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Change from conventional to organic rice farming system: biophysical and socioeconomic reasons

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Participatory Rural Appraisal was carried out in three sub districts namely; Gondang, Kedawung, and Sambirejo of Sragen District, Indonesia in October, 2008. These sites represented three rice farming namely conventional, low external input called semi organic and fully organic rice farming. The aim was to study biophysical and socioeconomic reasons of conversion from conventional to organic rice farming systems. Several methods of participatory rural appraisal were applied, namely historical land use, Venn diagram, field monitoring and ranking and scoring, besides direct interview in the field and visit farmers house. The results showed improving soil fertility, better selling price and income, better and healthier rice quality and less pest and diseases attack were the most benefits obtained from the conversion to semi and fully organic rice farming. Improving both chemical and physical soil fertility were put in the first and second rank for fully organic rice farming group, while better income and improving soil properties were for the semi organic rice farming group. The economic benefits were about 12,300,000 IDR (1,367 USD) and 14,400,000 IDR (1,600 USD) ha$^{-1}$ season$^{-1}$ with B/C ratio 4.5 and 6.0 for semi and fully organic rice farming, respectively. These systems are socially accepted encouraging communal works.

Keywords: Rice farming, conventional, low external input, fully organic, participatory rural appraisal

INTRODUCTION

In Indonesia, rice is not only a staple food, but also a source of income providing jobs for most villagers. Since the beginning of seventies through the First Long Term Development Program and it was executed by PELITA (Pembangunan Lima Tahun = Five Years Development Plan), increasing rice production has been one of the priorities of the Indonesian agricultural development. It is not only to meet the rice growing demand, but also to improve farmer income and to support food security. Like other rice producing countries, planting high yielding varieties and adding more mineral fertilisers are widely implemented to elevate rice and land productivities. Indonesia has been amazingly recognised in successful in increasing rice production and in 1984 reached rice self-sufficiency. This achievement was mainly due to application of a system of high external inputs (Green Revolution technology) including high yielding rice varieties and agrochemicals (Sukristiyonubowo, 2007).

It is also well known that fertilisers are the most functional input to replace nutrient removal and the high yielding rice varieties require more mineral fertilising to achieve their potential yields. Studies on the effect of mineral fertilisers on rice production conducted in many rice producing areas have tremendously increased in line with the development of high yielding rice varieties (Sukristiyonubowo and Tuherkih, 2009; Min et al., 2003; Cho et al., 2002; 2000; Soepratini, 1995; Adiningsih, 1992; Adiningsih et al., 1989; Prawirasumantri et al., 1983; Cooke, 1970; Uexkull, 1970). However, the use of agro-chemicals has been recognised as an important non-point source of surface and subsurface water contamination (Lal et al., 1998). Nutrients and pesticides residues carried away by eroded sediments and water

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run-off does not only reduce fertility of soil, but also
degrade surface water qualities (Sukristiyonubowo, 2008; 
Sukristiyonubowo et al., 2003).

It is coming to realize that combination between high 
external input and high yielding variety is not sustainable 
in the long term. In many rice growing centres are 
showing a levelling-off, even a decline or loss in 
productivity. Many farmers are in fact failing to achieve a 
high level of production leading to sustain a profitable 
agriculture. Furthermore, most farmers felt that it is 
difficult to plough their soil and pest and diseases attack. 
Consequently, more production cost is spent to manage 
their soil and crop.

Driven by improving customers concern with good 
food quality and safety, increasing demand for organic 
products as well as increasing awareness to protect land 
resources, many farmer groups in the rice producing 
areas have converted to organic rice farming. 
Furthermore, improving healthier and tastier rice product, 
fast growing urban market for rice organic products, and 
the prospect of higher prices are also considered as the 
driving force in converting from the conventional to 
organic farming system.

