Journal of Economics, Business, and Accountancy Ventura Vol. 19, No. 1, April – July 2016, pages 49 – 58

Increased productivity and technical efficiency of rice farming with the System of Rice Intensification (SRI) method in Purworejo District, Central Java

Herry Maridjo[1], Y.M.V. Mudayen[2], A. Tri Prihantoro[3]

[1, 2, 3] *Sanata Dharma University, Mrican, Caturtunggal, Depok, Sleman, 55281, DIY, Indonesia*

A R T I C L E I N F O

Article history:
Received 27 May 2016
Revised 22 June 2016
Accepted 24 June 2016

JEL Classification:
Q16

Key words:
Productivity,
Economic Efficiency,
System of Rice Intensification,
Organic Rice, and
Inorganic Rice.

DOI:
10.14414/jebav.v19i1.535

A B S T R A C T

This study aims to determine whether there is a significant difference in productivity between organic and inorganic rice farming, whether there is a significant difference in technical efficiency between organic nd inorganic rice farming, and whether fertilizer costs, labor costs, arable land area, and the length of the use of System of Rice Intensification (SRI) have a significant effect on the organic rice production. The target of this research is the improvement of economic efficiency and organic rice farming productivity in Purworejo District, Central Java. To achieve this target, this study used SRI method. The population was all farmers of inorganic and organic rice farming in Purworejo District. The samples consist of 45 people from organic rice farmers and 45 people from inorganic rice farmers in Ringgit Village, Purworejo. They were collected by random sampling and the data were analyzed using descriptive analysis and quantitative analysis. Descriptive analysis was done by comparing all necesary activities in both organic and inorganic rice farming. The descriptive analysis concludes that there is a difference in terms of the selection of seeds, seedlings, seed treatment before sowing, planting and watering, fertilizing, weeding and pest control. Quantitative analysis is done using Analysis of Variance (ANOVA) and multiple linear regeresi. The quantitative analysis concludes that there is a significant difference in productivity between organic rice farming and inorganic rice farming. There is a significant difference in technical efficiency between organic rice farming and inorganic rice farming. Fertilizer costs, labor costs, arable land area, and the length of the use of SRI method have a significant effect on the organic rice production.

A B S T R A K

Penelitian ini bertujuan untuk mengetahui apakah ada perbedaan yang signifikan dalam produktivitas antara usaha tani padi organik dan anorganik, apakah ada perbedaan signifikan dalam efisiensi teknis antara usahatani padi organik dan anorganik, dan apakah biaya pupuk, biaya tenaga kerja, luas lahan garapan, dan panjang penggunaan sistem intensifikasi padi (System of rice Intensification/SRI) memiliki pengaruh yang signifikan pada produksi padi organik. Target penelitian ini adalah peningkatan efisiensi ekonomi dan produktivitas pertanian padi organik di Kabupaten Purworejo, Jawa Tengah. Untuk mencapai target ini, penelitian ini menggunakan metode SRI. Populasi adalah semua petani dari usahatani padi organik dan anorganik di Kabupaten Purworejo. Sampel terdiri dari 45 orang dari petani padi organik dan 45 orang dari petani padi anorganik di desa Ringgit, Purworejo. Mereka dikumpulkan secara random sampling dan data dianalisis menggunakan analisis deskriptif dan kuantitatif. Analisis deskriptif dilakukan dengan membandingkan semua kegiatan yang diperlukan di kedua usahatani padi organik dan anorganik. Analisis deskriptif menyimpulkan bahwa ada perbedaan dalam hal pemilihan benih, bibit, perlakuan benih sebelum disemai, penanaman dan penyiraman, pemupukan, penyiangan dan pengendalian hama. Analisis kuantitatif dilakukan menggunakan Analisis Varians (ANOVA) dan regeresi linear berganda. Analisis kuantitatif menyimpulkan bahwa ada perbedaan yang signifikan dalam produktivitas antara usahatani padi organik dan anorganik. Ada perbedaan yang signifikan dalam efisiensi teknis antara pertanian padi organik dan anorganik. Biaya pupuk, biaya tenaga kerja, luas lahan garapan, dan lama penggunaan metode SRI memiliki efek signifikan pada produksi padi organik.

** Corresponding author, email address: [1] herrym@usd.ac.id, 2 mudayen@usd.ac.id, [3] prihantoro@usd.ac.id.*

1. INTRODUCTION

Organic farming is an alternative that needs to be developed on an ongoing basis. In the long run, organic farming can increase and maintain the level of production and fertility of agricultural land so that the farmers can be in a more stable economy. The transition period is one of the important things that should be known and understood in the process of converting from conventional farming to organic farming. Some previous studies conclude that during the transition period, the organic farming production is lower than the conventional one (Neera et al. 1999; Padel 2001). Therefore, this research is intended to analyze the productivity and technical efficiency of organic rice farming as well as the efforts to improve the productivity and technical efficiency of organic rice farming through the application of agricultural intensification method or commonly known as System of Rice Intensification (SRI).

