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Input Substitution analysis of Paddy Rice Farming in Different Land Area Strata in Bengkulu Province

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Abstract. The objectives of this study are 1) Analyze what production factors affect rice production in different strata of land area in Bengkulu Province. 2) Analyze the level of input substitution in paddy rice farming at different strata of land area in Bengkulu Province. The location determination method uses Three stages cluster sampling and the Proportionate Stratified Random Sampling sampling method, the sample number of 175 rice farmers. The data analysis method used is the cobb-douglass and MRTS production functions. 1) The results of the analysis show that only the land area factor (ha) has a real effect on production in all strata of land area. Meanwhile, in strata III and the combination of factors the use of female labor has a real effect on production, and on the combined land area the use of KCL fertilizer has a real effect on production. 2) Only the combination of male labor to female labor in Strata I is fully substituted with a substitution elasticity (ES) value greater than 1 (≥ 1) while in combination the use of fertilizer inputs is only partially substituted. Meanwhile, in strata II, III, and combined, both the combination of fertilizer inputs and male and female labor are only partially substituted.

Keywords: Input substitution, Marginal Rate Technical of substitution (MRTS), Paddy

1 Introduction

In general, farmers use inputs or production factors are still not optimal, which results in inadequate maintenance of agricultural activities. The productivity of rice plants on narrow land will be lower than the productivity of rice plants on large land (Phahlevi, 2013). Bengkulu Province has 56,721.13 Ha of paddy fields (BPS, 2022). Almost all regencies in Bengkulu Province have paddy fields. Referring to the data shown in Table 1, it can be seen that there are two regencies that have relatively large rice fields when compared to other regencies. These districts are Lebong and South Bengkulu, which represent the highland and lowland areas with productivity of 46.67 ku/ha and 60.15 ku/ha, respectively. The location, harvest area, total production, and productivity of rice by region/city in Bengkulu Province can be seen in table 1.1 below.

Table 1. Location, Harvested Area and Productivity of Rice by Regency/City in Bengkulu Province in 2020 and 2021

No	District/City	Harvested Area (Ha)		Production (Ton)		Productivity (Ku/Ha)	
		2020	2021	2020	2021	2020	2021
1	South Bengkulu	13.661,95	12.080,71	59.492	58.495	43,55	46,67
2	Seluma	11.628,61	11.381,84	43.757	49.274	37,63	41,57
3	Lebong	8.222,23	7.980,00	41.898	47.659	50,96	60,15
4	Rejang Lebong	5.181,95	5.643,56	27.427	28.068	52,93	52,58
5	North Bengkulu	5.111,21	3.924,75	23.366	15.701	45,72	44,08
6	Kaur	7.525,22	5.588,95	30.209	23.380	40,14	42,74
7	Mukomuko	6.322,81	3.792,80	37.105	20.945	58,68	57,93
8	Kepahiang	3.479,20	3.247,13	16.270	14.365	46,76	46,36
9	Central Bengkulu	1.787,44	1.847,02	7.061	7.098	39,51	48,76
10	Bengkulu City	1.216,66	1.234,37	6.245	6.132	51,34	48,76
Provinsi Bengkulu		64.137,28	56.721,13	292.834	27.111	45,66	48,09

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The production of paddy rice can certainly be influenced by the farmer's own land area, the amount of labor they use (JOK), as well as the use of fertilizers and medicines during the production process. In addition, there are internal and external elements that may affect the production process. However, the production process is certainly influenced by the inputs used such as the use of fertilizers, the difficulty of finding subsidized fertilizers in order to get cheaper prices due to scarcity, the cost of medicines that are also not cheap, and the use of labor. The amount of labor used will increase the labor wages that farmers have to pay. This causes farmers to experience difficulties in the production process, therefore it is necessary to combine the use of production inputs in order to reduce the problems faced by farmers.

The combination of inputs itself is called an isoquant where substitution between several inputs is carried out in an effort to maintain the amount of production to be produced. Each region has unique economic characteristics; in fact, even if all inputs are used in the same way, the output or value added generated from these inputs is not always the same. So, the problem is what factors are able to influence the production of wet-rice and how to combine input substitution in wet-rice farming on different strata of land area in Bengkulu Province.

