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Optimizing rice farming business inputs in shallow freshwater swamp (case study of Sungai Dua Village, Rambutan District, Banyuasin Regency)

Optimasi input usaha tani padi pada lahan rawa lebak dangkal
(*studi kasus Desa Sungai Dua Kecamatan Rambutan Kabupaten Banyuasin*)

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ABSTRAK

Salah satu tanaman pangan yang banyak dibudidayakan oleh masyarakat yaitu padi sawah. Ketahanan pangan menjadi komoditas unggulan dimana padi sawah menjadi ikonnya. Tujuan penelitian ini yaitu untuk mengetahui penggunaan faktor produksi pada optimasi beras berdasarkan efek output melalui masukan usaha tani dan menentukan faktor produksi dalam efisiensi ekonomi usahatani padi. Penelitian menggunakan analisis fungsi produksi *Cobb Douglas* dan Marginal Nilai Produk. Metode analisis data faktor produksi menggunakan analisis regresi berganda dengan *software* SPSS 25 sedangkan Nilai Produk Marginal (NPM) menggunakan *Stochastic Frontier Analysis* (SFA). Hasil penelitian menunjukkan bahwa faktor produksi yang dapat mempengaruhi input usaha tani padi terdiri dari pupuk dan benih dimana setiap penggunaan input lebih untuk bagian yang dibutuhkan, pendapatan petani dalam periode tanam 1 lebih tinggi dibandingkan periode tanam 2. Usaha pertanian padi sawah di Desa Sungai Dua Kecamatan Rambutan Kabupaten Banyuasin pada lahan rawa lebak dangkal setelah dilakukan analisis Marginal Nilai Produk maka musim tanam baik periode 1 dan periode 2 dinyatakan tidak efisien. Input usahatani yang belum optimal pada lahan rawa lebak dangkal yang terdiri dari pupuk dan benih, benih yang digunakan Inpara 2 yang cocok untuk lahan rawa tapi penggunaannya masih berlebih sedangkan pupuk seabagai peningkatan unsur hara bagi tanah dan tanaman tetapi penggunaannya masih sedikit disebabkan modal petani yang masih terbatas. F-hit>F-tab pada tiap strata dengan tingkat kepercayaan 95% dalam setiap strata maka dinyatakan bahwa variable bebas secara bersama-sama berpengaruh nyata terhadap variable terikat. Intensifikasi dalam memelihara tanaman perlu peningkatan penggunaan tenaga kerja untuk meningkatkan luaran dan penghasilan.

Kata kunci: input, lahan rawa lebak dangkal, optimasi, usahatani padi

ABSTRACT

One of the food crops that was widely cultivated by the community was lowland rice. Food security was a superior commodity where lowland rice was the icon. The objectives of this research was to determine the use of production factors in optimizing rice based on output effects through farming inputs and to determine production factors in the economic efficiency of rice farming. The research used production function analysis *Cobb Douglas* and Marginal Product Value. The production factor data analysis method used multiple regression analysis with *software* SPSS 25 while Marginal Product Value (NPM) used *Stochastic Frontier Analysis* (SFA). The results of the research showed that production factors that could influence the input of rice farming consist of fertilizer and seeds, where each time more input was used for the part needed, the farmer's income in planting period 1 was higher than planting period 2. Lowland rice farming in Sungai Dua Village, District Rambutan Banyuasin Regency in shallow swampy areas, after Marginal Product Value analysis was carried out, the planting season for both period 1 and period 2 was declared inefficient. Farming inputs that were not yet optimal in shallow swampy areas consist of fertilizer and seeds. The seeds used by Inpara 2 were suitable for swampy land but were still used excessively, while fertilizer was an increase in nutrients for the soil and plants but the use was still small due to farmers' limited capital. limited. F-hit >F- tab in each stratum with a confidence level of 95% in each stratum, it was stated that the independent variables together have a significant effect on the dependent variable. Intensification of plant maintenance was given more attention by increasing the use of labor to support increased output and maximum income.

