

Comparison of Organic and Conventional Paddy Farming: Study in Two Villages in Malang District, Indonesia

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Abstract.

Practicing organic farming is the way that can be chosen by farmers to realize the sustainable livelihood. However, the practicing of organic farming in Indonesia was only 0.6 percent or 208,042 hectares in 2017. The profit orientation of conventional farmers is the issue in conversion process from practicing conventional to organic farming. The objective of this study is to analyze the profit earned by farmers in conventional and organic paddy farming. Two village in Malang district, namely Sumber Ngepoh and Mulyoarjo, were chosen as study field. There are 32 organic paddy farmers from farmer group of Sumber Makmur 1 in Sumber Ngepoh village and 34 conventional paddy farmers from farmer group of Mulyo 2 in Mulyoarjo village were interviewed. The independent t-test was used to analyze the different of profit earned by those farmers. The mean of total cost in farmer group of Sumber Makmur 1 is 151 percent less than in farmer group of Mulyo 2. Furthermore, the mean of production, revenue, and profit in farmer group of Sumber Makmur 1 are 15, 21, and 66 percent respectively more than in farmer group of Mulyo 2. It is concluded that practicing organic paddy farming in Sumber Ngepoh village is more profit compared to practicing conventional paddy farming in Mulyoarjo village. This conclusion can be a basic for farmers in Mulyoarjo village to do conversion from practicing conventional paddy farming to organic paddy farming by objective to get similar benefit as gotten by farmers in Sumber Ngepoh village.

Keywords: sustainable livelihoods, organic farming, conventional farming, profit

1. Introduction

Doing farming activities is a means for farmers to making a living. Hence, agriculture has a very important role as a livelihood source for the farmers. Livelihood is defined as sufficient supplies and streams of food and money to fulfill basic necessities of life; while sustainable is defined as the preservation or increase of resource productivity on a long-term basis.^[1] Based on this definition, farmers must realizes sustainable livelihoods through their farming activities to guarantee sustainability to making a living. Achievement the sustainable livelihoods is only realized if the natural environment is sustainably managed.^[2] More specific, organic farming can increase peasant farmers' livelihood.^[3]

Organic farming leads to preservation of natural resources, causes minimal negative impact on nature and could be defined as a self-sufficient system.^[4] Moreover, organic farming depends on the use of natural resources, and focuses on sustainability, via (among other things) recycling resources and lowering pollution, so that it is a strive that contributes many of the worth and perspectives of ecological economics.^[5] However, in 2017, there is only 1.4 percent (69.8 million hectares) of organic agricultural land from total agricultural land in the world.^[6] This data indicates that most farmers in the world are still practicing conventional farming.

Conventional farming has been a common practice among farmer in improving productivity to meet the increasing demand.^[7] In line to this, conventional farming puts its focus on achieving maximum yields of a specific crop.^[8] To realize this achievement, conventional agriculture typically utilize synthetic, chemical inputs.^[9] Conventional farming is farming activities, which in its practice use not only synthetic chemical fertilizers, but also synthetic chemical pesticides and synthetic chemical herbicides as well as apply heavy irrigation, intensive tillage, or concentrated monoculture production.^[10]

In Indonesia, most farmers are also practicing conventional farming. It is indicated by total organic agricultural land in Indonesia that was only 0.6 percent (208,042 hectares) in 2017.^[11] In that year, there were 35,923,886 people working in agricultural sector¹ in Indonesia.^[12] Total of smallholders in Indonesia is 93 percent of total farmers and small family farming is generally carried out on modest plots averaging 0.6 hectares.^[13] These data show that farming activity in Indonesia has a very important role as a source of livelihoods for the large number of small farmers. By practicing the conventional farming, they are very dependent on the use of chemical agricultural inputs, such as chemical fertilizers, pesticides, insecticides and fungicides.

