SOCA: Jurnal Sosial Ekonomi Pertanian
Vol. 15, No. 3, September 2021, Page 450 - 457
ISSN: 2615-6628 (E), ISSN: 1411-7177 (P)
Accredited SINTA 2

https://ojs.unud.ac.id/index.php/soca

The Production Efficiency in Organic Rice Farming

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Submitted : July 30th, 2020 ; Revised : August 21th, 2020; Accepted: September 28th, 2020

Keywords: production factor; organic rice; farming.

Abstract

The production efficiency in farming must be achieved so that production was high and farmers' income increased. The aim of this research was to analyze the influence of the production factors used on the production of organic rice farming and to analyze the efficiency of production. The research was conducted by using a survey method with 79 farmers as respondents. The research location was in Jetis Village, Sambirejo Sub-district, Sragen Regency. The analysis tool used multiple linear regression and efficiency test. The results showed that the use of production factors had a significant effect simultaneously and partially, except for fertilizer production factors. Organic rice farming in Jetis Village was technically inefficient. In allocative terms, the use of land area, seeds, pesticides and labor was not yet efficient, while fertilizers were not efficient. Economically, the use of land area, seeds and pesticides was not yet efficient, while fertilizers and labor were not efficient.

How to Cite (APA 6th Style):
Pawitri, G., Budiraharjo, K., & Setiawan, B. M. (2021). The Production Efficiency in Organic Rice Farming. *SOCA: Jurnal Sosial Ekonomi Pertanian*, *15*(3), 450–457. https://doi.org/https://doi.org/10.24843/SOCA.2021.v15.i03.p03

INTRODUCTION

In this increasingly advanced modern era, public awareness of a healthy lifestyle and environmental sustainability had made people start to switch to consume organic rice which had a higher selling price. This was what made farmers started switching to organic farming because it can increase their business income. This income can certainly be more optimized if the use of agricultural production factors was managed efficiently. The use of production factors in farming was the main key to agricultural development because it will directly affect production and business income. The efforts to increase productivity can be done through production efficiency.

The production efficiency was the ability to use inputs optimally to obtain maximum results by using minimal costs. According to Syam (2012) there were three types of production efficiency, which were technical, economic and allocative efficiency. This was usually not noticed by farmers, so that the productivity of their rice farming had not been able to reach the maximum point. One of the provinces in Indonesia that mostly cultivated rice plants was Central Java Province. According to the Central Java Statistics Bureau (2018), the total rice production in Central Java for the period of January to December 2018 was 9,512,434 tons of GKG (milled dry grain).

Sragen Regency was the fifth largest rice producer in Central Java. According to the data from the Central Java Statistics Bureau (2018), rice production in Sragen Regency was 554,883 tons of GKG. The area of agricultural land in Sragen Regency itself reached an area of 40,121 Ha (Central Bureau of Statistics, Sragen Regency, 2015). The majority of farmers in Sragen Regency still cultivated rice chemically or not yet organically. Sambirejo Sub-district was the only sub-district that had been cultivating rice organically. This was what made Sambirejo Sub-district different from other sub-districts.

There were three villages in Sambirejo Sub-district that had been cultivating rice organically, which were Sukorejo, Jambeyan and Jetis villages. According to the data from the Central Bureau of Statistics of Sragen Regency (2015) rice production in Jetis Village reached 2 tons/hectare, while in Sukorejo Village and Jambeyan Village, it was only about 1 ton/hectare. The higher demand for organic rice with a higher selling price had made farmers in Sambirejo Sub-district started switching to organic farming. The productivity of organic rice farming performed by these farmers must be maximized so that the business income that they received can be more optimal, so it was necessary to study the efficiency or accuracy of the use of these production factors.

The research by Muhaimin (2012) stated that the variables of seed, land area, manure and organic medicines had a significant effect on the level of technical efficiency. Research by Laksmi et al. (2012) explained that the use of lowland rice farming inputs in one planting season showed that the input of NPK fertilizer, urea fertilizer, organic fertilizer and labor was allocatively efficient, while economically the use of pesticides was inefficient. Research by Nurlaela (2018) stated that the variables of land area, seeds and fertilizers had a value of NPMx/Px < 1 which means it was not efficient. Previous research only discussed one of the production efficiencies, while this research discussed the three production efficiencies. Research on rice itself was mostly in agriculture that still used

chemical fertilizers and pesticides. The innovation of this research was to discuss the overall production efficiency of organically planted rice commodities.

