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The Effect of Land use and Subsidized Fertilizer for Rice Production Case Study: Tangerang District, Banten

Tian Mulyaqin[1,*], *Septi* Kusumawati[1], *Nita* Winanti[1] and *Kardiyono*[1]

[1]Banten Assessment Institute for Agricultural Technology, Serang Banten, Indonesia

Abstract. Tangerang District is one of the rice producers in Banten Province. The intensification of rice production is one of the solutions due to the agricultural land conversion problem in Tangerang. The purpose of this study is to analyze the farmer perception about subsidized fertilizer and we also analyze the effect of land use and subsidized fertilizer for rice production at the farmer level in Tangerang. The data used in this study were collected through an interview survey using a structured questioner to 35 respondents in Tangerang in 2016. The data were analyzed using descriptive and quantitative analysis. The result showed that the farmers perceive that the availability of subsidized fertilizer is frequently rare especially for nitrogen fertilizer and phosphorus fertilizer. The study also shows the rice production at the farmer level was affected by land use, the application of subsidized urea fertilizer, the application of organic fertilizer, and the application of returning the straw to the paddy field. All of these significant factors on rice production were inelastic in the short term and long term. It is important to decrease agricultural land conversion and returning the straw to the paddy field to maintaining rice production in Tangerang.

1 Introduction

Rice is a staple food for most Indonesian. However, the Indonesian rice economy is facing a complex problem and requires appropriate approaches to ensure food sufficiency. Rice production has been very dynamic and supported by capable land resources [1]. The land is one of the main inputs in rice production. However, land conversion from the agriculture sector to other sectors is inevitable in Indonesia [2]. Nevertheless, regulation and policies to maintain agriculture land conversion were published by Government in Indonesia, however, this regulation is not effective yet implemented and it is difficult to control the conversion agriculture land to personal or public sectors such as infrastructure establishment or other sector's purposes [3, 4].

Optimization of input utilization such as the application of modern varieties and fertilizer has been lifting production per capita as well as yield significantly [1]. Then, the adoptions of improved technologies and production practices are also important drivers of

[*] Corresponding author: tianmulyaqin@pertanian.go.id

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agricultural development [5] However, the massive use of input in rice production system at present threatening to human health, other living organism, and environment, so alternatives strategies are needed to overcome few or more these challenges, while meeting the increasing demand for rice simultaneously [6].

This research objective is to analyze the farmer's perception of the availability and utilization of subsidized fertilizer and we also analyzed the factors that influencing rice production in Tangerang District, Banten Province. The previous research also studied the impact of land use and subsidized fertilizer at the national level [7], el Nino and la Nina [8, 9] for rice production, the differences with previous research are we put farmer practice on using certified seed, managing rice straw and subsidized fertilizer utilization including an organic and organic fertilizer at farmer level as a variable.

2 Material and Method

2.1 Research site

The research was conducted in Tangerang District. Tangerang District is a lowland with an altitude of 0-85 meters above sea level, located at the coordinates 6°00'- 6°20' south latitude and between 106°20'- 106°43' east longitude and about 49 km from Jakarta, the capital of Indonesia. Tangerang District is one of the fourth rice producers in Banten Province after Serang District, Pandeglang District and Lebak District. Period of 2010-2015 the average contribution of rice production in Tangerang District was 361,050 tons (17.86%) percent of the total production of 2,030,357 tons on average. The research site is the rice production center in Mauk Sub-district, Kronjo Sub-district, and Mekarbaru Sub-district. In 2016, BPS Tangerang District reported, the three sub-districts contributed around 17.07 percent or around 55,305 tons of rice from Tangerang's total rice production of 324,053 tons [10].

2.2 Research Methodology

This study used survey data through interviews using a structured questionnaire to 35 respondent farmers who carried out rice farming in the Mauk Sub-district, Kronjo Sub-district, and Mekarbaru Sub-district, in Tangerang District in 2016. The farmer perception about subsidized fertilizer were analyzed descriptively and the variables were examined that affect rice production are the area of land use, seeds, and subsidized fertilizers used by farmers, namely urea (nitrogen fertilizer), SP-36 (phosphorus fertilizer), NPK, and organic fertilizers, the application of fertilizer frequency, as well as farmers' practice in straw management. The data were analyzed using multiple linear regressions. Multiple linear regression analyzes the functional relationship or the influence of two or more variables on the dependent variable [11,12], in this analysis, the independent variable will be determined as X, the dummy variable as D and the dependent variable is stated as Y. The linear regression model in this study is as follows:

$$Y=\beta_0 + \beta_1X_1+ \beta_2X_2+ \beta_3X_3+ \beta_4X_4+ \beta_5X_5+ \beta_6X_6+ \beta_7X_7+ \beta_8D_8+ \beta_9D_9+ \beta_{10}D_{10} + \varepsilon \quad (1)$$