In Indonesia, there are six sub sectors of agricultural as source of livelihood for the farmers who live in rural area. The subsectors are food crops, horticultural crops, plantation (estate) crops, forestry, livestock and fishery. One of food crops commodity cultivated by the farmers in Indonesia is paddy. This commodity is the source of main foodstuff for Indonesian people and it widely planted in all 34 provinces in this country. In 2017, harvested area for paddy in Indonesia was 15,890,073 Hectare with production was 81,148,594 Ton.^[14]

As one of the paddy producing area, East Java province is the second-largest producer of paddy in Indonesia. In 2017, harvested area for paddy in this province was 2,285,232 Hectare with production was 13,060,464 Ton.^[15] Two villages as area for planting paddy in this province are Mulyoarjo and Sumber Ngepoh village. In Mulyoarjo village, there are a part of farmers plant paddy conventionally, while in Sumber Ngepoh village, there are a part of farmers plant paddy organically.

Encouragement must be done to the farmers so that they practice organic farming in order to make better the outcome of their livelihoods.^[16] The livelihood outcomes are component of sustainable livelihoods.^[17] One of the categories of livelihood outcomes is *more income*. Therefore, it is concluded that by doing conversion from practicing conventional farming to practicing organic farming can generate more income, which contribute to sustainable livelihoods. Doing conversion from conventional to organic farming means changing the use of agricultural inputs,

¹ This sector is included agriculture, forestry, hunting and fisheries.

namely from using chemical fertilizers, pesticides, insecticides and fungicides to using natural fertilizers, pesticides, insecticides and fungicides. The conversion of using farming inputs potentially leads to the change of cost of production, rate of production, selling price of the yield, and rate of profit from selling the yield.

Conventional farmers are more profit oriented compared to organic farmers.^[18] Therefore, the change of profit as a result of doing a conversion from practicing conventional farming to practicing organic farming encourage every conventional farmers to do a rational thing before they make the decision to convert from conventional to organic farming. In this context, they carry out a comparison analysis about profit, which is earned from conventional farming and from organic farming, deeply and carefully. Certainly, the analysis is intended to avoid the losses as a result getting the lower profit from doing the conversion.

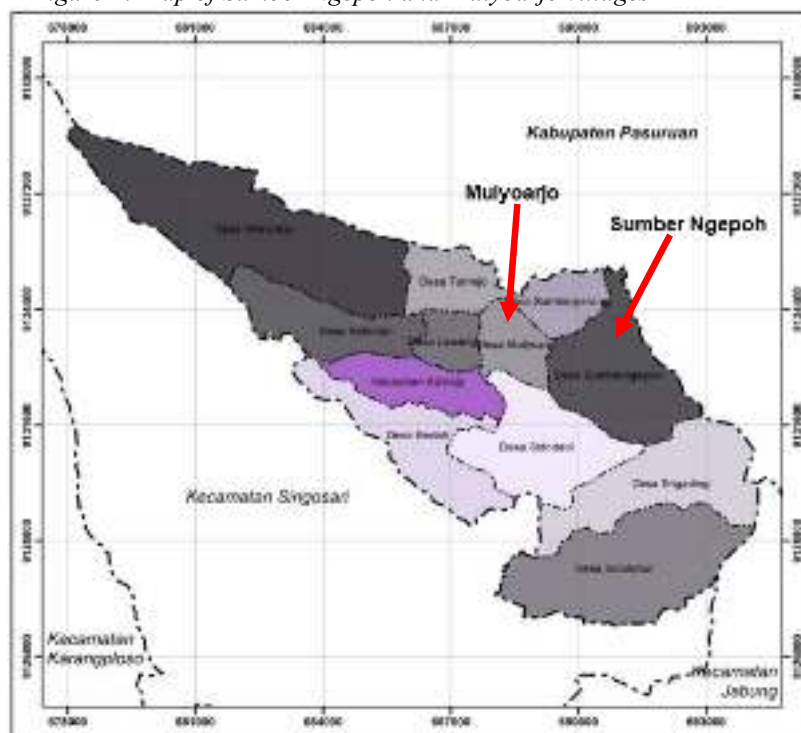
The fact that the farmers in Mulyoarjo village still plant paddy conventionally indicates a reluctance from them to do a conversion from practicing conventional farming to practicing organic farming. However, the consistency of them to plant paddy conventionally could not lead to conclusion that they earn profit from their farming is higher than profit earned by organic paddy farmers in Sumber Ngepoh village. It is needed a comparison of profit earned from conventional paddy farming in Mulyoarjo village and profit earned from organic paddy farming in Sumber Ngepoh village. The comparison must be made base on scientific method by using statistical analysis. This comparison does not carry out on individual level but on a group level. Based on the result of the comparison, a convincing conclusion about the profit earned from conventional paddy farming in Mulyoarjo village and from organic paddy farming in Sumber Ngepoh village could be stated. Therefore, the objective of this study is to analyze the profit earned in conventional paddy farming in Mulyoarjo village and in organic paddy farming in Sumber Ngepoh village where the analysis is based on the cost of paddy production (variable, fixed, and total cost), the total of paddy production, and the revenue from selling the paddy.