By definition, the term organic agriculture refers to a 
process that uses methods respectful of the environment, 
from production stages through the handling and 
processing. Thus, it is not merely concerned with a 
product, but the whole system used to produce and 
deliver the product to the ultimate consumers 
(Anonymous, 2004). Consequently, organic farming 
systems avoid applications of chemical fertilisers and 
pesticides, rely on organic inputs and recycling for 
nutrient supply, and emphasize cropping system design 
and biological processes for pest management (Rigby 
and Cáceres, 2001). They may thus reduce some 
negative effects attributed to conventional farming (Oehl 
et al., 2004; Mäder et al., 2002; Reganold et al., 1987). In 
some countries, research in organic farming system have 
been developed both in plot and farm scales with 
different purposes. (Chino et al., 1987) found that 
asparagine’s content of plant phloem sap is significantly 
lower under organic cultivation. (Kajimura et al., 1995) 
reported that the low densities of BPH (Brown Plant 
Hopper) and White backed Plant hopper was observed in 
organically farmed fields. Similar finding was reported by 
(Alice et al., 2004). Related to the milling and cooking 
quality of rice, (Prakhas et al., 2002) noted that rice 
planted in organic system significantly has better milling 
and cooking quality like total and head milled rice 
recovery, protein content, kernel elongation and lower in 
amylose content than cultivated with commercials 
fertilizers. Furthermore, (Zhang and Shao, 1999) reported 
that higher protein grains content will result in higher 
head rice recovery and lower amylose content. In line 
with soil aspects, So far, organic farming is usually 
associated with a significant higher level of biological 
activities and soil organic matter (Oehl et al. 2004; Mader 
et al., 2002; Hansen et al., 2001; Stolze et al., 2000). In 
fact, there are still limited studies in comparing organic 
and conventional systems (Hasegawa et al., 2005).

In Indonesia, particularly in Sragen District, organic 
agriculture has been introduced since 1999, when 
program of Go Organic 2010 was lunched by the 
government. It was promoted by the District office 
through the Extension Agency (the local named 
BAPELUH). The aims were to improve rice quality, 
 improve farmer income, and to bring in the Sragen 
District both in the national and international level. This 
paper talks about the biophysical and socio-economic 
reasons of changing from conventional rice to semi 
organic and fully organic rice farming system in 
Sambirejo sub district, the Sragen District.

METHODOLOGY

Participatory Rural Appraisal (PRA) was conducted in the 
Sragen District, one of the rice growing areas in Central 
Java Province, in October 2008. It was carried out in 
three rice producing areas, namely the Kedawung, 
Gondang, and Sambirejo sub districts. These sites 
represent conventional, low external input management 
also called semi organic, and fully organic rice farming 
systems, respectively. In addition, they were selected 
because their average rice yields were always higher 
than the average yield of the Sragen District (Figure 1).

Some methods of PRA were mainly applied to 
collect data. However, direct interview in the fields 
(without questioner) and visit to the individual farmer 
house were also applied to get specific information 
related with their cultural practices being done, the history 
of land use, and socioeconomic data. Data were 
classified into biophysical and socio-economic aspects. 
Biophysical parameters included historical of land use, 
cultural practices, and rice production. The socio-
economic data covered the perception of the farmers to 
the organic rice farming system, including social 
perception, cultural practices, marketing, production cost 
as well the rice selling price.

Techniques of PRA like historical land use; time 
trend, ranking and scoring, and Venn diagram were 
practiced. Historical land use was applied to collect data 
related with the development of land use in their village 
and cultural practices. Time trend was mainly focused to 
figure out the development of rice production for the long 
period.

In the low external input and fully organic rice 
farming, the data were gathered after their regular 
meeting organised every 35 days (in local named 
“Selapanan” meeting). Field visits were also carried out to 
see rice growth performance and take soil samples. In 
the conventional system, gathering data on agronomic 
and economic aspects to evaluate benefit-cost ration 
(B/C) were done by interviewing the farmers in the field
Figure 1. Average rice yield in three centers producing rice in the Sragen District, from 2000 to 2007 (Source: Sragen in figure 2000-2007)

and or in their house, since most of them were in the field for harvesting or land ploughing. The B/C ratio is calculated according to the formula below (Kadariah, 1998; Suriadikarta et al., 2004):

$$\text{Benefit} = \frac{\text{Production Cost}}{\text{Production Cost}}$$

Production cost is the sum of the labour cost and agricultural input cost, while benefit is the difference between the revenue and the production cost. When the B/C ratio is equal or higher than one, the rice farming system is efficient and gives more benefit. In contrast, when the B/C is lower than one, the system being done is not efficient.

Three rice farming systems, conventional, low external input management (semi organic) and fully organic rice systems were mainly distinguished according to the water sources, the fertilisers and pesticides being used. In the conventional system, the farmers applied mineral fertilisers, commercial pesticides, and the source of water originates from the irrigation water. In the low external input management or semi organic rice system only less nitrogen fertiliser (about 50 kg urea ha\(^{-1}\)), more organic fertiliser and bio pesticides are applied. In addition, the water source comes from spring water or deep well depending upon the topography of the land. The idea of semi organic rice farming system was just to make the product free from chemical input, commercial pesticides and less inorganic fertilisers. Fully organic rice farming system means the system completely free from inorganic fertilisers and commercial pesticides and the water source is fully from spring water. Thus, it was free from chemical product, the crop nutrients input and materials for pesticides must be coming from organically sources as well the water must be free from pollution.