Keywords: input, shallow wetlands, optimization, rice farming

INTRODUCTION

It is hoped that increasing farmers' production and income through agricultural sector activities can run smoothly by increasing food products intensively which is expected to improve farmers' living standards (Milfitrah, 2016). There is a high level of urgency for development to encourage development in the region, considering that the majority of the population works in the agricultural sector (Septiadi et al., 2020). The role of this sector has a major contribution in forming GDP (Septiadi & Joka, 2019). This sector also makes huge profits to the point that it can generate foreign exchange from exports of agricultural products. Rice is a major food commodity in Indonesia. Rice is a staple food and a commodity that has bright prospects for increasing income for farmers. One of the food crops that is widely cultivated by the community, namely lowland rice, can become a superior commodity and therefore become an icon of food security (Supriana, 2021). This commodity can drive the economy through the formation of various companies such as seed, fertilizer, machinery and pesticide companies. (Masganti et al., 2020) Swamp land used for agricultural cultivation has only reached 2.27 million Ha with rice plants at 0.66 million Ha (Haryono, 2017). Obstacles in developing lowland swamp rice include soil toxicity, chemistry, soil biology, physics, and economic problems, resulting in low plant productivity (Masganti et al., 2020). (Haryono, 2017) states that rice production is still low, namely > 4 tonnes/ha. The potential for lowland swamp land in South Sumatra Province, especially in Banyuasin Regency, is quite large. One of them is in Sungai Dua Village, Rambutan District, where most of the people have a source of livelihood from rice farming (Nearti et al., 2020). The rice planting system in Lebak swamps is greatly influenced by the height and duration of standing water so that it is divided into three categories of Lebak, namely shallow Lebak, middle Lebak and deep Lebak (Haryono, 2017). Rice production seen from the three varying typologies said that Lebak swamp land has obstacles including quite high water fluctuations, where there are floods in the rainy season and drought in the dry season. Supporting infrastructure is inadequate, including farming roads, drainage channels and limited farming capital, but it plays a role in contributing to ricenational until demanded to increase rice production. This population continues to increase every year by around 1.38 percent (Statistik, 2013). So far, the role of swamp land in national food security has not been prominent, while the potential and opportunity to increase national food production through the use and optimization of swamp land management is very large and prospective, so swamp land reclamation is a strategic step in balancing the shrinking of agricultural land (Wakhid & Syahbuddin, 2019). The use of swamp land for agricultural cultivation has only reached 2.27 million ha, with rice cultivation around 0.66 million ha (Haryono, 2013). There is a need to optimize the use of production factors as efficiently as possible both technically (technical efficiency) and price efficiency or allocative efficiency and economic efficiency if the agricultural business has achieved technical efficiency and price efficiency. Maximum profit requires that production factors must be arranged optimally. (Erwan Suriaatmaja et al., 2015). The research aimed to determine the use of production factors in optimizing rice based on output effects through farming inputs and to determine production factors in the economic efficiency of rice farming.

MATERIALS AND METHODS

Research Location and Time

The research was conducted in Sungai Dua Village, Rambutan District, Banyuasin Regency. The research location was chosen deliberately (*purposive*). The type of research carried out was classified as descriptive research*explanation research*. Data sources consist of primary data and secondary data. Primary data was collected using survey methods through questionnaires, group discussions and in-depth interviews through questionnaires. A questionnaire was a list of open-ended questions with each question being answered directly by the respondent so that respondents were free to provide answers with nominal data. Secondary data was data obtained from existing sources (Isyariansyah et al., 2018). Documents in the form of village monographs, village profiles in numbers and other relevant documents. The sampling method used was 100 lowland rice farmers in shallow swampy areas, taking a product of 13.3% from a population of 755 people. The data analysis method was carried out using multiple linear regression analysis via SPSS 25 statistical data processing software. Using the production function model*Cobb-Douglas*, the equation was as follows: where there were four variables included in the model, namely 1) labor (X_1), 2) seed (X_2), 3) fertilizer (X_3), 4) drugs (X_4). Production function*Cobb-Douglas* could be formulated:

$$Y = aX_1^{b1}X_2^{b2}........X_4^{b4}10^{\mu}$$

So that it could be analyzed, it was converted into a double linear log:

Log Y = log a + b1log X1 + b2 log X2 + ...+ b4 logX4 + μ.