2. Materials and Methods

Mulyoarjo and Sumber Ngepoh villages are located in Lawang sub district, Malang district, East Java province, Indonesia. These both areas were selected as the study area because the organic and conventional paddy farmers are available in these villages. Moreover, the villages are adjoining, so that the paddy planting areas in both villages have a similar characteristic, the steps in planting paddy done by farmers in both villages are also similar and the conditions of the farming community are similar.

There are two farmer groups in Mulyoarjo village, namely Mulyo 1 and Mulyo 2, and two farmer groups in Sumber Ngepoh village, namely Sumber Makmur 1 and Sumber Makmur 2. All farmers in two farmer groups in Mulyoarjo village plant paddy conventionally. While, all farmers in farmer group of Sumber Makmur 1 plant paddy organically. A part of farmers in Sumber Makmur 2 plant paddy conventionally and other plant paddy half-organically.

Figure 1: Map of Sumber Ngepoh and Mulyoarjo villages



Source: Damayanti et al. (2017)^[19] with modification.

Choosing one farmers group from each villages is intended to create an equality in doing comparison between organic paddy farmers from Sumber Ngepoh village and conventional paddy farmers from Mulyoarjo village. Farmer group of Mulyo 2 is chosen from Mulyoarjo village, and farmer group of Sumber Makmur 1 is chosen from Sumber Ngepoh village. There are 38 paddy farmers in farmer group of Mulyo 2 and 35 paddy farmers in farmer group of Sumber Makmur 1.

To determine the total sample size, this study used the equation to determine the sample size from a known (finite) population.^[20] The equation is shown as follow:

$$s = \frac{X^2 NP(1 - P)}{d^2(N - 1) + X^2 P(1 - P)} \quad (1)$$

where:

- s = Required sample size
- X² = The table value of chi-square for 1 degree of freedom at the desired confidence level (1.960 x 1.960 = 3.841).
- N = The population size.
- P = The population proportion (assumed to be 0.50 since this would provide the maximum sample size)
- d = The degree of accuracy expressed as a proportion (0.05)

By using the formula, the number of sample respondents in this research is 32 organic paddy farmers from farmer group of Sumber Makmur 1 and 34 conventional paddy farmers from farmer group of Mulyo 2. These sample size have fulfilled the requirement for minimum sample size, namely that a minimum sample size for quantitative research which using some form of statistical on data collected is 30.^[21] Moreover, generally, sample size greater than 25 or 30 will produce a good approximation.^[22]

Collecting data from respondents is done by direct interview to the farmers using structured questionnaire. The data, which were collected from respondents, were tabulated into excel spreadsheet to simplify in the data processing, both using excel or SPSS statistics version 16.0.

Kolmogorov–Smirnov test is used to test whether a sample was from a normally distributed population or not.^[23] Therefore, in this study, the normal distribution of data is tested using the Kolmogorov-Smirnov test. The equation of the Kolmogorov-Smirnov test is present as follow^[24]:

$$D_{KS} = \sup|F_N(x) - F_E(x)| \quad (2)$$

where:

D_{KS} = Kolmogorov-Smirnov test

$F_N(x)$ = The Empirical Cumulative Distribution Function (ECD)

$F_E(x)$ = The Expected Cumulative Distribution Function

x = Random sample

The hypotheses, which are used, in the test are:

H_0 : The data follow a normal distribution if the significant value is more than 0.05 ($p \geq 0.05$).