2 Materials and Methods

2.1 Location and Time of Research

Bengkulu Province is the location of the research and the planned time is March 2023. The next step was to select sub-districts representing the regency, namely Kecamatan Amen and Kecamatan Seginim. The final stage was to select village areas representing the previously selected sub-districts, namely Sukau Rajo Village and Pyang Mbik Village for Kecamatan Amen and Babatan Ilir Darat Sawah Ulu Village for Kecamatan Seginim. The stages of determining the research locations using the three stages cluster sampling method which is part of the multistage cluster sampling method because the selection of research locations is carried out in 3 stages are briefly explained in the following chart.

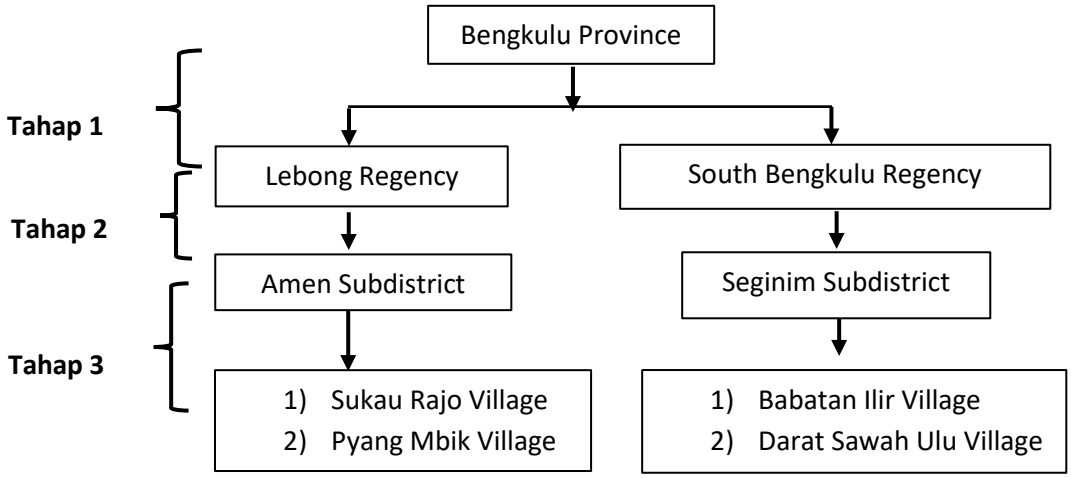

Figure 1. Three Stages Cluster Sampling

2.2 Respondent Selection Method

Respondent Determination Method The population in this study are farmers who do rice paddy farming with different land area strata. The technique of determining the sample is done intentionally, namely with the Proportionate Stratified Random Sampling method, the researcher determines the size of the sample intentionally. This is based on consideration of the limited amount of funds, time and energy available. One thing that is a fundamental consideration is that the population is homogeneous. Based on these considerations, the researcher obtained a sample size of 175 respondents from a total population of 625 rice paddy farmers from lebong district and Bengkulu Selatan district. The total population was divided into 332 farmers from Sukau Rajo village and Pyang Mbik village, and 293 farmers in Babatan Ilir village and Darat Sawah Ulu village. Farmers who cultivate rice paddies using different strata of land area are the respondents of this study.

Sukiyono (2018) states that the Proportionate Stratified Random Sampling method is used when there are proportionally stratified members in the population. Respondents are classified according to land area, so that the data obtained is then disseminated to all classes of farmers, both narrow, medium or large landowners, so that referring to the results of the analysis is not concentrated in one group only. Based on data on the total land area

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of the population of 625 people, it can be calculated the number of respondents based on the classification of land area. To find out the range of land area owned by farmers, it can be calculated using the following formula::

$$Interval\ strata = \frac{Largets\ land\ area - Narrowest\ Land\ Area}{Number\ of\ Stratun}$$

Based on this formula, the estimation of the class interval of rice paddy farming land area is presented as follows .
Narrow land area = 0.20 - 0.80 (ha)
Medium land area = 0.81 - 1.41 (ha)
Large land area = 1.42 - 2.00 (ha)