The term economic productivity illustrates a comparison between output and input (Rutkauskas and Paulaviciene 2005). Productivity in this study illustrates the relationship between the yield of rice production and the index of combined inputs for a variety of farming, particularly labor, capital and natural resources. The term technical efficiency illustrates the ratio between observation farming production and the output (production) of frontier production function (Syamsudin, Suryati, and Aktiviyani 2009).

Organic rice farming is now increasingly applied in various places in Indonesia and some of them use the planting method of System of Rice Intensification (SRI). Based on the result of the study conducted by Qingquan 2002 (in Syamsudin et al. 2009), the farming using SRI method in China can produce between 10-12 tons of rice/hectare. Rice cultivation trials by implementing SRI method in the eastern region of Indonesia can increase yields from 4.11 tons/hectare to 7.27 tons/hectare (Syamsudin et al. 2009). Results of a study conducted by Syamsudin et al., (2009) in Sukakarsa Village, Tasikmalaya District shows that the application of organic rice farming requires a very large amount of compost approximately 5-10 tons/hectare.

This study is designed as an applied research through the application of fertilizer management system on organic rice farming with SRI planting method to increase productivity and technical efficiency of organic rice farming production in Purworejo. Therefore, it requires a variety of social organizations and local governments to encourage organic rice farming in Purworejo, Central Java.

This study is conducted because the problem of food safety and security is one of the national strategic issues that must be dealt intensively and sustainably. Ironically, Indonesia, as an agricultural country, even still imports rice every year. Organic farming is an alternative to supply foodstuffs in order to be able to meet the needs of healthy living. Productivity and efficiency of organic rice farming still need to be improved through SRI method on an ongoing basis.

Based on the above background, this research raises the title: Increased Productivity and Technical Efficiency of Rice Farming with the System of Rice Intensification (SRI) Method in Purworejo, Central Java. The formulation of the problem in this research is: Is there a significant difference in the level of productivity between organic rice farming and inorganic rice farming?; Is there a significant difference in the technical efficiency between organic rice farming and inorganic rice farming?; How significant is the influence of fertilizer costs, labor costs, arable land area, and the length of the use of SRI method on the production of organic rice?

2. THEORETICAL FRAMEWORK AND HYPOTHESES

SRI is a rice planting method which is applied using the principles of fixing the roots of rice plants by regulating the irrigation, applying a single planting, determining early planting time, and improving soil quality. SRI planting method can reduce the amount of water usage and seeds requirement. The application of SRI method in China can produce between 10-12 tons of rice/hectare (Qingquan 2002 in Syamsudin and Aktiviyani 2009). The application of SRI method requires the calculation of organic material availability as a base material of organic fertilizer and optimization calculation of the use of compost and local micro-organisms.

The research team conducted a preliminary study entitled "Comparison Study of the Level of Production Cost, Sales Results and the Level of Income of Organic and Inorganic Rice Farmers in Ringgit Village, Ngombol Subdistrict, Purworejo, Central Java in early 2013". The preliminary study results showed that, compared with inorganic farming system, organic farming system was more environmentally friendly, more efficient use of seeds, cheaper production cost due to the use of manure and natural pesticide, and more productive in agricultural land. In addition, the price of organic rice was more expensive than the price of inorganic rice, so that the income of organic farmers was higher than that of inorganic farmers.

There are four previous studies that are relevant

for references in this study. **First**, the research conducted by Sri (2012) with the title: Comparative Analysis of Socioeconomic Levels between Organic Farmers 'Purworejo Organic Farmers Association' and Conventional Farmers" (Case Study of Rice Farming in Ringgit Village, Ngombol Subdistrict, Purworejo, Central Java). Data were analyzed using two-sample t-test. The results showed that the socioeconomic level of organic farmers was pretty good. The condition of the house, the level of food consumption, health, communication tools, the ownership of infrastructure, social life, and the cost of education for children showed that the level of welfare of organic farmers was better than that of inorganic farmers.

Second, the research conducted by Prayoga (2010) with the title: "Productivity and Technical Efficiency of Wetland Organic Rice Farming". Data were analyzed with Maximum Likelihood Estimator method. The results showed that the organic rice farmers, in the 8th and 5th year, were more productive and more efficient than the conventional farmers.

Third, the research conducted by Syamsudin and Aktaviyani (2009) with the title: "The Application of Fertelizer on Organic Rice Farming with SRI method in Kukakarsa Village, Tasikmalaya District". Data were analyzed using Paired Sample t-test. The results showed that organic rice farming using SRI method was more profitable than conventional rice farming.