H_1 : The data do not follow a normal distribution if the significant value is less than 0.05 ($p \leq 0.05$).

“A t-test is a type of statistical test that is used to compare the means of two groups. There is the independent t-test, which can be used when the two groups under comparison are independent of each other”.^[25] Based on these statements, the independent sample t-test will be used in this research. The formula of the independent sample t-test which will be used in this research is:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad (3)$$

where:

t = t-test value

\bar{x}_1 = The means for components of economic performance in organic farming

\bar{x}_2 = The means for components of economic performance in conventional farming

s_1^2 = Variance for components of economic performance in organic farming:

$$\frac{\sum (x_1 - \bar{x}_1)^2}{n_1} \quad (4)$$

s_2^2 = Variance for components of economic performance in conventional farming:

$$\frac{\sum (x_2 - \bar{x}_2)^2}{n_2} \quad (5)$$

n_1 = Number of respondents in organic farming

n_2 = Number of respondents in conventional farming

The hypotheses, which will be used to find out the different of components of economic performance, are:

- H₀ : $p \geq 0.05$ means there is no the significant different of the components of economic performance between organic and convention farming.
- H₁ : $p \leq 0.05$ means there is the significant different of the components of economic performance between organic and convention farming.

The significance level (α) which is used to accept or to reject the hypothesis is 5 percent (0.05). The hypothesis null (H₀) will be rejected if $t_{\text{calculated}} > t_{\text{table}}$ and vice versa. The result of the t-test will be used to determine the more profitable farming.

Refer to the objective of this study; this study is to analyze the profit earned in conventional paddy farming in Mulyoarjo village and in organic paddy farming in Sumber Ngepoh village. Therefore, the comparison of mean of variable cost, fixed cost, total cost, production, revenue and profit is done between farmer group of Mulyo 2 and Sumber Makmur 1.

Given that the farming land area owned by each farmer in both villages varies, then this thing causes the use of farming inputs, cost of production, production, selling result and profit are different. Therefore, in doing data processing, data of farming land area in both villages are converted into one Hectare. Thus, data of farming inputs, cost of production, production, selling result and profit in both village varies are also converted equal to one Hectare.

3. Results and Discussion

Test of sample distribution normality by using Kolmogorov-Smirnov test shows that all data are distributed normal. This thing is shown by Significant (Sig.) values for all data is more than 0.05. The results of the Kolmogorov-Smirnov test is presented in the Table 1. Based on this result, the data can be processed by using the parametric inferential statistical test, namely t-test.

The result of data processing by using t-test, as shown in Table 2., shows that all p value are less than 0.05. This means that there is the different the mean of variable cost, fixed cost, total cost, production, revenue and profit between in farmer group of Mulyo 2 and in farmer group of Sumber Makmur 1. The different of the mean states that by practicing the different paddy farming lead to the different using the agricultural inputs, such as fertilizers and pesticides. It influences to the cost of production, which must be spent by the farmers. In turn, it also influence to the profit earned by the farmers.

Table 1: Tests of Normality

The mean of	Kolmogorov-Smirnov		
	Statistic	df	Sig.
Variable Cost Organic	.119	32	.200
Variable Cost Conventional	.116	34	.200
Fixed Cost Organic	.135	32	.147
Fixed Cost Conventional	.066	34	.200
Total Cost Organic	.110	32	.200
Total Cost Conventional	.114	34	.200
Production Organic	.120	32	.200
Production Conventional	.137	34	.103
Revenue Organic	.120	32	.200
Revenue Conventional	.138	34	.101
Profit Organic	.114	32	.200
Profit Conventional	.138	34	.097

Source: Data processed by authors, 2019

Table 3. present the mean of profit and its components, namely variable cost, fixed cost, total cost, production, selling price, and revenue, both in farmers group of Sumber Makmur1 and Mulyo 2. From the table, it is seen that variable, fixed and total cost which must be spent by the farmers in farmers group of Sumber Makmur 1 to run their organic paddy farming is 153, 81, and 151 percent respectively less than variable cost, which must be spent by the farmers in farmers group of Mulyo 2.