After estimated the category stratum, the number sample to be used is calculated. The following is the calculation of the number of samples with the following formula (Sukiyono, 2018)

$$D = \frac{B^2}{4}$$

Where the value of B = bound of error (the highest sampling error limit) with the value of D = error rate or confidence (5% = 0.05). Then the sample calculation can be calculated using the following formula.

$$n = \frac{\left(\sum_{i=1}^{L}\left(N_i\sigma_i\right)\right)^2}{N^2D + \sum_{i=1}^{L} N_i{\sigma_i}^2}$$

Based on the calculation, the distribution of samples of wet-rice farmers based on the classification of land area is presented in Table 3.2 below.

Table 2. Distribution of Rice Paddy Farmer Samples Based on Land Area Scale Classification

No	Land Area Strata	Sukau Rajo Village	Pyang Mbik VIllage	Babatan Ilir Village	Darat Sawah Ulu Village	Total
1	Narrow Land	23	21	17	28	89
2	Medium Land	7	15	15	7	44
3	Land Area	2	25	9	6	42
Total		32	61	41	41	175

Based on table 3, it is known that the distribution of respondents is divided into three strata of land area, namely 89 farmers for narrow land strata, 44 farmers for medium land strata and 42 farmers for large land strata.

2.3 Data Collection Methods

Primary and secondary data were used to collect information in this study. Direct interviews with respondents using a pre-prepared questionnaire were used to obtain primary data. Secondary data were collected from relevant institutions such as the Central Statistics Office, the Department of Agriculture, books, and journals.

2.4 Data Analysis Method

The data analysis method used in this study, namely, using the Cobb-Douglass production function adopted from Karmini (2018) and using the analysis of the level of substitution, namely the Marginal rate technical of substitution (MRTS) adopted from Widyantara (2018).

2.4.1 Rice Production

Mathematically, the Cobb-Douglas production function with variable inputs of paddy rice production, namely: Land (LHN), Seed (BNH), Urea Fertilizer (UREA), Phonska Fertilizer (PHONSKA), KCL Fertilizer (KCL), Male Labor (TKP), and Female Labor (TKW), and serves as a model for each stratum of different land areas namely large land, medium land, and narrow land. The model is written as ::

$$ln\ Q_i = ln\ \beta_0 + \beta_1\ ln\ L\ HN + \beta_2\ ln\ B\ NH + \beta_3\ ln\ U\ REA + \beta_4\ ln\ P\ HONSKA +$$

$$\beta_5\ ln\ K\ CL + \beta_6\ ln\ T\ KP + \beta_7\ ln\ T\ KW + ln\ \mu^e$$

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By:

Q	= Production
I	= The i-th stratum
LHN (X1)	= Land Area (Ha)
BNH (X2)	= Seed (Kg)
UREA (X3)	= Urea (Kg)
PHONSKA (X4)	= Phonska (Kg)
KCL (X5)	= KCL (Kg)
PSTD (X6)	= Pesticide (l)
TKP (X7)	= Male Labor (Rp)
TKW (X8)	=Women Workers (Rp)
β0, β1, β2.... β8	= Regression Coefficient
μ^{e}	= Confounding Error

A. F Test or Goodness of Fit Models

According to Ghozali (2016), the F test is known as a model feasibility test, used to assess the feasibility of the research model. If the F test is significant, the model can be used. The F test can be completed with a significance level of 0.05 (α = 5%). The test can use the following formula.

$$F = \frac{\frac{R^2}{k}}{(1 - R^2)(n - k - 1)}$$

With R2 = Coefficient of Determination; k = Number of Variables Observed; n = Number of Samples observed. The following are the requirements for applying the model to be used, namely (Ghozali, 2016):

a. Using significance values:
   1. If the significance value of F > 0.05, the research model is considered unsuitable for use (F test is not significant).
   2. If the significance value of F < 0.05, then the research model is suitable for use (significant F test)..