Fourth, the research conducted by Darmansyah A.N. et al. (2013) with the title: "Analysis of Technical Efficiency and Factors Affecting the Efficiency on Cabbage Farming in Talang Belitar Village, Sindang Dataran Subdistrict, Rejang Lebong District". Data were analyzed using Ordinary Least Square method. The results showed that the number of seed, organic fertilizer, urea, NPK, Pesticides and Labor simultaneously had significant effect on the cabbage production by 98.7% at the confidence level of 99%. The determinant factors that affect the level of efficiency of cabbage farming indicated that the age of the farmer and the use of technology had a significant effect, at the confidence level of 90%, while the education of farmers, farming experience, and land status did not have a significant effect on cabbage production. Furthermore, the factors of the age of farmers, the education of farmers, farming experience, land status and the use of technology simultaneously had an effect on cabbage production by 61.25%. There are three hypotheses in this study:

H_1: There is a significant difference in productivity between organic rice farming and inorganic rice farming.

H_2: There is a significant difference in the technical efficiency between organic rice farming and inorganic rice farming.

H_3: There is a significant effect of fertilizer costs, labor costs, arable land area, and the length of the use of SRI method on organic rice production.

3. RESEARCH METHOD

Sample of the Study

This is a development study based on applied research, designed to improve productivity and technical efficiency of organic rice farming through the implementation of SRI planting method on an ongoing basis. This research was conducted from May to October 2015. The research site is in Ringgit Village and Popongan Village, Purworejo District, Central Java Province. These locations were chosen as the test site because the organic farming groups in Ringgit Village have been started since 1997. Both locations are eligible for applying the SRI method. The population in this study is all organic and inorganic rice farmers in Ringgit Village, Ngombol Subdistrict, Purworejo, Central Java. The sample in this study is as many as 45 organic rice farmers and 45 inorganic rice farmers in the village. The sampling technique used a non-probability sampling with quota sampling technique.

The data were done by using questionnaire, focus group discussions and interviews. Questionnaire was used to collect primary data in the form of: identity and background of the respondents, the level of productivity of organic farming, the level of technical efficiency, the effect of fertilizer costs, labor costs, arable land area, and the length of the use of SRI method on the rice production. Focus group discussion involves local government officials, local community leaders, organic rice farmers, and a team of researchers to obtain data about: the implementation model of SRI method, the method of training that fits the needs of organic rice farmers, the strategy to maintain the sustainability of organic rice farming, and the strategy to establish the involvement of social organizations and local governments in the development of organic rice farming. Depth interviews are conducted to obtain the data about: empirical overview of organic rice farming in detail, productivity and efficiency of organic rice farming.

Data analysis techniques used in this research were descriptive analysis and quantitative analysis. Descriptive analysis is in the form of a discussion about the difference between organic rice farming and inorganic rice farming. Quantitative analysis includes the calculation of total factors of productivi-

ty (TFP) index, the calculation of technical efficiency, ANOVA, and multiple regression analysis. TFP index is used to measure the productivity of farming both for the organic and the inorganic rice farmers. To compare the total factors of productivity (TFP) is using the Fisher index with the formula as follows (Coelli and Bettese 1998):

$$TFPst = \frac{Output\ \ Indeks\ _{st}(Fisher)}{Input\ \ Indeks_{st}(Fisher)}. \quad (1)$$

$$Output\ Indeks_{st}(Fisher) =$$

$$Q_{st}^{F}(Kuantitas\ Output\ Indeks) = \sqrt{Q_{st}^{L} x Q_{st}^{p}}. \quad (2)$$

$$Input\ Indeks_{st}(Fisher) =$$

$$Q_{st}^{F}(Kuantitas\ Input\ Indeks) = \sqrt{Q_{st}^{L} x Q_{st}^{p}}. \quad (3)$$

Description:
$Q_{st}^{F} = Indeks\ Kuantitas\ Output\ (Fisher)$
$Q_{st}^{L} = Indeks\ Kuantitas\ Output\ (Laspeyres)$
$Q_{st}^{P} = Indeks\ Kuantitas\ Output\ (Paasche)$
s = inorganic rice farming
t = organic rice farming.

While the technical efficiency of farming production can be estimated with the following formula (Coelli and Bettese 1998):

$$TE_i = \frac{y_i}{y_i^*} = \frac{\exp(x_i\beta + v_i - u_i)}{\exp(x_i\beta + v_i)} = \exp(-u_i). \quad (4)$$

Description: *yi* is an actual farming production through observation and yi* is an alleged frontier production derived from stochastic frontier production function. The estimation with states that all farmers have been doing their business 100% efficient is tested using *Likelihood Ratio Test method*, with the formula (Coelli and Bettese 1998): LR = -2 [ln{L(Ho)/L(H_1)}].