Table 2: T Tests Results

Profit and its components	P(T<=z) two-tail
Variable cost	1.68E-07
Fixed cost	7.11E-07
Total cost	1.44E-07
Production	0,030169
Revenue	0,001046
Profit	3.76974E-18

Source: Data processed by authors, 2019

From Table 3., it can also be seen that production of organic paddy is higher than the conventional paddy. The different of production in both village reach 15 percent. While the selling price of paddy grain for organic paddy is 8 percent higher than conventional paddy. The production and selling price of paddy grain contribute to the revenue of paddy grain. This thing causes that the revenue of paddy grain, which is earned by the farmers in farmers group of Sumber Makmur 1 is 21 percent higher than the farmers in farmers group of Mulyo 2.

From Table 3., it can be seen that profit of organic paddy is higher than the conventional paddy. The different of profit in both village reach 66 percent. This is caused by the low of total cost in organic paddy farming in Sumber Ngepoh village compared to Mulyoarjo village and the high of selling result of paddy grain earned by farmers in Sumber Ngepoh village compared to Mulyoarjo village.

Table 3: The mean of Cost, Production, Price and Profit

Mean of	Unit	Organic	Conventional	Percentage O to C
Variable cost	IDR	7,027,126	17,783,603	(-) 153
Fixed cost	IDR	243,879	442,258	(-) 81
Total cost	IDR	7,271,006	18,225,861	(-) 151
Production	KG	7,119	6,074	15
Price	IDR	5,000	4,612	8
Revenue	IDR	35,596,667	28,005,294	21
Profit	IDR	28,325,661	9,779,433	66

Note: O means Organic; and C means Conventional

Source: data processed by authors, 2019

The low of variable cost to run organic paddy farming in Sumber Ngepoh village compared to variable cost to run conventional paddy farming in Mulyoarjo village is caused by the use of natural farming inputs by farmers in Sumber Ngepoh village, namely the use of animal manure (from cow, goat and buffalo) for fertilizers and some useful plants for pesticides. All farmers in farmer group of Sumber Makmur 1 have livestock as source for animal manure. This thing help them to reduce the cost to procurement of the fertilizer, such as to buy chemical fertilizers. The application of the animal manure to organic paddy plant carried out by the farmers throughout the paddy-planting season. Besides as resource of the animal manure, the livestock also has an important function as a savings for the farmers. They can sell it if they need more money.

To control the rat (*Rattus argentiventer*), the farmers in farmers group of Sumber Makmur 1 use the *gadung KB (Dioscorea composita)*. This tuber is used only to control the breeding of the rat. While, to control the *sundep (Scirpophaga innotata)* the farmers use the *dringu daun* (leaf of *Acorus calamus*) and the *daun sirsak* (leaf of *Annona muricata*).

The variable cost, which must be spent by the farmers in farmers group of Mulyo 2, is to buy the chemical fertilizers and pesticides. The kinds of chemical fertilizers are Urea², ZA³, NPK Phonska⁴ and TSP⁵. While, the kinds of the chemical pesticides are Decis⁶, Furadan⁷ and Ally⁸.

The fixed cost, which must be spent by the farmers in farmer group of Sumber Makmur 1, is to pay tax for their farming land and to pay organic certificate. The amount of cost of tax for farming land that must be paid by the farmers in this group is lower than the amount of cost of tax for farming land that must be paid by the farmers in farmer group of Mulyo 2. This thing causes the fixed cost, which must be spent by the farmers in farmer group of Mulyo 2, is higher than the fixed cost, which must be spent by the farmers in farmer group of Sumber Makmur 1.

Meanwhile, the amount of cost, which must be spent by the farmers in farmer group of Sumber Makmur 1, to get the organic certificate is IDR 33 Million. The validity period of the certificate is 3 years. Therefore, each farmers must contribute about IDR 26,191⁹ per month to pay the certificate. By paying jointly the cost for the organic certificate are mitigating for the farmers. Moreover, by having the organic certificate give a benefit to increasing the image of their organic paddy to consumers.

The high of total cost, which is spent by farmers in farmers group of Mulyo 2, is caused by the high of variable cost, namely to buy chemical farming inputs. This variable cost is higher compared to the variable cost to pay organic certificate, which is spent by each farmers in farmers group of Sumber Makmur 1.