To complete the biophysical data, soil samples were also taken in three rice farming systems including conventional, low external input, and fully organic rice farming. Composite samples of topsoil, 0-20 cm layers, were taken in October 2008 and August 2010, before land preparation. These samples were submitted to the Analytical Laboratory of the Indonesian Soil Research Institute at Laladon Bogor to determine chemical properties and texture of the soils. Soil chemical analyses included the measurement of pH (H\(_2\)O and KCl), organic matter (organic carbon and total nitrogen), phosphorus, potassium, base saturation and cation exchange capacity (CEC) as well as iron (Fe) and manganese (Mn) contents. Organic matter was determined using the Walkley and Black method, pH (H\(_2\)O and KCl) was measured in a 1:5 soil-water suspension using a glass electrode method, total P and available P were measured colorimetrically using HCl 25% and Olsen methods, respectively. The total potassium (K) was extracted using Chloride Acid 25 % (HCl 25%) and subsequently determined by flame-spectrometry (Indonesian Soil Research Institute, 2009).

Farmer group named Sri Makmur was representing group of fully organic rice farming located in Sambirejo and Sri Rejeki farmer group speak for low external input management or semi organic. Some farmers from
Gondang and Kedawung sites were interviewed and visited for conventional rice farming system. However, the discussion was focusing on fully and semi organic, while for conventional system was just emphasized on an economic analysis.

RESULTS AND DISCUSSION

History of Land Use and Cultural Practices

The farmers mentioned that rice fields, locally known as sawah, in their villages even in the district level have been taking place since long time ago. They do believe that wetland rice system has been the way to produce rice before Dutch colonization. The oldest farmer, 85 years old, stated that when he was in the childhood his parents have already been familiar with the rice farming. Furthermore, the farmers were also no doubt to say that before wetland rice system the land use was forest, although they could not distinguish whether the primary or the secondary forest. Being protected forest and many agro-forestry (Karang kitri or taloon in the local name) surrounding their village proved that forests were in their village. This opinion was supported by many scientists. According to (Bene et al., 1977; Lal, 1985) about one-third of the land surface of our planet is forested and more than half of these forests are in tropics.

From the beginning of working for wetland rice to 1973, called the first organic rice farming, they used to cultivate local rice verities, such as Bengawan, Raja Lele and Pandan Wangi, with only added organic fertilisers. No synthetic fertilisers and commercial pesticides were applied. The crop rotation was rice-rice meaning only two times planting rice per year. Green manure called “aram-aram” and cattle manure were used to be given in their lands. The “aram-aram” mainly originated from the leaves of both legumes shrubs and legumes tress grown surrounding the village, farm road and dykes. Thus, these communities have basically already been familiar with the organic system. With planting local varieties, pest and diseases attacks were less, even sometimes free from pest and diseases. When the pest and diseases attacked, they applied bio pesticides made of wild plant and species. This was combined with “Suwuk” and followed by village cleaning ceremony (locally known as “upacara bersih deso”). “Suwuk” is an indigenous knowledge or a local wisdom to protect the fields free from pest and diseases. Suwuk is only done by selected farmer via communicating with the most powerful thing (God almighty) and the pest being attacked, not to hit and not to damage the rice being planted. Principally, the selected farmer conducts directly in the fields with the “sesajil”, not kill the pest, and just drive out the pest and disease. In a certain condition, this way is still applied mainly in low external input and fully organic rice systems. Currently, they sprayed organic pesticide made of the leave of wild plants for example Titonia diversicola combined with tobacco and “rempah-rempah” (spices). Organically sources for producing fertilisers and pesticides could easily be found in their surrounding fields or village.

During that period, the rice production varied from 1 to 2 tons ha$^{-1}$ as genetically the potential yield of local varieties was also low. Although the rice yield was considered low, the farmers were feeling favourable since no or merely little money was spent to manage rice fields. Other reasons were also mentioned (1) the soil was easy to be ploughed, (2) aram-aram and cattle manure were only applied once during land ploughing, (3) fewer agricultural practices were done, only weeding was carried out, and (4) the yield was also enough to support their carbohydrates demand, as they never faced famine. They did not only eat rice, but tuber crops like cassava, sweet potato and taro as well. Sometimes, they used to eat banana. All the crops were cultivated in the garden in the system of ‘karang kitri’ (traditional agro forestry).

