td>2. Difficulty to finding employment or farm labor.</td>
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<td>3. Difficulty to transplanting the seedling with wide spacing, and one-two seeds per hole.</td>
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<td>4. The majority of farmers prefer to use chemical fertilizers.</td>
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<td>5. Difficulty to controlling pests and diseases.</td>
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2. Difficulty to finding employment or farm labor

Concerning the availability of laborers in the research site, it was found that in the rice planting season, it was difficult to get laborers, since all farmers planted rice simultaneously. Even some farmers hired laborers from other villages. Moreover, the planting area is very wide, but the availability is relatively fixed, due to most laborers age above 40 years. Productive laborers, with the ages of 18-40 years are more likely to look for jobs in other villages, as cigarettes factory workers, drivers, and others, even workers in foreign countries.

The unavailability of labor is also due to the interaction between the land owners and land hirers (pengedok) and workers. If the owners have many brothers or sisters or friends whose professions are farmers, there is not be difficulty in finding laborers. Usually land owners also have good relationships with land hirers, since they are key people who manage the farming from land preparation to harvesting activities. The relationship among the land hirers themselves is very good, so that they manage lands one after another. There are respondents who have got fixed workers so that they do not have any difficulty in managing their lands. It is these respondents who have a good economic condition.

3. Difficulty to transplanting the seeds with wide spacing

Planting rice using a wide or regular distance, one of the methods is to use a string tied in sticks placed between each side of the field with the distance of 25 cm – 30 cm, or 40 cm or even 50 cm if the land is fertile or well managed. The lines should be signed (or tied) at the same interval in order to adapt to the width of the row so that the uniform distance may be convenience while weeding. A brush-like form made of bamboo with a removable space or distance may also be used.

Another alternative is by using a specific harrow to mark a surface in a square pattern function to plant seeds in the intersection of the lines. Some farmers said that this special harrow is better than string. It turns out that some farmers have difficulty in practicing this model.

Some farmers also said that in the conventional method no measurement is practiced, and the planting activities are quicker. Furthermore, some labors complained that transplanting the seeds with wide spacing, and transplanting one-two seeds per hole gives them a backpack and is difficult to reach, so it is impractical and complicated.

4. The majority of respondents prefer to use chemical fertilizers

Based on the results of research and in-depth interviews, it was found that the amount of chemical fertilizers practiced by Q-SRI farmer was relatively high. They still relied on chemical fertilizers to solve their agricultural problems. As the extension officer said, the need for chemical fertilizers, especially urea was still high, at average the non SRI farmers at least needed 500 kg/ha, even some farmers, almost 1 tons/ha.

Rasat (leader of farmer group) explained that the Q-SRI farmers still relied on chemical fertilizers to make their lands fertile and to accelerate their plants, especially rice plants that are consired too hard to handle. Plants, especially rice not only needs Nitrogen (Urea) but also NPK, Phonzka, SP36 and others.
The quantity of the use of organic fertilizers was still low, as the farmers tended to know the results immediately. Therefore, chemical fertilizers are considered to quickly solve their problems, i.e. their plants are quick to grow well and last longer than organic fertilizers. The matter is that the characteristic of organic fertilizers is to give a long term impact for land recovery. And the extension officers have encouraged the use of these organic fertilizers to keep the soil fertile.

From the observation in the field, it was found out that farmers had difficulty in practicing the SRI method because they still relied on chemical fertilizers, and little organic fertilizers are used, even this SRI approach leads farmers to make use of organic fertilizers.

5. Difficulty to controlling pests and diseases

Pests and diseases are the biggest problems for rice farmers. The main disease is beurreum caused by virus RTBV (Rice Tungro Bacilliform Virus) or RTSV (Rice Tungro Spherical Virus) with the vector of planthopper carrier. The symptoms of rice attacked by the virus are that the plants cannot grow well, their leaves are yellow to orange and spotted brown.

The factors influencing the growth and development of this tungro diseases are among others the availability of inoculums sources (plants attacked), vectors (infectors), sensitive variety, supporting environment, wind speed and simultaneous planting.

Based on the in-depth interviews, it was shown that the attack of the pests and diseases to the rice plants because the farmers in the farming are considered to invite them, even to make them stay and grow well and this degrades the quality of the field itself. If this happens, the field will dry out and cannot be used anymore.