Where:

Y = income (Rp/Ha)

a = intercept, b1, b2....b4 (regression coefficient) μ = error

X1 = labor (Rp/HKSP)

X2 = seeds (Rp/Kg),

X3 = fertilizer (Rp/Kg)

X4 = medicines (Rp/Liter).

1) The basic hypothesis used to test regarding production:
   Ho : $\overline{X_a} \geq \overline{X_b}$, H1 : $\overline{X_a} < \overline{X_b}$.
2) The basic hypothesis used to test income:
   Ho : $\overline{X_a} \geq \overline{X_b}$, H1 : $\overline{X_a} < \overline{X_b}$.

Where:

$\overline{X_a}$ = average production/income of rice farming on shallow land after the price increase basic grain

$\overline{X_b}$ = average production/income of rice farming before the increase in the basic price of grain.

Next, multiple linear regression testing was carried out, including the F test and t test. This research for the F test was carried out to see the influence of independent variables simultaneously or together on the dependent variable in Sungai Dua Village. Then the t test was used to see the partial influence of the independent variable on the dependent variable. Before carrying out the t test, the diversity was first seen using the F test.

$$F_{count} = \frac{S_a^{2}}{S_b^{2}}$$

. If $F_{count} > F_{table}$, then the difference was tested using the formula:

$$t_{count} = \frac{\overline{X_a} - \overline{X_b}}{\sqrt{\frac{(n_a-1)S_a^{1}+(n_b-1)S_b^{2}}{n_a+n_b-2} \, x \, \sqrt{\frac{n_a+n_b}{n_a-n_b}}}}$$

Where:

n_a = number of samples of rice farming after the increase in the basic price of grain

If Fcount $\leq$ Ftable then the difference was tested using the formula:

$$t_{count} = \frac{\overline{X_a} - \overline{X_b}}{\sqrt{\frac{S_a^{2}}{n_a} + \frac{S_b^{2}}{n_b}}}$$

testing rules for production

1) If $t_{count} > t_{table}$ α = 0,10 that H_1 This means that rice production after the increase in the basic price of grain was lower than rice

2) production before the increase in the basic price of grain.
3) If $t_{count} \leq t_{table}$ $\alpha = 0,10$ then it was accepted that Ho means that rice production after the increase in the basic price of grain was higher or the same as rice production before the increase in the basic price of grain. Testing rules for income.
4) If $t_{count} > t_{table}$ $\alpha = 0.10$ then H was accepted, This means that the income from rice farming after the increase in the basic price of grain was higher than the income from rice farming in shallow swamp land before the increase in the basic price of grain.
5) If $t_{count} \leq t_{table}$ $\alpha = 0.10$, then Ho was accepted, meaning that the income from rice farming on shallow swamp land after the increase in the basic price of grain was lower or the same as the income from rice farming on shallow land before the increase in the basic price of grain.

Testing using production factors was efficient when using marginal product value (NPM) analysis with a unity production factor that could be used with *Stochastic Frontier Analysis* (SFA), with the formula:

$NPM_{Xi} = P_{Xi}$ atau $\frac{NPMXi}{P_{xi}} = 1$,

$NPMXi = PY.PMxi$,

Where:

NPM = Value of marginal product,

P_{xi} = Price of the ith input ke - i,

PY = Production,

PMxi = Marginal product on the i-th input, the regression coefficient obtained was the same as the production elasticity (Ep)

Elasticity comes from the difference between input divided by output price and PM divided by PR. PM was obtained from bi times the output divided by the input.

Criteria as followed:

$\frac{NPMXi}{P_{xi}} = 1$ This means that the use of production factors was at the optimum point,

$\frac{NPMXi}{P_{xi}} > 1$ This means that the use of production factors was not yet efficient, so the use of factors production needs to be increased.