In 1973 the cultural practices drastically changed, when the high yielding rice varieties were introduced. Year 1973 was recognized as the starting time in changing to the conventional system (Green Revolution Technology). Variety of IR-27 was the first high yielding variety (HYV) planted in these villages. The mineral fertilisers and commercial pesticides were provided by the government through the credit scheme under the BIMAS program. All farmers had to take part in this program since the aims were to increase national rice production, to increase farmer income and to elevate prosperity. Consequently, during the period of conventional system, from1973 to 1999, high mineral fertiliser application rates have been adapted to the rice fields and the rice yields were tremendously enhanced by year. Nationally, it is noticed that in 1985 Indonesia achieved self-sufficient in rice. It can be said that the average yield increase varied from 25 to 100 %.

About 300 kg urea, 100 kg TSP and 100 kg KCl ha$^{-1}$ season$^{-1}$ (or the ratio was 3:1:1 for urea, TSP and KCl, respectively) were broadcasted to the field with the highest rice yield reached about 6 to 8 tons ha$^{-1}$ depending on the variety being cultivated. However, the farmers were feeling not so delighted, with following reasons (i) they started borrowing the money from the government, (ii) had to purchase agricultural inputs every planting season, (iii) their land became hard to be ploughed, (iv) more time was allocated to manage their fields, (v) in fact not much profit was obtained as selling price standard was given by the government and considered low, and (vi) loss contact with the nature. Furthermore, for the land preparation, they did spend more time and budget to make the puddle structure. Considering that every activity for managing the rice field had to be paid with money and feeling that “gotong royong” (communal work) was no longer exist, therefore, introducing organic rice farming was easily accepted.
Table 1. Farmer groups in Sambirejo Sub District participating in semi and fully organic rice farming system

<table>
<thead>
<tr>
<th>No</th>
<th>Farmer Group</th>
<th>Number of member</th>
<th>Rice farming system</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sri Makmur</td>
<td>62</td>
<td>Fully organic</td>
</tr>
<tr>
<td>2</td>
<td>Gemah Ripah</td>
<td>30</td>
<td>Semi organic</td>
</tr>
<tr>
<td>3</td>
<td>Sri Rejeki</td>
<td>36</td>
<td>Semi organic</td>
</tr>
<tr>
<td>4</td>
<td>Margo Rukun I</td>
<td>30</td>
<td>Semi organic</td>
</tr>
<tr>
<td>5</td>
<td>Margo Rukun II</td>
<td>20</td>
<td>Semi organic</td>
</tr>
</tbody>
</table>

Figure 2. Average rice yield trend of three differences rice farming system in Sambirejo sub district (representing fully and semi organic rice farming system), Gondang and Dawung (for conventional system), the Sragen district compared to The Central Java Province (Where the Sragen District were administratively belong to)

Hence, it can also be said that curiosity in organic rice farming system is growing well, as there are evident degradation of land resources taken place in conventional rice farming system. During the conventional rice farming system, from 1973 to 1999, many high rice yielding varieties have already been cultivated for example IR-27, IR 36, IR 42, IR 64 and Mentik Wangi. The last two varieties are continuously farmed for the organic rice system.

In 2000, in Sukorejo Village, Sambirejo Sub District the farmers converted to the semi and fully organic rice farming system. It was encouraged by the district leader through the Extension Agency at the district level. The farmers were enthusiastic to take part in the regular meeting and to be guided by the leader of farmer and extension worker. Up to now, there are five farmers' groups in the Sambirejo Sub District as presented in Table 1.

The amount of compost added varies from 2 to 3 tons ha\(^{-1}\) season\(^{-1}\) and the highest rate is always given to the dry season. However, during the three years doing organic farming, they used to apply compost up to 7 tons ha\(^{-1}\) season\(^{-1}\) with the average yield of about 1.5 tons ha\(^{-1}\) season\(^{-1}\). Furthermore, after the third year yield improvement was taken place in some farmers. So far, the trend of the rice yield can be illustrated as in Figure 2.