Analysis of variance was used to analyze whether there is any difference in the level of productivity and technical efficiency before and after the application of SRI method. In addition, ANOVA is also used to analyze whether there is any difference in revenue and economic benefits before and after the application of SRI method.

Multiple linear regression analysis is used to analyze the effect of fertilizer costs, labor costs, arable land area, and variety of rice seeds on the production of organic rice. Multiple linear regression analysis was done using the stochastic frontier production function with Cobb-Douglas' model assumption that is transformed into linear regression as follows:

$$Yi = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e_t. \quad (5)$$

Description:
Y = organic rice production in one season (in ton)
X_1 = total fertilizer (in kg)
X_2 = labor
X_3 = arable land area
X_4 = the length of the use of SRI method
e = error term

To ensure the stimulators, it was obtained from the ordinary least squares estimator such as it is in BLUE (best linear Unbiased Estimator), some classical assumption tests such as multicollinearity test and heteroscedasticity test should be conducted (Gujarati 2003). Multicollinearity test is conducted using Klein rule of Thumbs method. Heteroscedasticity test is conducted using White Method. To test the validity of the questionnaire instrument, the researchers used using Product Moment Correlation formula, while to test the Reliability is using Alpha - Cronbach formula (Ghozali 2005).

4. DATA ANALYSIS AND DISCUSSION

Organic farming is a cultivation system using organic materials only. The organic materials may include fertilizers and pesticides. To meet the need of fertilizers is using compost derived from leaves or manure, especially cows, buffalos or goats coming from the surrounding environment. The pesticides used in organic farming are derived from natural materials existing in the vicinity. These two materials are very easy to obtain.

In conventional farming system, which is now better known as inorganic farming, the need for fertilizers and pesticides (inorganic fertilizers) is supplied only by factory with a relatively high price. In certain situation, it is difficult to get fertilizers and pesticides from the stores, or even they could be obtained through a reservation to certain groups of farmers. In addition, the use of inorganic fertilizers and pesticides in the long term is not profitable because the land becomes increasingly hard, and pest/disease will become more resistant, requiring higher fertilizers and pesticides. On this basis, organic farming system is likely more efficient than inorganic farming system. It can be seen from the cheaper cost of the purchase of organic fertilizers and pesticides.

In Ringgit Village, the price of organic fertilizers and pesticides is much cheaper because the materials are easily obtained from the surrounding environment so that the dependence on the factory is also relatively low. The dependence will be getting lower when the farmers also keep livestock including cows, buffalos or goats, and trees whose leaves can be taken at any time or by collecting fallen leaves and rice straw crops. Manure and leaves/straw will automatically become compost over time. The composting time can be accelerated and the odor of manure can be eliminated by adding certain microbial isolates that are widely sold in stores or can be made

Table 1
The Difference between Inorganic Rice Farming and Organic Rice Farming with SRI Method

No.	Activity	Inorganic rice farming (conventional)	Organic rice farming with SRI method
1	Land processing	Using tractor/cow with the sequences that the land is plowed, raked, and leveled	Using tractor/cow with the sequences that the land is plowed, raked, sprinkled with organic fertilizers, and leveled.
2	Seed selection	There is special technique to select the seed The process of preparing seeds before planting : the seeds are soaked for one day and one night, the seeds are ripened for two days and two nights, and the seeds are ready to be planted.	There is a special technique to select the seed using saline solution The process of preparing seeds before planting: Good quality seeds are washed to remove the salt, The seeds are ripened for two days, and The seeds are ready to be planted.
3	Seedbed	Seedbed is directly made in the field. The seeds needed are ± 34 -45 kg / hectare	Seedbed can be mad e both directly in the field and in a container. The seeds needed are ± 5 -7 kg / hectare
4	Seed treatment before planting	The seeds which are ready for planting are removed and then the roots are cleaned from the soil using water. Next, parts of the leaves are cut and split per bond. The seeds are rested for 1 hour until 1 day before planting.	The seeds are removed together within the soil attached to the roots and planted directly in the field.
5	Implantation	The age of seedling s which are ready for planting is 18 -25 days after sowing One planting hole is filled with 5 -8 seedlings. Seedlings are planted with the depth of ± 5 cm (sometimes more).	The age of seedlings which are ready for planting is 7 -12 days after sowing. One planting hole is filled with 1 seedling. Seedlings are plante4d in shallow with the depth of ± 2-3 cm.
6	Watering	The field is flooded with water with the height of 5 -7 cm above the surface continuously	Using intermittent watering, a watering system in which the field is not continuously flooded. There is a good drainage system in each plot of the field.
7	Fertilizing	Using Urea, TSP, and KCl	Using manure/ bokashi added with organic liquid fertilizer containing local microorganisms
8	Weeding	With the aim to discard the weeds. Using herbicides	In addition to discarding the weeds, the technique of immersing the uprooted into the soil also aims to improve the soil structure, using manpower and tools.
9	Pest Control	Using toxic chemicals	Using organ ic pesticides

with ease. Composting is getting easier by making use of organic waste processing machine derived from the government assistance in 2008.