Where:
Y = Rice yield at farmer level (kg)
β_0 = Intercept
β_{1-10} = Variable Coefficient
X_1 = Land use (hectare)

X_2 = the amount of urea used (kg)
X_3 = the amount of SP-36 used (kg)
X_4 = the amount of NPK used (kg)
X_5 = the amount of seed used (kg)
X_6 = the frequent of fertilizer application (times)
X_7 = the amount of organic fertilizer used (kg)
D_8 = dummy: used the certified seed (1), otherwise (0)
D_9 = dummy: used organic fertilizer (1), otherwise (0)
D_{10} = dummy: returned the straw to the field (1), otherwise (0)
ε = the error

The capability of regression models to predict the impact of variables for rice production was tested by the linear correlation coefficient between the values estimated by the regression model and actual values (R squared) and we also examine the model using F-test to analyze the variables has simultaneous effect on rice production or not [13, 14, 15].

3 Result and Discussion

3.1 Respondent Characteristics

Table 1. It shows that the respondents have an average age of 45 years with an age range between 21 years until 66 years. Most of the respondents are in productive age, so they have a strong relationship with the performance of the rice production process. In terms of education of farmers, respondents are on average graduated from elementary school; this can be seen from the average formal education that has been done by respondent farmers for more than 7 years. However, in a range, the respondent farmers have gone through formal education ranging from 2 years or have not graduated from elementary school to 12 years or have graduated from high school. Education has an important role in in the adoption of technology [16].

Table 1. Respondent characteristic

	Average	**Min**	**Max**
Age (years)	45.95	21	66
Education (years)	7.26	2	12
Land tenure (years)	1.61	0.3	4.0
Rice farming experience (years)	17.80	3	40
Farmer’s family member (person)	5	0	8

Table 1. Also shows that the land use by the respondent ranges from 0.3 hectares to 4 hectares with average land use is about 1.61 hectares. However, our research results (Table 2.) show that more than 50 percent of the respondents their land status is only sharing or *sakap* (62.86%), 11.43% of respondents rent their land, and 25.71% of farmers as the owner and as a grower also.

Table 2. Land tenure status

	N	%
Own	9	25.71
Tenant	4	11.43
Share (*sakap*)	22	42.86
	35	100

The farming experience of respondents in doing rice farming is quite experienced. It can be seen from the average farming experience of more than 17 years with the range of experience of respondent farmers in rice farming ranging from 3 years to 40 years. This farming experience is very important in supporting the implementation of rice farming. The more experienced, the better at doing his farming (Table1.)

The number of respondent farmer family members ranged from 0 or did not have dependents to 8 people. These family members can play a role as input in the workforce in the form of labor in the family to help family farming. The higher the workforce in the family, of course, the labor costs will be reduced if the costs are not calculated (Table 1.)

3.2 Farmers' perceptions of the provision, distribution, and use of subsidized fertilizer

The provision and distribution of subsidized fertilizers for the agricultural sector are regulated regularly every year through a Regulation of the Minister of Agriculture (*Permentan*) concerning the Need and Highest Retail Price (*HET*) for Subsidized Fertilizer. In 2015, this is regulated in *Permentan* No. 130/2014. This regulation regulates the allocation of subsidized fertilizers which is calculated according to the location-specific balanced fertilization recommendation by considering the proposed needs submitted by the provincial government in the form of a recapitulation of the Group Needs Definitive Plan (RDKK), as well as the budget allocation for fertilizer subsidies in 2015.

Table 3. Farmer knowledge about RDKK

	n	%
As a farmer union member		
Yes	35	100.00
No	0	0.00
Total	35	100.00
Information about RDKK (fertilizer proposal)		
Know	13	37.14
do not know	22	62.86
Total	35	100.00
If you know RDKK, do you join to arrange it?		
Yes	9	69.23
No	4	30.77
Total	13	100.00

The RDKK document is a planning document for subsidized fertilizer needs in one year which is compiled based on deliberations by members of farmer groups, which is the basic document for ordering subsidized fertilizers from farmer group associations or agricultural production equipment distributors. This is regulated in Pementan No. 82/2013 on guidelines for fostering farmer groups and farmer group associations. However, Table 3. shows that not many respondent farmers are aware of the RDKK document in the planning submission of subsidized fertilizer proposals. Although all of the respondent farmers (100%) are members of the farmer group, only 37.14% of the respondents know about the RDKK document, the remaining 62.86% of the respondents do not know the document. Then, of the respondents who know the RDKK documents, 69% more were involved in the preparation of RDKK documents, the rest were never involved. Planning for the proposal of subsidized fertilizers through the RDKK document is a crucial point in meeting fertilizer needs at the farmer group level, so if it is not good it will have an impact on the allocation of fertilizer availability in the region. Suryana et. al reports that part of RDKK compiled at the farmer group level is inaccurate, both procedurally or the accuracy of the data presented, as a result, there is RDKK whose volume of fertilizer needs is smaller or greater than real needs or not all farmer's fertilizer needs are planned based following the plants their cultivates in a one-year cycle [17].