It is also interesting to note that the decomposer to foster composting was produced by the farmers. It was made from 10 litres rice washed water (in local called ‘leri’), one corm of banana tree, one kg sugar or “tetes” (the liquids coming out from pressed sugar cane) and rotten fruits usually jack fruit, pine apples or mango. All
Table 2. Soil chemical and physical properties of conventional, low external input and fully organic rice farming in three sub districts of Sragen Districts (Soil were sampled in 2008 and 2010)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>pH (H2O)</td>
<td>5.80</td>
<td>5.67</td>
<td>5.68</td>
<td>6.07</td>
<td>5.63</td>
<td>5.76</td>
</tr>
<tr>
<td>pH (KCl)</td>
<td>5.27</td>
<td>4.89</td>
<td>4.23</td>
<td>5.67</td>
<td>4.93</td>
<td>4.45</td>
</tr>
<tr>
<td>Organic Matter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C (%)</td>
<td>1.21</td>
<td>1.17</td>
<td>1.52</td>
<td>1.67</td>
<td>1.58</td>
<td>2.29</td>
</tr>
<tr>
<td>N (%)</td>
<td>0.11</td>
<td>0.07</td>
<td>0.10</td>
<td>0.14</td>
<td>0.13</td>
<td>0.18</td>
</tr>
<tr>
<td>HCl 25 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P (ppm P2O5)</td>
<td>1605</td>
<td>836</td>
<td>1602</td>
<td>695</td>
<td>1640</td>
<td>1721</td>
</tr>
<tr>
<td>K (ppm K2O)</td>
<td>79</td>
<td>17</td>
<td>27</td>
<td>110</td>
<td>68</td>
<td>100</td>
</tr>
<tr>
<td>P Bray I (ppm P2O5)</td>
<td>289</td>
<td>-</td>
<td>11</td>
<td>-</td>
<td>158</td>
<td>-</td>
</tr>
<tr>
<td>P Olsen (ppm P2O5)</td>
<td>-</td>
<td>105</td>
<td>-</td>
<td>31</td>
<td>-</td>
<td>82</td>
</tr>
<tr>
<td>Texture</td>
<td>clay</td>
<td>clay</td>
<td>silty clay</td>
<td>silty clay loam</td>
<td>silty clay</td>
<td>silty clay loam</td>
</tr>
</tbody>
</table>

Materials were put together in the 25 litres plastic drum, afterward it was tightly covered, then, it allowed for one or two weeks. With this local decomposer, the process of composting took place about 21 to 30 days. The main materials for making compost were rice straw, cattle dung and sometimes added with banana steam.

When the question of will the farmers move to fully organic rice farming addressed to the group of semi organic, the main responses came up during the discussion was they will not. The reasons were the demand of semi organic products; the selling price and the income were higher than their expectations. In addition, semi organic still gives promise to conserve the land, to produce healthy food, and to get a better life.

**Crop Rotation and Rice Yield**

The crop rotation in the conventional, low external input and fully organic rice farming systems is rice-rice-rice with two rice varieties namely IR-64 and Mentik Wangi were cultivated. In fully organic rice farming system, these varieties are simultaneously grown in every cropping season to fulfil their own and market demands. It was also mentioned that the areas planted for Mentik Wangi was wider than for IR 64. This is due to Mentik Wangi was for sale and the price was higher than IR-64 variety. The qualified seeds for next planting were coming and selecting from their harvest.

The first cropping period was started in the rainy season, the second was in the end of wet season and the last cropping was in the dry season. The planting time of the rainy season is usually started from November to December, the second planting time from March to April, and for the dry period is between July and August. The planting time is arranged in different time to continuously supply the local and national market, like the producer of baby foods, and sometimes the international demand.

In the beginning of doing semi and fully organic rice farming, the first season (wet season) yielded of about 1-2 tons ha\(^{-1}\), the second season 1.5 to 2.0 tons ha\(^{-1}\) and in the dry season reached 2.5 tons ha\(^{-1}\). Since they have already been familiar with the organic rice farming before, lower rice yields during the first three years doing organic farming did not make the farmers panic and quit from the system. Furthermore, given support from the local government (a guarantee that the products were bought by the local government with the selling price of rice grains was 1000 to 2000 IDR higher than the price of conventional system) and the farmer group leader, they kept on practicing organic rice farming systems. After three years, the rice yield continuously enhanced about 25 – 30 % as illustrated in Figure 2. In farmers opinion, the reasons were closely related with the improvement of the soil fertility (biological, physical and chemical), besides less pest and disease attacked. Increasing soil fertility may result from enhancing microorganism activities due to better soil environmental system. To prove this opinion the soil were sampled in 2008 and 2010 and the results of soil analysis are given in Table 2.