At the time of transition from the use of inorganic fertilizers to organic fertilizers, the production decreased drastically by about 20%, because, at first, the response of the plants to the organic fertilizer is still slow due to unstable soil conditions. In the next harvests, the results are getting better, equal to and even exceed the inorganic farming production. Since the price of organic rice is higher, approximately 30%, than the price of inorganic rice, at the time of transition when the organic rice productivity drops, the organic rice farmers can still earn a higher total margin of about 10%. Thus, a drop in rice production at the time of transition from inorganic farming to organic farming does not reduce the income of farmers.

Technical efficiency and productivity improvement are getting greater when the organic farming is implemented by using SRI method. The intensive farming includes land preparation, excellent seeds selection, seedbed, seed treatment before planting, planting the excellent seeds, spacing, watering, ferti-

Table 2
Productivity of Organic and Inorganic Rice Farming

Group Statistics

	Types of Rice	N	Mean	Std. Deviation	Std. Error Mean
The Productivity of Organic & inorganic rice (Ton/Ha)	Organic	45	5.1673	.91386	.13623
	Inorganic	45	4.3344	.92451	.13782

Source: Primary Data, processed 2015.

Table 3
The Difference Test of the Level of Productivity between Organic Rice Farming and Inorganic Rice Farming

		Levene's Test for Equality of Variances		t-test for Equality of Means						
				T	Df	Sig (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.						Lower	Upper
Productivity of Organic & Inorganic Rice (Ton/Ha)	Equal variances assumed	.946	.005	4.298	88	.000	.83289	.19378	.44779	1.21800
	Equal variances not assumed			4.298	87.988	.000	.83289	.19378	.44779	1.21800

Source: Primary Data, processed 2015.

Table 4
The Difference in Technical Efficiency between Organic Rice Farming and Inorganic Rice Farming

	Types of Rice	N	Mean	Std. Deviation
Technical Efficiency	Organic Rice	45	0.7108	0.12570
	Inorganic Rice	45	0.5962	0.12717

Source: primary data, processed 2015.

lizing, weeding, and pest control. In principle, the rice farming using SRI method is as follows: a) young seedling plant is less than 12 days after sowing (HSS) when the seedling is still leafy 2 strands; b) One hole is for one seedling with a distance of 30 × 30, 35 × 35 or less; c) the movement of the plant should be done as soon as possible (less than 30 minutes) and must be handled carefully so that the roots do not break and the seedling is planted in shallow; d) The supply of water maximum 2 cm, and at a certain period it is dried until rupture (Irrigation is intermittent/disconnected); e) Weeding from the start is about 10 days and repeated 2-3 times at intervals of 10 days; f) Using only organic fertilizer (compost or green manure).

Based on the interview with a prominent farmer in Ringgit Village, the seed needed in rice farming with SRI method is only 6 kg/hectare in which the production could reach 6-7 tons/hectare, while conventionally, the seed required is approximately 36 kg/ha in which the production could only reach 4 ton/hectare. Overall, the difference in advantage or superiority between organic rice farming with SRI method and conventional (inorganic) rice farming can be seen in Table 1.

The productivity of organic and inorganic rice farming is determined by calculating the amount of rice produced (in tons) per farmer, and then divided by the arable land area of each farmer. From the calculation, it is obtained that the average productivity of organic rice farming is 5.1673 tons per hectare and inorganic rice farming is 4.3344 tons per hectare. The productivity of organic and inorganic rice farming can be seen in Table 2.

From the calculation above, it can be seen that the productivity of organic rice farming (5.1673 tons per hectare), is higher than the productivity of inorganic rice farming (4.3344 tons per hectare). However, when compared with the results of the study conducted by Qingquan 2002 (in Syamsudin and Aktiviyani 2009), the rice farming using SRI method in China can produce between 10-12 tons of rice/hectare, and the pilot rice farming by implementing SRI method in the eastern region of Indonesia can increase the productivity from 4.11 tons/hectare to become 7.27 tons/hectare (Syamsudin and Aktiviyani 2009). The productivity of organic rice farming which is still relatively low is likely caused by the improper selection of seeds, the lack of experience in using the SRI method, the less

Table 5
The Difference Test in Technical Efficiency between Organic Rice Farming and Inorganic Rice Farming Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
				T	Df	Sig (2-tailes)	Mean Difference	Std. Error Difference	95% Confidence interval of Difference	
		F	Sig						Lower	Upper
Technical Efficiency	Equal variances assumed	.005	.946	4.298	88	.000	.11457	.02666	.06159	.16754
	Equal variances not assumed			4.298	87.988	.000	.11547	.02666	.06159	.16754

Source: Primary Data, processed 2015.