There are two things, which cause the high production of organic paddy in Sumber Ngepoh village compared to production of conventional paddy in Mulyoarjo village, namely:

- (a) the farming land area, which is owned by the farmers in farmers group of Sumber Makmur 1, is more wide compared to the farming land area that is owned by the farmers in farmer group of Mulyo 2,
- (b) the *wereng (Nilaparvata lugens)*, which come into farming land in Mulyoarjo village, also decreased the paddy production in this village.

The different of selling price between organic paddy from Sumber Ngepoh village and conventional paddy from Mulyoarjo village is based on the way to determine the price. The determination of selling price of organic paddy is done by all farmers in farmers group of Sumber Makmur 1. The price is determined in the group meeting which is carried out in every 4 month, namely on 15 April, 15 August and 15 December. Before the meeting take place, the survey of the price of paddy in central

² Urea is known as Nitrogen (N) fertilizer.

³ ZA is known as Nitrogen (N) with Sulfur (S) fertilizer.

⁴ NPK is known as compound (Nitrogen (N), Phosphorus (P), and Potassium (K)) fertilizer.

⁵ TSP is the Triple Super Phosphate fertilizer.

⁶ Decis is used to eradicate the *wereng (Nilaparvata lugens)*.

⁷ Furadan is used to eradicate the *penggerek batang (Tryporyza innotata)*

⁸ Ally is a herbicide.

⁹ This IDR 105,000,- is obtained from IDR 33 Million divided by 36 month (3 years to expired time for certificate) is being IDR 916,667. This IDR 916,667 is divided by 35 farmers is being IDR 26,191.

market at Lawang sub district and Malang city is done by two to three of the members of the farmer group. The price, which is gotten from the survey is the price of conventional paddy. Based on this price, the farmers in farmers group of Sumber Makmur 1 determine the selling price for their paddy above of the surveyed price. Meanwhile, the farmers in farmer group of Mulyo 2 sell their paddy is follow on the price for conventional paddy, which is sold in the central market at Lawang sub district and Malang city.

The rate of paddy production and the selling price of paddy in each farmers group contribute to the revenue earned by farmers in each farmer group. The high production and selling price of organic paddy contribute to the higher revenue earned by the farmers in farmer group of Sumber Makmur 1. This revenue, together with the lower of total cost production which spent by the farmers in farmer group of Sumber Makmur 1, contribute to the more profit earned by the farmers in this group. The continuity of high profit earned by the farmers in farmer group of Sumber Makmur 1 is also support by selling of paddy to one of member of the group, namely the head of the farmer group. Therefore, all the farmers only face one trader and the selling process can be controlled directly by them. In contrast, the farmers in farmer group of Mulyo 2 sell their paddy to one of two middleman in Mulyoarjo village, so that they can not control the determine the selling price.

4. Conclusions

The practice of organic paddy farming in Sumber Ngepoh village show many benefit obtained by the farmers in that village. Because, they use the organic farming inputs, which contribute to the higher profit earned by them. Moreover, having the livestock is not only as source of organic fertilizer, but also as savings source for their family. Therefore, this practice to plant organic paddy can also be done by the farmers in Mulyoarjo village, so that they can potentially get the similar benefits as gotten by farmers in Sumber Ngepoh village.

The own the smaller farming land by farmers in farmer group in Mulyo 2 compare to the farmers in farmer group in Sumber Makmur 1 can be one reason for the farmers in Mulyoarjo village to convert their farming practice, namely from conventional to organic. By this, they can reduce the farming variable cost, suppress the *wereng* attack, and increase the paddy yields. They can also imitate the way to determine of selling price for their paddy as similar to the way done by the farmers in farmer group in Sumber Makmur 1.

However, to do the conversion from practicing the conventional paddy to practicing the organic paddy, it is needed the preliminary effort to reduce the dependence to use chemical fertilizers and pesticides. In this issue, the head of the farmers group in Mulyo 2 plays an important role to invite the members of the farmer group to do the conversion. Thus, the strong social tie among the farmers is the central key to achieve this mission.

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