Application of organic fertiliser of about 3 tons ha\(^{-1}\) season\(^{-1}\) both in low external input (semi organic) and fully organic improved soil chemical and physical properties, especially improved pH, C-organic and total nitrogen content in the soil. While for texture, it became lighter as the farmers feel. Whereas, in the conventional the pH become more acid showed by reducing value from 5.80 to 5.67 due to the acidic effect of using intensive mineral fertilisers and less or no recycling organic matter or straw. So far, the available major nutrient also reduced, it may be due to 1) the amount of
Figure 3. The average rice in three differences rice farming system in Sambirejo (representing fully and semi organic farming), Gondang and Dawung (representing conventional system) sub district, the Sragen District. Data were gathered in 2008 with the PRA method and interviewed

mineral fertiliser added was beyond the recommended rate and 2) the soil organic matter reduced.

Compared to the conventional rice system, in the beginning of doing the semi and fully organic rice system the rice yield were lower about 3 – 4 tons ha\(^{-1}\) season\(^{-1}\). However, after eight years the rice productions were relatively comparable with the conventional system (see Figure 2). Tremendous increase of rice yield starting in year 2006 may be also due to application of ‘growth regulator’ produced by the farmers, besides regular application of organic fertilizers/compost. Growth regulator was made of 10 eggs, 5 tea spoons honey, 1 can milk and 1 kg sugar. It is weekly applied from heading stage to milky stage.

Looking at the yield by season, in all systems the rice yield tended to increase and the highest rice grain yield was achieved in the dry season (Figure 3).

Compared to the organic rice farming period before 1973 and after 2000, it can be concluded that the recent organic rice farming mainly apply compost (sometimes combined with liquid organic fertilizer made by the farmers) and grow high yielding rice varieties, while the period before 1973 used to apply ‘aram-aram’ (green manure) and cultivate local variety. These made big different in planting intensity, in period before 1973 only two times planting leading to rice production.

Biophysical and Socioeconomic Reasons Change to Semi and Fully Organic Rice Farming

The main topic to be discussed during the PRA was why the farmers like to convert from conventional to organic rice farming (semi organic and fully organic rice farming system)? By using scoring and ranking method the answers could be summarized in term of soil (physical and chemical properties), yield quality (taste, cooking quality and physical rice performance), economical and practical agronomic aspects as presented in Table 3 and 4.

The reason of increasing chemical soil properties was the most important benefit obtained from changing to fully organic rice farming with the total score of 48 (38 %) followed by improving physical soil fertility with total score of 27 (21 %). The farmers do believe that improving soil fertility is a form of natural investment for their rice sustainability since they think also that better soil will result in better income and life. It is also interesting to note that although the selling price and their income increased by year, the farmers did not put them into the most benefit gained from changing to fully organic rice system. The farmers do believe improving soil fertility will produce better rice yield, in term of quantity and quality of yield. Finally, it makes a good selling price leading to income. Therefore, the farmers preferred not to put them into the first rank, but it was placed into third rank with only supported by 19% of the members. Their long experiences in doing organic rice farming, since the farmers were younger up to 1973 as well from 2000 up to now, have also made them sensitive in differentiated the quality, especially in taste and cooking quality. In addition, with the organic farming less broken rice is produced.

Similar reasons were also mentioned by the group of semi organic rice farming system. However, only the rank and score given by the participants were different as presented in Table 5. In this group, improving selling
Table 3. The reasons, scoring and ranking of converting from conventional to fully organic rice farming system represented by Sri Makmur Farmer Group in Sambirejo sub district, the Sragen District

<table>
<thead>
<tr>
<th>No</th>
<th>Reasons</th>
<th>Rank</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The soil chemical fertility is getting improved</td>
<td>I</td>
<td>48 (38%)</td>
</tr>
<tr>
<td>2</td>
<td>Physically, their plowing layer is getting thicker and easier to be plowed</td>
<td>II</td>
<td>27 (21%)</td>
</tr>
<tr>
<td>3</td>
<td>The selling price and income is getting better</td>
<td>III</td>
<td>24 (19%)</td>
</tr>
<tr>
<td>4</td>
<td>Less pest and disease attack</td>
<td>IV</td>
<td>15 (12%)</td>
</tr>
<tr>
<td>5</td>
<td>The rice yield is more healthier and in term of quality is better</td>
<td>V</td>
<td>13 (10%)</td>
</tr>
</tbody>
</table>

Note: score from 1 (for the lowest score) to 5 (for the highest score) Rank from I (is the best) to V (the lowest)

Table 4. The reasons, scoring and ranking of converting from conventional to semi organic rice farming system represented by Sri Rejeki farmer group in the Sambirejo sub district, the Sragen District.