This research has the aims of 1) analyzing the effect of the use of production factors on the organic rice farming production and 2) analyzing the technical, allocative and economic efficiency of organic rice farming. This research need to be done, therefore organic rice farmers in Jetis Village knew the use of efficient and inefficient production factors.

RESEARCH METHOD

The research was conducted from December 2019 to January 2020 in Jetis Village, Sambirejo Sub-district, Sragen Regency. The research method that used was a survey method with a total of 79 farmers as respondents. The types of data collected were primary data and secondary data. Primary data was obtained by interviews while secondary data was obtained through library research. The data analysis that used was 1) multiple linear regression and 2) efficiency test

The data analysis used production function of Cobb-Dauglass model that can be written as follows (Tahir *et al.*, 2010) :

$$Y = A\ X_1^{b1}\ X_2^{b2}\ X3^{b3}\ X4^{b4}\ X_5^{b5}\ \varepsilon^{u}$$

That equation was then changed to be a linear regression form (Sholikah & Kadarmanto, 2020) :

$$Ln\ Y = Ln\ A + b_1 LnX_1 + b_2 LnX_2 + b_3 LnX_3 + b_4 LnX_4 + b_5 LnX_5 + u$$

The statistic test that used was normality test, classical assumption test, F test and t test.

According to Hartono (2016) the calculation method of technical efficiency was:

$$ET = \frac{MPP_{xi}}{APP_{xi}}$$

Decription:

MPP : *marginal physical product*

APP : *average physical product*

According to Hidayat (2013) allocative efficiency can be calculated by using a formula as follows:

$$EH = \frac{b\bar{Y}P_{\bar{Y}}}{\dot{X}P_{\dot{X}}}$$

Description:

EH : price efficiency (allocative efficiency)

b : regression efficiency

$\bar{Y}$: organic rice production

$P_{\bar{Y}}$: origanic rice price

$\dot{X}$: production factor

$P_{\dot{X}}$: production factor price x

According to Satiti (2013) economic efficiency can be calculated by formula:

$$EE = ET \times EH$$

RESULT AND DISCUSSION

The Effect of the Used of Production Factor to the Organic Rice Production

The relation between production factors (X) and production result (Y) can be found through the production function of Cobb-Douglas model. This function can be written in the following equation:

$$\text{Ln } Y = \text{Ln } 5{,}805 + 0{,}390 \text{ Ln}X_1 + 0{,}214 \text{ Ln}X_2 - 0{,}016 \text{ Ln}X_3 + 0{,}365 \text{ Ln}X_4 + 0{,}419\text{Ln}X_5$$

This equation showed the relation between the production factors and the harvested rice production. These production factors had production variables that showed a positive connection, such as the land variable, seed variable, pesticide variable and labor variable, which means that these variables had a positive effect on the rice production that was produced. The fertilizer variable showed a negative relation which means that the variable had a negative effect on rice production that produced by farmers. This was the same as Susilowati & Tinaprilla (2012) that a positive value from the actual data will increase production if input was added and a negative value indicated that the use of input had been excessive so it need to be reduced.

Based on the F test, the F value that obtained was 419,224 with a *sig* value of 0.000. The *Sig* value <0.05 mean simultaneously the production factors affected the rice production that produced by farmers.

Based on t test data, the following results were obtained:

Table 1. t Test Result

Variable	T	*Sig.*
Land Area	6,347	0,000
Seed	4,464	0,000
Fertilizer	- 0,551	0,583
Pesticide	3,705	0,000
Labor	6,916	0,000

Source: Result of Processed Data (2020)

Table 1 showed the variables that have an effect and have no effect partially. The land area variable had a t value of 6.347, the seed variable was t 4.464, the pesticide variable was 3.705 and the labor variable was 6.916 with a sig value <0.05 which means that partially these variables affected organic rice production. This means that the addition of inputs will increase the yield of rice production.

The fertilizer variable had a t value of –0.551 and a sig value > 0.05 which means that partially the fertilizer variable had no effect on organic rice production. This situation can occur because the use of fertilizer inputs had been excessive, so that it tended to reduce production yields. This can also happen if fertilization was not followed by weeding so that the nutrients contained in the fertilizer will be absorbed by weeds. This was in line with Sugito (2013) that fertilization followed by weeding can increase yields, while fertilization that was not followed by weeding will tend to reduce yields.