B. T- test (Partial)

Ghozali (2016) states that the partial test (t test) is used to determine the effect of each independent variable on the dependent variable. To conduct a partial test, the following formula is used.

$$t_{hitung} = \frac{(b_i - b)}{s_{bi}}$$

Description:
t = Test Value t
b = hypothesized value
bi = coefficient of the i-th independent variable
Sbi= standard deviation of the i-th independent variable i

a. With testing criteria:
   1. If t-count ≥ t-table then H0 is accepted. So the factors affecting rice production have an effect and H1 is rejected.
   2. If t-count < t-table then H0 is rejected. So the factors affecting rice production have no effect and H1 is accepted..

C. Determination Coeffiecient Test (R^2)

According to Ghozali (2016: 95), the coefficient of determination (R2) test is a test that measures the ability of the regression model to explain variations in the dependent variable. The size of the coefficient of determination value can be calculated using the formula below.

$$KD = r^2 \times 100\%$$

a. The coefficient of determination has the following criteria.
   1. If the R value2 is 1 or close to 1, it indicates that the contribution of the independent variable to the dependent variable increases.
   2. If R2 is equal or close to zero, it indicates that the contribution of the independent variable to the dependent variable is decreasing.

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2.4.2 Input Substituion Analysis

Input substitution analysis on different land area strata can be calculated on the scale of narrow land, medium land, and large land. The production function reveals the relationship between production and inputs and the following model is used. According to Widyantara (2017), the MRTS level of fertilizer input can be calculated using the following formula :

A. MRTS level between fertilizer inputs (UREA, PHONSKA, KCL)
   a. MRTS rate of Phonska fertilizer (PHONSKA) and Urea fertilizer (UREA)

$$MRTS_{UREAPHONSKA} = -\frac{\beta_4}{\beta_3}$$

   b. MRTS rate of Urea fertilizer (UREA) and KCL fertilizer (KCL)

$$MRTS_{KCLUREA} = -\frac{\beta_5}{\beta_3}$$

   c. MRTS rate of KCL fertilizer (KCL) and phonska fertilizer (PHONSKA)

$$MRTS_{KCLPHONSKA} = -\frac{\beta_5}{\beta_4}$$

B. MRTS level between male and female labor inputs (TKP and TKW)
   a. MRTS level of TKP dan TKW

$$MRTS_{TKPTKW} = -\frac{\beta_7}{\beta_8}$$

   b. MRTS level of TKW dan TKP

$$MRTS_{TKWTKP} = -\frac{\beta_8}{\beta_7}$$

According to Wydyantara (2017), the smaller the MRTS (Margin Rate Technical of Substitution) value, the more difficult the substitution between the inputs used, and the larger the MRTS value, the easier the substitution between production factors. The following formula can be used to calculate the elasticity of substitution between inputs (ES).

   a. Elasticity of subtitution (ES) of fertilizer use :
      1. Elasticity pf subtitution of Urea fertilizer use (ES_{UREA})

$$ES_{UREA} = \beta_3 \frac{UREA}{PHONSKA}$$

      2. Elasticity of substituion of Phonska fertilizer use ($ES_{PHONSKA}$)

$$ES_{PHONSKA} = \beta_4 \frac{KCL}{PHONSKA}$$

      3. Elasticity of substituion of KCl fertilizer use (ES_{KCL})

$$ES_{KCL} = \beta_5 \frac{KCL}{UREA}$$

   b. Elasticity of substitution (ES) of the use of male labor and female labor.

$$ES_{TKP} = \beta_8 \frac{TKP}{TKW}$$

$$ES_{TKW} = \beta_9 \frac{TKW}{TKP}$$

3 Results and Discussion

3.1 Average Use of Production Inputs

In paddy rice farming, farmers use a variety of inputs to produce maximum production, namely: land, seeds, fertilizers, and labor are presented in the following table.