<table>
<thead>
<tr>
<th>No</th>
<th>Reasons</th>
<th>Rank</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The selling price and income is getting better</td>
<td>I</td>
<td>46 (26%)</td>
</tr>
<tr>
<td>2</td>
<td>The chemical soil fertility is getting improved</td>
<td>II</td>
<td>44 (25%)</td>
</tr>
<tr>
<td>3</td>
<td>Physically, their plowing layer is getting thicker and easier to be plowed</td>
<td>III</td>
<td>34 (19%)</td>
</tr>
<tr>
<td>4</td>
<td>The rice yield is more healthier, free from commercial pesticides and in term of quality is better</td>
<td>IV</td>
<td>32 (18%)</td>
</tr>
<tr>
<td>5</td>
<td>Less pest and disease attack</td>
<td>V</td>
<td>20 (12%)</td>
</tr>
</tbody>
</table>

Note: Score from 1 (for the lowest score) to 5 (for the highest score) Rank from I (is the best) to V (the lowest)

price leading to better income was the most important aspect in converting to the semi organic rice system. It was given score 46, meaning that 26 % of the members mentioned improving selling price leading to better income was the most benefit got from semi organic.

Simple Economic Analysis

Average data of the Dry Season 2008 including the average rice yield and labour cost collected during PRA and interviewed were used for constructing economic analyses. Two simple economic analyses were made namely (a) when the family labours were not considered as the production cost (presented in Table 5) and (b) when they considered as production cost (presented in Table 6). Some assumptions were considered including:

+ The highest rice selling prices of semi organic and fully organic rice were applied. The price for the semi organic product was Rp 2.500 IDR kg⁻¹, and for fully organic system was Rp 2.800 IDR kg⁻¹.
+ To simplify the calculation, the analysis was done for the hectare basis.
+ The price of synthetic fertilisers and commercial pesticides were the marketplace price. The price of Urea was Rp 2000 IDR kg⁻¹, SP-36 Rp 4000 IDR kg⁻¹, KCl 12.000 IDR kg⁻¹, respectively. While for pesticides were Rp 50.000 IDR can⁻¹.
+ To the same rice stocker, except for the traditional system. It was sold by ‘tebasari’ system to rice trader. That the reason why in the conventional farming system did not pay for the harvest labour.
+ The revenue was mainly calculated from the rice grain yield. The bekatul: a powder originated from the skin of rice grain was not considered, although in term of price, it is more expensive than the rice (‘beras’).
Table 5. Simple economic analysis for three differences rice farming system including conventional, semi and fully organic rice farming in the Sragen District, Indonesia for the dry season 2008 (in IDR) when the family labours were not considered as the production cost

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameters</th>
<th>Conventional</th>
<th>Semi organic</th>
<th>Fully Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Production Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Labor cost:</strong></td>
<td>4,700,000</td>
<td>2,540,000</td>
<td>2,340,000</td>
</tr>
<tr>
<td></td>
<td>Land preparation</td>
<td>1,200,000</td>
<td>800,000</td>
<td>600,000</td>
</tr>
<tr>
<td></td>
<td>Planting</td>
<td>800,000</td>
<td>600,000</td>
<td>600,000</td>
</tr>
<tr>
<td></td>
<td>Fertilization</td>
<td>200,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Weeding</td>
<td>800,000</td>
<td>600,000</td>
<td>600,000</td>
</tr>
<tr>
<td></td>
<td>Pest and diseases control</td>
<td>200,000</td>
<td>40,000</td>
<td>40,000</td>
</tr>
<tr>
<td></td>
<td>Watering</td>
<td>1,500,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Harvest</td>
<td>-</td>
<td>500,000</td>
<td>500,000</td>
</tr>
<tr>
<td></td>
<td><strong>Agricultural input cost:</strong></td>
<td>2,300,000</td>
<td>160,000</td>
<td>60,000</td>
</tr>
<tr>
<td></td>
<td>Mineral fertilizers</td>
<td>2,200,000</td>
<td>100,000</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Organic fertilizer</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Commercial Pesticides</td>
<td>100,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bio pesticides</td>
<td>-</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td>‘Scorr’</td>
<td>-</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td>Total Cost</td>
<td>7,000,000</td>
<td>2,700,000</td>
<td>2,400,000</td>
</tr>
<tr>
<td>2.</td>
<td>Revenue</td>
<td>15,000,000</td>
<td>15,000,000</td>
<td>16,800,000</td>
</tr>
<tr>
<td>3.</td>
<td>Benefit</td>
<td>8,000,000</td>
<td>12,300,000</td>
<td>14,400,000</td>
</tr>
<tr>
<td>4.</td>
<td>B/C ratio</td>
<td>1.13</td>
<td>4.55</td>
<td>6.00</td>
</tr>
</tbody>
</table>