Moreover, planting rice made at different times among fields causes the green planthopper vector carrying the beurreum disease survives and spreads viruses in the next planting season. Unwise application of pesticides and chemical fertilizers may kill natural enemies that should be able to control pests existing in the agricultural fields. One way to control the pests and diseases is by reducing the use of chemical pesticides and fertilizers, so that natural enemies are not killed and pests can be annihilated.

Besides plant rotation using other commodities, suppressing and even cutting the life cycle of pests that carry the vector of beurreum disease is necessary. Another positive effect of the plant rotation is that the soil will not be so fatigued and is slow to recovered. A Simultaneous planting is other good choice to control the green planthopper and to help prevent the spread virus tungro. Based on these research results, it can be explained that pests and diseases are problems and obstacles the farmers faced in practicing the SRI methods, because of the SRI principle is to encourage the use of organic fertilizers, natural enemies and minimalist the use of chemical pesticides.

V. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. Net profit of rice farming obtained by SRI farmers is IDR 16,045,593 per hectare per season. While that Q-SRI farmers is IDR 9,321,610 per hectare per season. So that net profit of SRI farmers higher than Q-SRI farmers around 41.91% per hectare.

2. Based on data analysis found two categories the level of practice (SRI farmers) such as; moderate (2.50-3.49) and high (3.50-4.49) level of practice. The high level of practice such as; seeds selection with salt water, make the seedbed before cultivating, transplanting seedlings at young age - 7 to 12 days old, transplanting one-two seeds per hole, transplanting wide spacing, and practicing the intermittent irrigation.

3. The correlation between the level of practice in SRI and the net profit from rice farming in the SRI project, using the Spearman Correlation Coefficient (r) is 0.730. It means that the higher the level of practice the SRI project, the higher the net profit from the rice farming.

4. Problems and obstacles of farmers in doing the SRI project, such as; most of Q-SRI farmers (98.82%) and 48.00% of SRI farmers difficult to transplanting young seedlings. SRI farmers (52%) and Q-SRI farmers (96.47%) difficult to finding employment or farm labor. Moreover, 40.00% of SRI farmers and most of Q-SRI farmers (90.59%) difficult to transplanting the seedlings with wide spacing, and one or two seeds per hole. Most of Q-SRI farmers (94.12%) prefer use chemical fertilizer, on contrary, 44% SRI farmers still using chemical fertilizer. The last, 48.00% SRI farmers and most of Q-SRI farmers (91.76%) difficult to controlling pest and disease.

RECOMMENDATIONS

1. SRI farmers to continue practicing SRI, and efforts to disseminate their experiences to other farmers, to influence farmers who not yet practicing SRI to practice SRI.

2. SRI and Q-SRI farmers have problem lack adequate capital resources to invest on improved rice farming, such as purchasing organic fertilizer, herbal pesticides, and others. Moreover, SRI farmers recommended using bank or the existing credit services to expand their farms.

3. SRI farmers should increase revenue or income, such as; reduce cost of chemical fertilizers or herbicides. Furthermore, SRI farmers or farmer group creates of organic fertilizer or herbal pesticides. In addition, SRI farmers get multiple benefits such as increase income, local creativity will increase, and environmental sustainability.

4. The policy implication of findings in this study is that government should give support, such as intensive training about principle of SRI (transplanting young seedlings, transplanting the seedlings with a wide spacing, and one or two seeds per hole), simplify access to credit, prevention and treatment of pests and diseases.
5. Government should develop a policy or promotion of SRI. Incentives for growing SRI project in the form of subsidy for equipment, manure, organic pesticides etc. may help in the promotion of SRI. This policy to improve in SRI project for expanding in area SRI project, and increasing the number of farmers to practice the SRI project

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REFERENCES


LIST OF ABBREVIATION

BPS
Biro Pusat Statistik (Central Bureau of Statistic in Indonesia)

Bulog
Badan Urusan Logistik (National Logistic Agency in Indonesia)

IDR
Indonesian Rupiah

IPM
Integrated Pest Management

MD
Man-Day

MOL
Mikro Organisme Lokal (Local Microorganism)

Q-SRI farmers
Farmers who quit practicing SRI project

SRI
System of Rice Intensification

SRI farmers
Farmers who still practicing SRI project