Table 3. Average Input Use and Production in Rice Paddy Farming at Different Size Strata

No	Variables	Unit	Average Input Use and Production (UT/MT)			
			Strata I	Strata II	Strata III	Combined
1	Production	Kg	2891,292	5253,409	8357,738	4797,143
2	Land Area	Ha	0,54	1,03	1,62	0,92
3	Urea	Kg	148,314	263,636	408,9286	239,857
4	Phonska	Kg	105,280	194,318	270,8333	167,400

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No	Variables	Unit	Average Input Use and Production (UT/MT)			
			Strata I	Strata II	Strata III	Combined
5	KCL	Kg	51,685	90,909	139,881	82,714
6	Male Labor (TKP)	JOK	26,157	31,5	41,7619	31,245
7	Femare Labor (TKW)	JOK	15,123	18,704	24,571	18,29

Source: Processed Primary Data, 2023

3.2 Results of Rice Paddy Production Function Analysis on Different Land Area Strata

3.2.1 Production Model Estimation

The results of the regression analysis of the estimation of the production model of paddy rice farming using the cobb-douglass model on different land area strata consisting of Determination (R2), F-test, and t-test (Partial) are presented in table 5 below.

Table 4. Results of Cobb-Douglass Production Function Analysis on Strata of Narrow Land Area, Medium Land, Large Land and Combined

Variables	Stratum I			Stratum II			Stratum III			All strata		
	Regression Coefficient	Standard Error	t_{stat}	Regression Coefficient	Standard Error	t_{stat}	Regression Coefficient	Standard Error	t_{stat}	Regression Coefficient	Standard Error	t_{stat}
LHN (X1)	0.811	0.118	6.860**	0.720	0.146	4.913**	0.654	0.209	3.116**	0.785	0.670	11.710**
BNH (X2)	-0.304	0.640	-0.475	0.973	0.630	1.543	0.104	0.644	1.616	0.718	0.391	0.183
UREA (X3)	0.528	0.695	0.760	0.681	0.704	0.966	0.606	0.785	0.771	0.697	0.456	1.528
PHONSKA (X4)	-0.104	0.103	-1.010	0.918	0.688	1.334	0.110	0.421	0.262	-0.273	0.471	-0.579
KCL (X5)	0.675	0.434	1.554	0.316	0.465	0.680	0.179	0.473	0.380	0.628	0.288	2.180**
TKP (X6)	0.757	0.201	0.375	-0.193	0.110	-1.757	-0.237	0.111	-2.144	-0.664	0.908	-0.731
TKW (X7)	0.265	0.243	1.092	0.220	0.939	0.234	0.191	0.112	1.704**	0.196	0.852	2.300**
Konstanta	7.542	0.851	8.856	7.821	0.635	12.300	8.088	0.662	12.21	7.655	0.402	19.000
t_{-table}	1.663			1.687			1.689			1.653		
F_{stat}	99.686			38.197			22.617			899.142		
F_{table}	2.213			2.364			2.38			2.152		
R^2	0.896			0.881			0.823			0.974		

Source: Processed Primary Data, 2023

Table 5. Results of Marginal Rate Technical of Substitution (MRTS) Analysis Fertilizer inputs

Independent Varible	Strata I					
	Regression Coefficient	Mrts Level	Description	Elasticity of Substituion (ES)	Percentage(%) ES	Description
Urea	0.528	-0.178	Substitution	0,7440	80,146	Partial substitution
Phonska	-0.104	6.470	complementary	-0,051	-5,515	Partial substitution
KCL	0.675	-1,278	Substitution	0,235	25,368	Partial substitution
Independent Variable	Strata II					
	Regression Coefficient	Mrts Level	Description	Elasticity of Substituion (ES)	Percentage(%) ES	Description
Urea	0,681	-13,481	Substitution	0,924	63,417	Partial substitution
Phonska	0,918	-0,345	Substitution	0,424	29,100	Partial substitution

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KCL	0,316	-0,465	Substitution	0,109	7,480	Partial substitution
	Strata III					
Independent Varible	Regression Coefficient	Mrts Level	Description	Elasticity of Substituion (ES)	Percentage(%) ES	Description
Urea	0.606	-0,182	Substitution	0,910	88,52	Partial substitution
Phonska	0.110	-1,625	Substitution	0,057	5,54	Partial substitution
KCL	0.179	-0,296	Substitution	0,061	5,93	Partial substitution
	Combination					
Independent Varible	Regression Coefficient	Mrts Level	Description	Elasticity of Substituion (ES)	Percentage(%) ES	Description
Urea	0,697	0,340	complementary	0,486	82,935	Partial substitution
Phonska	-0,237	2,649	complementary	-0,110	-18,771	Partial substitution
KCL	0,628	-0,90	Substitution	0,216	35,836	Partial substitution

Meanwhile, in addition to the combination of fertilizer inputs, there is also a combination of male and female labor inputs, as presented in Table 6. As follows.