Technical Efficiency, Allocative and Economic of Organic Rice Farming

Based on the data analysis, these following results were obatained:

Table 2. Analysis Result of Technical Efficiency

Variable	Production Elasticity
Land Area	0,390
Seed	0,214
Fertilizer	- 0,016
Pesticide	0,365
Labor	0,419
Total	1,372

Source: Result of Processed Data (2020)

Table 2 explained that the total value of technical efficiency was 1.372 which means that organic rice farming in Jetis Village was simultaneously not efficient, so it was necessary to add production inputs so that farming can achieve technical efficiency. This was in line with Dewi et al. (2018) that the value of technical efficiency = 1 was efficient, the value of technical efficiency > 1 was not efficient and the value of technical efficiency < 1 was not efficient. The total technical efficiency values also showed that simultaneously farming encountered an increasing return to scale. This was in line with Agustia (2013) that a positive regression coefficient value indicated that the data was increasing, which means the addition level of production factors resulted in high additional products and a negative regression coefficient value indicated that the data was decreasing, which means the additional level of production factors resulted in low product addition. The production factor variable had a technical efficiency value of < 1 which means that partially organic rice farming in Jetis Village was not yet efficient. This situation occurred because the use of production inputs had not been optimal, so that production factors need to be added.

The land area variable had a production elasticity value of 0.39, seed 0.214, fertilizer -0.016, pesticide 0.365 and labor 0.419. The variable was inelastic because the value of EP < 1, so that the addition of input must be stopped. This was different from Wu's research (2020) which stated that the variables of fertilizer, seed and labor were not technically efficient, so that the addition of inputs was relatively profitable, while the land variable was technically inefficient.

Based on the analysis of allocative efficiency data, the following results were obtained:

Table 3. Analysis Result of Allocative Efficiency

Variable	$\frac{\textbf{NPMxi}}{\textbf{Pxi}}$	**t**	***Sig.* (2-*tailed*)**
Land Area	2,917	192,039	0,000
Seed	12,710	91,238	0,000
Fertilizer	- 0,567	- 153,310	0,000
Pesticide	194,755	37,075	0,000
Labor	1,423	51,101	0,000

Source: Result of Processed Data (2020)

Table 3 showed that the variables of land area, seeds, fertilizers, pesticides and labor had sig values (2-tailed) ≤ 0.05 (different test with 1) which mean that farming was not allocatively efficient. The allocative efficiency value for the variable of land area was 2.917, seed was 12.710, fertilizer was -0.567, pesticide was 194.755 and labor was 1.423. The value of allocative efficiency NPMxi/Pxi > 1 had not reached efficiency, so that production factors need to be increased, while the value of allocative efficiency NPMxi/Pxi < 1 was not efficient, so that production factors need to be reduced. This was different from the research by Cai & Yan (2019) which stated that labor and input costs were inefficient, so that additional inputs will reduce production output.

Based on the data analysis, these following result were obtained:

Table 4. Analysis Result of Economic Efficiency

No.	Variable	Economic Efficiency (EE)
1	Land Area	1,138
2	Seed	2,720
3	Fertilizer	0,009
4	Pesticide	71,086
5	Labor	0,596

Source: Result of Processed Data (2020)

Table 4 showed that the economic efficiency value of the land area variable was 1.138, seed was 2.720 and pesticide was 71.086. The value > 1 was not yet efficient, so that production factors need to be added. The economic efficiency value of fertilizer variable was 0.009 and labor was 0.596. The value < 1 was not efficient. This situation occurred because the use of production inputs had been excessive so that production factors need to be reduced. The organic rice farming in Jetis Village had not yet reached economic efficiency, so that the use of production factors must be adjusted, thus farming can reach economic efficiency. In contrast to Linh's research (2012), labor and land area variables had not been economically efficient, so that additional inputs will increase production output.

CONCLUSION

The conclusion of this research was that the simultaneous use of production factors affected organic rice production and partially, fertilizer variables had no significant effect on organic rice production. The use of production factors in Jetis Village, Sambirejo Sub-district, Sragen Regency was technically inefficient and allocatively the variables of land area, seed, pesticide and labor had not been efficient, while fertilizer variables were not efficient. Economically, the use of land area variables, seeds and pesticides had not been efficient, while the production factors for fertilizers and labor were inefficient.

RECOMMENDATION

The suggestions for organic rice farmers in Jetis Village, it was better to add the use of land area, seeds and pesticides, so that organic rice production can increase. The addition of these production factors can be done until the value of NMPxi/Pxi = 1. The area of land used by farmers on average was still limited and less extensive, thus farmers can form a joint venture, so that the land that used

was wider and organic rice farming will be more efficient technically, allocatively and economically.

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