Table 6
Multiple Regression Analysis

Coefficients[2]

	Unstd. Coefficients		Std. Coefficients		
	B	Std. Error	Beta	T	Sig.
Constant)	-1121.545	728.403		-1.540	.132
Fertilizer Costs (IDR)	.038	.006	.388	6.658	.000
Labor Costs (IDR)	.008	.000	.033	.828	0.413
Arable Land Area (meter square)	2.206	.221	.583	9.996	.000
The length of the Use of SRI Method.	463.380	176.720	0.001	2.622	.012

a. Dependent Variable: Results of organic rice production (ton)
Source: Primary Data, processed 2015.

Table 7
Results of Multicollinearity Test with VIF and Tolerance Methods

Coefficients[a]

Model		Unstd. Coefficients		Std. Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-1121.545	728.403		-1.540	.132		
	Fertilizer Costs (IDR)	.038	.006	.388	6.658	.000	.313	3.192
	Labor Costs (IDR)	.008	.000	.033	.828	.413	.664	1.506
	Arable Land Area (meter square)	2.206	.221	.583	9.996	.000	.313	3.196
	The length of the Use of SRI Method (year)	463.380	176.720	.091	2.622	.012	.884	1.131

Dependent Variable: Organic rice production (kg)
Source: Primary Data, processed 2015.

precise fertilizer and so forth.

To answer the research question about whether there is any difference in productivity between organic rice farming and inorganic rice farming, the researchers conducted a difference test. The difference test results can be seen in Table 3.

From Table 3, it can be seen that F-count for the variance of both population is 0.946 with a probability of 0.005 (assuming the two variances are not equal). Since the probability is < 0.05, H_0 is rejected, or the variances are unequal. To see whether the productivity of the organic rice farming (5.1673 tons per hectare), and inorganic rice farming (4.3344 tons per hectare), the difference test is then conducted. From the difference test, it is obtained that t count is 4.298, with a probability of 0.000, which means that there is a significant difference in productivity between organic rice farming and inorganic rice farming. Even though the productivity of organic rice farming has not been as expected (the productivity of organic rice farming in eastern region of Indonesia reached 11 tons per hectare), but seeing that the productivity of organic rice farming is higher than inorganic rice farming, so the organic rice farming remains a good choice to increase agricultural productivity.

To answer the research question about how high the technical efficiency between organic rice farming and inorganic rice farming, the calculation is made on the amount of rice produced (in tons per

Table 8
Results of Heteroscedasticity Test using the Method of Spearman-Rank and Kendall

		Organic Rice Production (ton)
Fertilizer Costs (IDR)	Pearson Correlation	.912**
	Sig (2-tailed)	.000
	N	45
Labor Costs (IDR)	Pearson Correlation	.586**
	Sig (2-tailed)	.000
	N	45
Arable Land Area (meter square)	Pearson Correlation	.943**
	Sig (2-tailed)	.000
	N	45
The length of the use of SRI method	Pearson Correlation	.371*
	Sig (2-tailed)	.012
	N	45
Organic rice production (ton)	Pearson Correlation	1
	Sig (2-tailed)	
	N	45

Source: Primary Data, processed 2015.

Table 9
F-test

ANOVA[b]

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.5777E9	4	6.442E8	224.474	.000[a]
Residual	11.148E8	40	2869884.918		
Total	2.692E9	44			

Predictors: (Constant), The length of the use of SRI method, fertilizer costs (IDR), arable land area (meter square), labor costs (IDR)
b. Dependent Variable: Organic rice production (ton)
Source: Primary Data, processed 2015.

Table 10
Model of Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.978[a]	.957	.953	1694.073

Source: Primary Data, processed 2015.

hectare) per farmer, and then divided by the limit of the possible production of organic rice per hectare based on the case study in eastern region of Indonesia (7.27 tons per hectare). From this calculation, it is obtained that the average technical efficiency of organic rice farming is 0.7108, and inorganic rice farming is 0.5962. The level of technical efficiency can be seen in Table 4 and Table 5.

To answer the research question about whether there is significant difference in technical efficiency between organic rice farming and inorganic farming, the difference test is then conducted. The difference test results can be seen in Table 4.