Table 6. Results of Marginal Rate Technical of Substitution (MRTS) Analysis of Labor Input

	Strata I					
Independent Varible	Regression Coefficient	Mrts Level	Description	Elasticity of Substituion (ES)	Percentage(%) ES	Description
TKP	0,757	-0,351	Substitution	1,28	90,18	Full Substitution
TKW	0,2659	-28,474	substitution	0,14	9,85	Partial Substitution
	Strata II					
Independent Varible	Regression Coefficient	Mrts Level	Description	Elasticity of Substituion (ES)	Percentage(%) ES	Description
TKP	-0,193	11,419	complementary	-0,32	168,42	Partial substitution
TKW	0,220	0,877	complementary	0,13	-68,42	Partial substitution
	Strata III					
Independent Varible	Regression Coefficient	Mrts Level	Description	Elasticity of Substituion (ES)	Percentage(%) ES	Description
TKP	-0,2379	1,24	complementary	-0,39	156%	Partial substitution
TKW	0,1912	0,82	complementary	0,14	-56%	Partial substitution
	Combined					
Independent Varible	Regression Coefficient	Mrts Level	Description	Elasticity of Substituion (ES)	Percentage(%) ES	Description

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TKP	-0,664	-0,295	Substitution	-0,388	718,518	Partial substitution
TKW	0,196	-3,38	Substitution	0,334	-618,519	Partial substitution

3.2.2 Marginal Rate Technical of substitution (MRTS) Analysis

3.2.2.1 Strata I

A. Fertilizer Input Combination

In the combination of phonska fertilizer with urea, if the use of urea fertilizer is increased by 1kg/UT/MT, it will reduce 0.178 kg/UT/MT of phonska fertilizer. In line with research conducted by Widyantarta (2017). The combination of the use of phonska and urea fertilizers obtained the elasticity of substitution (ES) value is not equal to 1, which is 0.744, which means that the combination of phonska and urea fertilizers is only partially substitutable, meaning that each addition of 80.146% phonska fertilizer can replace 100% urea fertilizer. Similarly, in the combination of urea fertilizer with KCL, if the use of KCL fertilizer is increased by 1kg/UT/MT, it will reduce the use of urea by 1.278 kg/UT/MT.

In the combination of KCL and phonska fertilizer, the elasticity of substitution (ES) value is not equal to 1, which is 0.235, meaning that the combination of KCL and phonska fertilizer inputs is only partially substitutable. If the use of phonska fertilizer is added by 1% then kcl fertilizer is added by 25.368%. In contrast to the use of phonska and urea if the use of urea adds 1% then the use of phonska fertilizer is reduced by 5.51% with an elasticity of substitution (ES) value not equal to 1 which is 0.051 the combination of phonska and urea fertilizer inputs is imperfectly substitutable (Widyantara, 2017).

B. Combination of Male and Female Labor Input

The combination of the use of male labor and female labor both have substitution properties. Where if the use of female labor is added 1 person, it will reduce the use of male labor by 0.351. Vice versa, if male labor is added by 1 person, it will reduce the use of female labor by 2.847. The elasticity of substitution (ES) result is 1.28 for the combination of male and female labor, which means that the value of ES is greater than 1 and the combination of inputs is fully substitutable, so 90 male workers can replace 100 female workers. In contrast to the combination of female to male labor, the ES value is 0.14 or not equal to 1, which means that the combination of inputs is partially substitutable and 10 male workers can replace 100 female workers.