RESULTS AND DISCUSSION

Production Factors

Production factors were resources used for the production process. Production factors used in lowland rice farming in two farmer groups, namely Selat Kandis II and Suka Ratu which were members of the Sabolio Farmer Group Association (Gapoktan) located in Sungai Dua Village, Rambutan District, Banyuasin Regency, include land, equipment, seeds, fertilizers, pesticides, herbicides, insecticides and labor. The swampland agricultural system was included in potential and prospective land for development in the future (Syahputra et al., 2019).

Non-tidal swamp land that forms a basin was called lowland swamp land. The topography of the land experiences flooding both periodically and permanently. The use of this land was greatly influenced by water conditions and seasons, this land could be reserved for agricultural development, especially during the dry season. Shallow wetlands have inundation levels below 50 cm for less than 3 months. Shallow Lebak swamps often experience drought, whereas deep Lebak swamps often experience flooding (Simatupang & Rina, 2020).

The main production factor in agriculture was landbecause it was a place for plants to grow and develop. Plants will grow and develop if the land conditions and surrounding resources consist of biological (plants and animals) and non-biological (soil, climate, weather). The important thing in the agricultural sector was land area. Agricultura activities rely on land as the most important production factor. Agricultural land management areas were very important in production or farming activities (Ubaidillah et al., 2021).

The Land Area

The land area used in the lowland rice farming system by optimizing farming inputs such as labor, seeds, fertilizer and medicines. Land plays a very important role in the agricultural sector because agriculture relies on the fertility of the soil in an area. Large agricultural land affect the size of the business and ultimately affects the efficiency of the business (Juliyanti & Usman, 2018). The land area used in optimizing lowland rice farming systems on shallow lowland swamp land could be seen more clarly in Table 1.

Table 1 showed that the optimal land area for lowland rice farming systems in shallow swamps in the Selat Kandis II and Suka Ratufarmer groups which was cultivated has the highest value of 55% with a range between 500 – 1000 m^2 while the lowest was 14% in the range >1000 m^2. The area of land owned by farmers greatly influences production so that it could increase the income of lowland rice farming. Farmers who have large areas of land will produce high production if they were managed well so they could get high income, and vice versa, if farmers have small land they will produce less if they were not managed well. The land area owned by respondent farmers in East Bulontio Village, Sumalata District, North Gorontalo Regency was at most 1 hectare or less. The number of respondent farmers who have a land area of 0.1-1 Ha was 52 people with a percentage of 74.28% (Ramli et al., 2021).

Rice farming in Sungai Dua Village, Rambutan District, Banyuasin Regency is influenced by seeds, labor, medicines and fertilizer using regression analysis through the production function*Cobb-Douglas.* The results of the regression analysis of production factors that influence rice farming in Sungai Dua Village in planting period 1 and planting period 2 can be seen more clearly in Table 2 and Table 3.

Based on Table 2, it is known that F-count > F-tab in each stratum with a confidence level of 95%. Knowing in more detail the results of the F test are as follows: 1) stratum 1 shows that F-count = 254.923> F-table = 2.29 with a confidence level of 95%, then it shows that the independent variables together have a real effect on the dependent variable, 2) stratum 2 shows that F-count = 36.579> F-table = 2.29 with a confidence level of 95%, this means that the independent variables together have a significant effect on the dependent variable, whereas in Table 3 it is known that F-count > F- table on each stratum with a confidence level of 95%. Knowing in more detail the results of the F test are as follows, 1) stratum 1 showed that F-count = 67.958> F-table = 2.29 with a confidence level of 95%.