From Table 4 and Table 5, it can be seen that the F-count for the variance of both population is 0.005 with probability (sig.) of .946 (Assuming both variances are equal. Since the probability (sig.) is 0.946 > 0.05, then H0 is accepted, which means that the population variances are equal. To see whether there is a difference in technical efficiency between organic rice farming (0.7108), and in organic farming (0.5962), the difference test is then conducted. From difference test, it is obtained that t-count is 4.298 with a probability (sig) of 0.000 <0.05, which means that there is a significant difference in technical efficiency between organic rice farming and inorganic rice farming. The technical efficiency of organic rice farming is higher than that of inorganic rice farming because the organic rice farming in the study site has already begun using the SRI method. However, the level of technical efficiency could still be improved to get closer to 1 or over it.

To answer the research question about whether the fertilizer costs, labor costs, arable land area and

the length of the use of SRI method have an effect on the organic rice production (IDR), the multiple regression analysis is then conducted.

From Table 6, the regression equation is as follows:

$Y = -1121.545.038\ X_1 + 0.008\ X_2 + 2.206\ X_3 + 463.380X_4$

Based on the regression results above, it can be seen that the constants is -1121.545 with significance asymptote value of 0.132 greater than alpha 0.05, so it can be said that the constants has no significant effect on the production of organic rice. Furthermore, the cost of organic fertilizer is 0.038 with significance asymptote value of 0.000 smaller than alpha 0.01. Thus, it can be stated that the cost of organic fertilizer has a significant positive effect on the organic rice production at the confidence level of 99%. This means that if the cost of organic fertilizer is increased by one unit, the organic rice production will also increase by 0.038 units.

For the variable of cost of labor has a beta coefficient of 0.008 with significance asymptote value of 0.413 greater than alpha 0.05. Thus, it can be said that the labor cost does not significantly influence the organic rice production, at confidence level of 95%.

For the variable of land size of organic rice farming has a beta coefficient of 2.206 with significance asymptote value of 0.000 smaller than alpha 0.01. Thus, it can be said that the land size has significant positive effect on the organic rice production at the confidence level of 99%. This means that if the land size is increased by one unit, the organic rice production will also increase by 2.206 units at the confidence level of 99%.

Furthermore, the variable of the length of the use of SRI method has a beta coefficient of 463.380 with significance asymptote value of 0.012 smaller than alpha 0.05. Thus, it can be said that the length of the use of method of SRI method has a significant effect on the organic rice production at the confidence level of 95%. This means that if the length of the use of SRI method is increase by one unit, the organic rice production will also increase by 463.380 units at the confidence level of 95%.

To determine whether the regression equation can be used as a good estimation tools, the researchers conducted a classical assumption test. The classical assumption test in this research consists of multicollinearity test and heteroscedasticity test. The results of classical assumption test are as follows: First, the test results multicollinearity test. The multicollinearity in this research relies on the value of Variance Inflation Factor (VIF) and its tolerance value. If the VIF value is below 10, and the tolerance value is below 1, it means that the there is no multicollinearity. From the statistic test, it is obtained the values of VIF and tolerance as shown in Table 7.

From Table 7, it can be concluded that the regression model does not experience multicollinearity problem because all of the values of Variance Inflation Factor (VIF) for independent variables are below10, and the value of its tolerance is less than 1.

Results of Heteroscedasticity Test

The heteroscedasticity test in this study is conducted using the method of Spearman-Rank and Kendall. The heteroscedasticity test can be seen in Table 8.

From Table 8, it can be seen that the significance asymtot value of (2-tailed) the correlations of each independent variable with the dependent variable is smaller than alpha 5%, which means that the regression does not contain heteroscedasticity problem. From the tests above can be said that the regression equation has been free from the symptom of heteroskedasticity and multicollinearity, which means that the regression equation has been qualified as the BLUE estimator (best, linear, unbiased, estimator).

After performing classical assumption test, it was found that the regression equation is BLUE, the F test and t test were then conducted. From the F test by using multiple regression analysis, it was obtained that the value of F-count is 224.474 (in sig.0.000) which means that the cost of fertilizer, the cost of labor, farming land size and the length of the use of SRI method simultaneously affect the organic rice production. In other words, the regression model used in this study is correct. The results of F-test can be seen in Table 9.

From the t-test using multiple regression analysis (table 5), it is obtained that the t-count of cost of fertilizer is 6.658 (at sig. 0.000 <0.05); t count of cost of labor is 0.828 (at sig.0.416 > 0.05); t-count of farming land size is 9.996 (at sig 0.000 <0.05), t-count of the length of the use of SRI method is 2.622 (at sig 0.012 <0.05), which means that the cost of fertilizer, land size, and the length of the use of SRI method have an effect on the production of organic rice farming, and cost of labor has no effect on the production of organic rice farming.