3.2.2.2 Strata II

A. Fertilizer Input Combination

The results of the analysis of the combination of the use of the three fertilizers urea, phonska, and KCL in the medium land area stratum (Stratum II) are all substitutable. In the combination of phonska fertilizer with urea, if the use of urea fertilizer is increased by 1kg/UT/MT, it will reduce 1.3481 kg/UT/MT of phonska fertilizer. The results of the analysis on the combination of urea fertilizer with KCL, if the use of KCL fertilizer is added by 1kg/UT/MT, it will reduce the use of urea by 0.3450 kg/UT/MT. Similarly, in the combination of KCL and phonska fertilizer, if phonska fertilizer is added by 1kg/UT/MT, it will reduce the use of KCL fertilizer by 0.461 kg/UT/MT.

The use of phonska and urea fertilizers obtained an elasticity of substitution (ES) value not equal to 1 (≠1) which is 0.924, which means that the combination of phonska and urea fertilizers is only partially substitutable. The addition of phonska by 1% can replace 63.417% of urea fertilizer. Similarly, in the combination of KCL and phonska fertilizers, the elasticity of substitution (ES) value is not equal to 1, which is 0.424, meaning that the combination of KCL and phonska fertilizer inputs is only partially substitutable, each 1% addition of KCL fertilizer can replace 29.1% of phonska fertilizer.

In the analysis of the elasticity of substitution (ES) of KCL and urea fertilizers, the result is not equal to 1, which is 0.109, which means that the combination of these inputs is not fully substitutable and only partially substitutable after 1% addition of KCL fertilizer can replace 7.48% of urea fertilizer. Based on the analysis of the combination of the three fertilizers, namely urea, phonska, and KCL, all three have an elasticity of substitution (ES) value not equal to 1 (≠ 1), meaning that the combination of the three fertilizers is only partially substitutable in line with the statement of Tati Joesron and Fatthorrazi (2012: 121).

B. Combination of Male and Female Labor Input

Similarly, the combination of the use of male labor and female labor both have a complementary nature where, if the use of female labor is added, the use of male labor is also added. Vice versa, if male labor is added, female labor is also added. The MRTS analysis results obtained a combination value between male and female labor of

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1.1419, meaning that if female labor is added by 1.1419 then male labor is also added by 1.1419. Likewise, in the analysis of female labor on male labor if male labor is added by 0.887 then female labor is also added by 0.887.

Meanwhile, the result of the elasticity of substitution (ES) analysis is -0.32 for the combination of male and female labor, which means that the ES value is smaller than 1 and the combination of inputs is partially substitutable every 168 female labor can replace 100 male labor. The ES value of female to male labor is 0.13 or not equal to 1, which means that the combination of inputs is partially substitutable 68 male labor can replace 100 female labor.

3.2.2.3 Strata III

A. Fertilizer Input Combination

The results of the analysis of the combination of the use of the three fertilizers urea, phonska, and KCL in the medium land area stratum (Stratum III) are all substitutable. In the combination of phonska fertilizer with urea, if the use of urea fertilizer is increased by 1kg/UT/MT, it will reduce 0.182 kg/UT/MT of phonska fertilizer. The results of the analysis on the combination of phonska fertilizer with KCL, if the use of KCL fertilizer is added by 1kg/UT/MT, it will reduce the use of phonska by 1.625 kg/UT/MT. Similarly, in the combination of KCL and urea fertilizer, if urea fertilizer is added by 1kg/UT/MT, it will reduce the use of KCL fertilizer by 0.296 kg/UT/MT.

The combination of fertilizer inputs is not equal to 1, which means that the inputs are only partially substitutable. Such as the use of phonska and urea fertilizers, the elasticity of substitution (ES) value is not equal to 1, which is 0.910, meaning that the combination of phonska and urea fertilizers is only partially substitutable, each 1% addition of phonska can replace urea fertilizer by 80.52%. The combination of the use of KCL and phonska fertilizers obtained the elasticity of substitution (ES) value is not equal to 1, which is 0.057, which means that the combination of kcl and phonska fertilizer inputs is only partially substitutable, the addition of 1% kcl fertilizer can replace phonska by 5.54%. Similarly, the elasticity of substitution (ES) analysis of kcl and urea fertilizers obtained results not equal to 1, which is 0.061, which means that the combination of these inputs is not fully substitutable and only partially substitutable, the addition of 1% kcl can replace urea fertilizer by 5.93%.