Table 1. Optimized Land Area for Lowland Rice faring Systems in Rawa Lebak Shallow in the Selat Kandis II and Suka Ratu Farmer, 2023

No	Land Area (m^2)	Number of People	Percentage (%)
1	< 500	31	31
2	500 - 1000	55	55
3	>1000	14	14
Total		100	100

Source : Primary data Processed

Table 2. Regression coefficient for rice farming inSungai Dua Village, Period 1, 2023

Level	Parameter	Regression Coefficients	t-count	t-table
I	bo	1.423		1.534
	X1	0.566	0.627	
	X2	0.948	1.514	
	X3	0.612	3.167	
	X4	0.125	1.363	
R^2	0.673			
F-hit	254.923			
F-tab	2.29			
	bo	0.235		1.534
	X1	0.225	1.246	
	X2	0.016	0.076	
	X3	0.527	2.232	
	X4	0.116	1.557	
R^2	0.673			
F-hit	254.923			
F-tab	2.29			

Table 3. Regression coefficient for rice farming inSungai Dua Village, Period 2, 2023

Level	Parameter	Regression Coefficients	t-count	t-table
I	bo	1.634		1.534
	X1	0.114	1.010	
	X2	0.456	2.982	
	X3	0.428	2.682	
	X4	0.089	1.736	
R^2	0.916			
f-hit	67.958			
f-tab	2.29			
II	bo	1.186		1.534
	X1	0.043	0.325	
	X2	0.265	1.624	
	X3	0.876	6.495	
	X4	0.068	1.578	
R^2	0.875			
f-hit	232.5546			
f-tab	2.29			

Source: Processed primary data

Which means that the independent variables together have a real effect on the dependent variable, 2) stratum 2 shows that F-count = 232.546> F-table = 2.29 with a confidence level of 95% stating that the independent variables together have a significant effect on the dependent variable.

In the income difference test for period 1 and period 2 based on farmers' income level 1) strata 1, the value of t-count > t-table where t-count = 15.081 > t-table = 1.534, then H is accepted$_1$ This means that rice farming income after period 1 is higher than rice farming income before period 2. 2) strata 2 t-count = 12.513 > t-table = 1.534 so H is accepted$_1$ This means that rice farming income after period 1 is higher than rice farming income before period 2. This shows that income in the first period of production is higher than in period 2 due to different planting techniques where period 1 uses Jajar Legowo (JARWO) 4 : 1 while period 2 using Direct Seed Sowing (TABELA) because it is quicker to plant so that you don't encounter rain. This area is shallow swampy land which is still influenced by rainwater. According to (Erwan Suriaatmaja et al., 2015) states that Table 1 includes: 1) stratum 1 where the F test showed F-count = 221.524 > F-table = 2.18 with a confidence level of 95%. 2) stratum 2 shows that F-count = 66,835 > F-table = 2.18 at the 95% confidence level. 3) stratum 3 where the F test shows F-count = 35.955 > F-table = 2.69 with a confidence level of 95%. Based on each strata 1 – 3 in Table 1 showing the value of F-count > F-table, it is stated that the independent variables together have a significant effect on the dependent variable.

Meanwhile, Table 2 includes: 1) stratum 1 where F-count = 125,892 > F-table = 2.18 at the 95% confidence level, 2) stratum 2 where F-count = 35,569 > F-table = 2.18 at 95% confidence level, 3) stratum 3 where F-count = 32.244 > F-table = 2.69 at the 95% confidence level. Based on each strata 1 – 3 in Table 2 showing F-count > F-table, it is stated that the independent variables together have a significant effect on the dependent variable. T test in periods 1 and 2 with 3 strata, namely 1) stratum 1 t-count = 19.127 > t-table = 1.699 so H is accepted$_1$ meaning that rice farming income after period 1 is higher than rice farming income before period 2, 2) strata 2 t-count value = 1.551 <t-table of 1.669 then Ho is accepted, meaning rice farming income for period 1 is lower than rice farming income before the period 2, 3) stratum 3 t-count value = 10.257 > t-table = 1.771, then H is accepted$_1$ This means that rice farming income after period 1 is higher than rice farming income before period 2.

Analysis of rice farming on shallow wetlands in each stratum in periods 1 and 2, where the variable is the independent variable, for more clarity, see Table 4 and Table 5. In Tables 4 and 5, the Marginal Product Value showed that rice farming on shallow swampy land in Sungai Dua Village, Rambutan District, Banyuasin Regency in each stratum is good in periods 1 and 2 of the Marginal Product Value analysis for variable X.1 (labor).