To know how much the influence of cost of fertilizer, the cost of labor, the land size, and the length of the use of SRI method, it can seen from the result of R^2. The result of R2 count in Table 10 is 0.957, which means that the changes in the production of organic rice farming 95.7% is determined by

the four independent variables, namely cost of fertilizer, cost of labor, farming land size, and the length of the use of SRI method, while the remaining 4.3% is determined by other variables outside the model.

From the results of regression analysis show that the regression coefficient for "the length of the use of SRI method" and the "land size" is quite high. The high regression coefficient for "the length of the use of SRI method" explains that the appropriate use of SRI method takes a long time, so that a farmer can understand the behavior of the rice properly, from the selection of rice seeds to the harvest time. The regression coefficient of land size is also quite high which explains that the larger the land used, the higher the productivity of the organic rice farming because the use of many different types of costs (labor costs, cost of fertilizer) becomes more efficient.

5. CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

Organic rice farming productivity (5.1673 tons per hectare) in Purworejo District is more productive than inorganic rice farming productivity (4.3344 tons per hectare), although the productivity is still lower than the organic rice farming productivity in eastern Indonesia (7.8 tons per hectare). The technical efficiency of organic rice farming (0.7108) is significantly different from the inorganic rice farming (0.5962). despite the fact that the level of efficiency of organic rice farming is not maximized. The regression coefficient of the length of the use of SRI method is very big or 463.380 and then followed by the regression coefficient of land size amounting to 2.206. This means that the length of the learning time for the farmers in using SRI method is crucial to determine the high rice production. The same thing also occurs for the land size, in which the larger the land used for organic rice farming using SRI method, the higher the production

The organic rice farmers should continuously learn in terms of selecting seeds, planting, regulating the water and so forth so that they are eventually able to implement SRI method correctly. The correct application of SRI method can increase the productivity of farming. If possible, the farmers should continue to look for additional land, for example, by transforming dry land into rice fields because there is evidence that the larger the land, the higher the production.

REFERENCES

Coelli, TJ, DSP Rao and GE Bettese, 1998, *An Introduction to Efficiency and Productivity Analysis,* Kluwer Academic Publisher, Boston.

Darmansyah AN et al. 2013, Analisis Efisiensi Teknis dan Faktor yang Mempengaruhi Efisiensi pada Usaha Tani Kubis di Desa Talang Belitar, Kecamatan Sindang Dataran, Kabupaten Rejang Lebong, *Jurnal Agrisep,* Vol. 12, No. 2 September 2013, pp. 177 – 194.

Ghozali, Imam, 2005, *Aplikasi Analisis Multivariate dengan Program SPSS,* Semarang: Badan Penerbit Universitas Diponegoro.

Gujarati, Damodar N, 2003, *Basic Econometrics 4th* ed., New York: McGraw-Hill.

Neera, P, M Katano, and T Hasegawa, 1999, *Comparison of Rice Yield after Various Years of Cultivation by Natural Farming*, Plant Production Science.

Padel, S 2001, 'Conversion to Organic Farming A Typical Example of the Diffusion of an Innovation?', *Sociologia Ruralis*, Vol. 41(1), European Society for Rural Sociology, ISSN 0038-0199.

Prayoga, Adi, 2010, 'Produktivitas dan Efisiensi Teknis Usaha Tani Padi Organik Lahan Sawah', *Jurnal Agro Ekonomi,* Volume 28, No. 1, May 2010, pp. 1-19.

Rutkauskas, J and E Paulaviciene, 2005, 'Concept of Productivity in Service Sector', *Engineering Economics*, Vol. 43(3), ISSN 1392-2785.

Sri, Anastasia Ervin, 2012, 'Analisis komparatif tingkat sosial ekonomi antara petani organik 'Perkumpulan Tani Organik Purworejo' dampingan kongregasi Suster Cinta Kasih Putri Maria dan Yosef (PMY) dan petani konvensional' (Studi kasus pertanian padi di Desa Ringgit Kecamatan Ngombol, Kabupaten Purworejo, Jawa Tengah)', Undergraduate Thesis, Yogyakarta: Universitas Sanata Dharma.

Suhartini and Edi Dwi Cahyono, 2009, 'Kajian sistem pertanian padi organik: dalam perspektif indogenoeus knowledge/technology dan ekonomi lingkungan (Kasus di Sragen, Jawa Tengah dan Malang, Jawa Timur)', Thesis, Malang: Universitas Brawijaya.

Syamsudin, Tati Suryati and Sri Aktiviyani, 2009, 'Penerapan pemupukan pada pertanian padi organik dengan metode System of Rice Intensification (SRI) di Desa Sukarasa, Kabupaten Tasikmalaya', *Journal Agroland,* Vol. 16 (1), March, <http://jurnal.untad.ac.id/jurnal/index.php/.../210/178>, viewed 12 April 2015.