B. Combination of Male and Female Labor Input

The results of the mrts analysis obtained a combination value between male and female labor of 1.24, meaning that if female labor is added by 1.24 or by 60.1%. Likewise, in the analysis of female labor on male labor, if male labor is added by 0.82, female labor is also added by 0.82 or 39.8%.

The elasticity of substitution (ES) is -0.39 for the combination of male and female labor which means the ES value is smaller than 1 and the combination of inputs is partially substitutable 156 female labor can replace 100 male labor, as well as the combination of female to male labor which obtained the ES value of 0.14 or not equal to 1 which means the combination of inputs is partially substitutable 56 male labor can replace 100 female labor.

The results of the Elasticity of Substitution (ES) analysis both in the combination of fertilizer use and labor use both have elasticity of substitution (ES) values smaller than 1 (≠1) which means that the combination of fertilizer and labor production inputs is only partially substitutable or imperfect substitution Widyantara (2017), and Tati Joesron and Fatthorrazi (2012).

3.2.2.4 Combined

A. Combination of Fertilizer Input Use

The results of the MRTS analysis on the three types of fertilizer show that only the combination of kcl fertilizer and phonska fertilizer is substitutable. It can be seen that all combinations of fertilizer inputs are not equal to 1, which means that these inputs are only partially substitutable. As with the use of phonska and urea fertilizer, the elasticity of substitution (ES) value is not equal to 1, which is 0.486, meaning that the combination of phonska and urea fertilizer is only partially substitutable, each 1% addition of phonska can replace urea fertilizer by 82.935%. In the combination of KCL and phonska fertilizers, the elasticity of substitution (ES) value is not equal to 1, which is -0.110, meaning that the combination of KCL and phonska fertilizer inputs is only partially substitutable, a 1% reduction in KCL fertilizer can replace phonska by 18.771%. Similarly, the elasticity of substitution (ES) analysis of kcl and urea fertilizer does not equal 1, which is 0.216, meaning that the combination of inputs is not fully substitutable and is only partially substitutable, with a 1% addition of kcl fertilizer able to replace urea fertilizer by 35.836%.

The substitution of male labor in table 7. is 718 female labor can replace 100 male labor while the combination of female labor is 618 female labor can only replace 100 male labor. Based on the results of the analysis, the combination of female and male labor has MRTS values that are substitutable but both are imperfectly or partially substitutable with the value of the elasticity of substitution not equal to one (≠1). It can be concluded that the combination of labor inputs of both women and men is only partially substitutable and in the combination of the

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three fertilizer inputs is also partially substitutable with an elasticity value not equal to 1. In line with what is stated by Mutia (2021), Karmini (2018) the Elasticity value is not equal to 1 means that the combination of inputs in each variable is imperfectly or only partially substitutable.

4 Conclusions and Suggestion

Based on the results of the analysis that has been done on the factors that affect the production of paddy rice and the level of marginal substitution (MRTS) obtained conclusion:

a. Only Land Area has a significant effect on production in all strata of land area (strata I, II, III, and combined). In stratum III and combined female labor has a real effect on the production of paddy rice. On the combined land area, the use of KCL fertilizer has a significant effect on the production of paddy rice.
b. Only the combination of male labor to female labor in the narrow land stratum (stratum I) is fully substitutable with an elasticity of substitution (ES) value greater than 1 (≥ 1) while in the combination of fertilizer input use is only partially substitutable. Whereas in strata II, III, and the combination of both fertilizer inputs and male and female labor are only partially substitutable.

After conducting a study on the relevant themes, researchers can make the following recommendations to address these challenges:

a. Farmers are expected to use production inputs, especially beih, urea fertilizer, phonska fertilizer, KCL fertilizer in accordance with what has been recommended by the government and agricultural extension workers in order to increase rice production optimally
b. This research is only limited to 3 different land area strata, namely land area strata I, II, and III due to limited time, cost, and energy, so for future researchers, suggestions that can be given in relation to this research are to add research objects to other land area strata and inputs.

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