**Note:** The labor cost for fertilization in the semi and fully organic systems was included in Land preparation.

Table 6. Simple economic analysis for three different rice farming systems including conventional, semi and fully organic rice farming in the Sragen District, Indonesia for the dry season 2008 (in IDR) when the family labours were considered as the production cost

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameters</th>
<th>Conventional</th>
<th>Semi organic</th>
<th>Fully Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Production Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Labor cost:</strong></td>
<td>5,000,000</td>
<td>3,330,000</td>
<td>3,240,000</td>
</tr>
<tr>
<td></td>
<td>Land preparation</td>
<td>1,200,000</td>
<td>800,000</td>
<td>700,000</td>
</tr>
<tr>
<td></td>
<td>Planting</td>
<td>800,000</td>
<td>800,000</td>
<td>800,000</td>
</tr>
<tr>
<td></td>
<td>Fertilization</td>
<td>300,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Weeding</td>
<td>900,000</td>
<td>800,000</td>
<td>800,000</td>
</tr>
<tr>
<td></td>
<td>Pest and diseases control</td>
<td>300,000</td>
<td>200,000</td>
<td>140,000</td>
</tr>
<tr>
<td></td>
<td>Watering</td>
<td>1,500,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Harvest</td>
<td>-</td>
<td>700,000</td>
<td>800,000</td>
</tr>
<tr>
<td></td>
<td><strong>Agricultural input cost:</strong></td>
<td>2,300,000</td>
<td>160,000</td>
<td>60,000</td>
</tr>
<tr>
<td></td>
<td>Mineral fertilizers</td>
<td>2,200,000</td>
<td>100,000</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Organic fertilizer</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Commercial Pesticides</td>
<td>100,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Bio pesticides</td>
<td>-</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td>‘Scorr’</td>
<td>-</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td></td>
<td>Total Cost</td>
<td>7,300,000</td>
<td>3,460,000</td>
<td>3,300,000</td>
</tr>
<tr>
<td>2.</td>
<td>Revenue</td>
<td>15,000,000</td>
<td>15,000,000</td>
<td>16,800,000</td>
</tr>
<tr>
<td>3.</td>
<td>Benefit</td>
<td>7,700,000</td>
<td>11,540,000</td>
<td>13,500,000</td>
</tr>
<tr>
<td>4.</td>
<td>B/C ratio</td>
<td>1.05</td>
<td>3.34</td>
<td>4.09</td>
</tr>
</tbody>
</table>

**Note:** The labor cost for fertilization in the semi and fully organic systems was included in Land preparation.
CONCLUSION

Improving soil fertility, better selling price and income, better and healthier rice quality and less pest and diseases attack were the most benefits got from the conversion to semi and fully organic rice farming system. Among these reasons, improving both chemical and physical soil fertility were the most advantage and put in the first and second rank for the fully organic rice farming group, while better income and improving soil fertility were for the group of semi organic rice farming. In these sites rice fields have been existing since long time ago and they becomes the way to produce rice. Up to 1973, the farmers used to farm organic rice system, to cultivate local varieties and to apply green manure. The yields were considered low, varying from one to two tons ha$^{-1}$. From 1973 to 1999, they have been doing conventional system (green revolution technology) applying high mineral fertilizers and planting high yielding varieties. The average yield varied between 5 and 7 tons ha$^{-1}$ with the highest yield reached about 8 tons ha$^{-1}$. Since 2000 the farmers in the Sambirejo sub District have been working for the semi and fully organic rice farming. These systems gave benefits about 12,300,000 IDR (1367 USD) ha$^{-1}$ season$^{-1}$ and 14,400,000 IDR (1600 USD) ha$^{-1}$ season$^{-1}$, with the B/C ratio was 4.5 and 6.0 for the semi and fully organic rice farming, respectively. Socially, these systems are highly accepted encouraging the communal work, village clearness, and composting.

REFERENCES