Table 4. Analysis of rice farming on shallow wetland per strata in period 1, 2023

Variable	With a	NPM	Px	NPM/Px	Decision
Strata 1					
X1	0.036	1,873,566.99	8000	234.1958	Not yet efficient
X2	0.175	2,098,250.09	2600	807.0192	Not yet efficient
X3	0.856	2,942,869.44	1750	1,681.6396	Not yet efficient
X4	0.075	1,956,762.68	17000	1,151.0367	Not yet efficient
Strata 2					
X1	0.120	2,345,678.79	8000	293.2098	Not yet efficient
X2	0.365	6,477,479.62	2600	2,491.3383	Not yet efficient
X3	0.432	6,744,869.47	1750	3,.854.2111	Not yet efficient
X4	0.097	5,457,020.48	17000	321.0012	Not yet efficient

Source: Primary data processed

Table 5. Analysis of rice farming on shallow wetland per strata in period 2, 2023

Variable	With a	NPM	Px	NPM/Px	Decision
Strata 1					
X1	0.132	2,448,236,18	8000	306.0295	Not yet efficient
X2	0.197	2,632,387,17	2600	1,012.4566	Not yet efficient
X3	0.625	3,352,982,93	1750	1,915.9902	Not yet efficient
X4	0.068	2,379,462,08	1700 0	139.9683	Not yet efficient
Strata 1I					
X1	0.235	6,132,128.90	8000	766.5161	Not yet efficient
X2	0.018	5,362,212.52	2600	2,062.3894	Not yet efficient
X3	0.508	7,367,523.89	1750	4,210.01365	Not yet efficient
X4	0.118	5,781,769.56	17000	340.1041	Not yet efficient

Source: Processed primary data

Variable X2 (seed), variable X3 (fertilizer) and variable X4 (medicines) in each strata are not yet efficient or the use of inputs must be increased but must be adjusted to the recommended dosage and must not be excessive or reduce the amount so that the income for rice farmers in shallow swampy areas in Sungai Dua Village.

The use of inputs that are not yet optimal is influenced by high input costs and farmers' ignorance of the standard amounts used according to recommendations from experts or field instructors (Kurniati & Darus, 2019). The use of production inputs is not yet optimal because the optimization level still exceeds the value 1 and is less than the value 1 (Ginting, 2013). The inefficient use of production inputs is caused by farmers not being able to obtain optimal results and profits in cassava farming developed on dry land which requires efficient use of production inputs. So far, farming management has been seen from experience and limited capital, so that optimization in using production inputs has not been possible (Dewi, 2018). It is known that differences in the use of rice production inputs each year are away from the optimal point due to farmers' limited capital. Seeds and fertilizers are often used excessively or do not comply with the prescribed dosage, such as using standard seeds of 40 kg per hectare, but farmers still use twice as much fertilizer, namely 80 kg per hectare. The seeds developed in the Inpara 2 type of lowland swamp land are suitable for development, where superior varieties are used as technology, while fertilizer is used to add nutrients to plants so that it is easy to apply, such as KCL fertilizer, NPK and manure. The use of fertilizer and seeds that are not suitable will have an impact on rice production. Irrational and unbalanced fertilization can damage soil fertility and affect crop production (Nugraha et al., 2015). Therefore, rice farmers in shallow wetlands must be able to balance the increase in the basic price of grain towards income by optimizing rice farming inputs so that the income of rice farmers in shallow wetlands can increase.

CONCLUSION

Factors that influence the production of lowland rice farming simultaneously include labor, seeds, fertilizer, medicines. The use of production inputs such as labor, seeds, fertilizer and medicines is not optimal so it must be reduced or increased. Increasing the amount of lowland rice production is carried out by utilizing planting land for lowland rice cultivation and using fertilizers and pesticides which must be in accordance with the correct dosage as recommended. Intensification of plant maintenance is given more attention by increasing the use of labor to support increased output and maximum income.

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