Table 4. It shows that most of the respondent farmers (88.57%) buy subsidized fertilizer at official kiosks that have been determined by the government to distribute fertilizers in their area, others (11.43%) buy at the nearest market, although not as a kiosk to distribute fertilizer in their area.

Most of the respondent farmers purchased subsidized fertilizers or 91.4% by cash, the remaining 8.57% could make credit to a kiosk and pay for the harvest. However, farmers' perceptions of the availability of subsidized fertilizers when purchasing fertilizers, 45.71% of respondents said it was sometimes available, 31.43% said it was scarce, and 22.86% always available.

The response of the respondent farmers, if there is a shortage of fertilizers, is that the respondent will buy fertilizer from another area even though it is not designated for the area (48.57%), others will wait until the fertilizer is available again (45.72%), the rest are forced to buy unsubsidized fertilizer, even though the price is more expensive (5.71 %). Farmers also perceived about the kind of subsidized fertilizer that frequently rare are N-fertilizer (65.71%), P-fertilizer (45.71%), NPK (11.43%), and KCl (17.14%).

Table 4. Purchase and availability of subsidized fertilizers

	n	%
Where did you buy the fertilizer		
at the official kiosk was determined by the government	31	88.57
at sub-district market	4	11.43
Total	35	100.00
Payment method		
Cash	32	91.43
credit to the kiosk	3	8.57
Total	35	100.00
Fertilizer availability		
Always available	8	22.86
sometime available	16	45.71
Rare	11	31.43
Total	35	100.00
Farmer's response when the fertilizer rare		
Buy a subsidized fertilizer from another region	17	48.57
Buy non-subsidized fertilizer though more expensive	2	5.71
Waiting until the subsidized fertilizer available	16	45.72
Total	35	100.00
Kind of subsidized fertilizer frequently rare*)		
Urea (N-fertilizer)	23	65.71
SP-36 (P-fertilizer)	16	45.71
NPK (K-fertilizer)	4	11.43
KCL	6	17.14
*) respondent can choose more than one choice	35	

3.3 Factors affecting rice production

The rice production model in this study is influenced by several variables. The results of the multiple linear regression analysis show that the variables affect rice production in Tangerang Regency (Table 5.). The result indicates that the production estimator model in this study has R Square value of 0.917 which means that the diversity of these explanatory variables are simultaneously able to explain 91.7% of the diversity of the rice production population at the study site. We also examine the model using F test [14], Table 5. Show that the model has F value =26.642 > F statistical table $_{(10.25).5\%}$=2.24. It is means the model is significant at 5% level and reject the null, it is meaning that all variables in the model are simultaneously affect the rice production.

Table 5. Results of parameter estimation and statistical test of rice production models

Variable	Estimated Parameters	Sig.		Elasticity	
				Short Run	Long Run
Intercept	1499.499	0.513			
Land use	3337.882	0.000	*	0.729	0.000
Use of urea	6.433	0.06	*	0.312	-0.057
Use of SP-36	-2.473	0.297		0.202	-0.026
Use of NPK	-3.746	0.103		-0.061	-0.018
Seed	8.756	0.751		-0.026	-0.006
Frequent of fertilizer application	-453.539	0.688		-0.133	0.000
Organic fertilizer	3.619	0.046	*	0.071	-0.027
Dummy of certified seed	-692.132	0.320		-0.070	0.000
Dummy of organic fertilizer	-2643.137	0.023		-0.108	0.000
Dummy of straw management	2240.859	0.012	*	0.073	0.000
F value =26.642 > F statistical table $_{(10,25),5\%}$=2.24					
R-square = 0.917					
R-square (adjusted) = 0.883					
*) Significant level at 10%					

Table 5. indicates that the land use, the application of subsidized urea fertilizer, the application of organic fertilizer, and the application of returning the straw to the paddy field are significant and have a positive effect at the 10% level of significance on the rice production at farmer level. The coefficient of farm size (land use) is significant and positive. The result implies that a 1 unit increase in land size increases the value of rice output by about 3337.882 units in the model. Another significant factor is the application of subsidized urea fertilizer. It indicates a 1 unit increase in the application of subsidized urea fertilizer increases the value of rice output by about 6.43 units in the model. Then, the use of organic fertilizer also impact the rice production significantly, it is indicated 1 unit increase in the application of organic fertilizer increase the value of rice production about 3.62 unit in the model. This finding in line with the previous research that land use and the application of fertilizers (organic and inorganic fertilizer) have a significant impact on increasing rice production [7, 18]. We also found in this research that the application of returning straw to the field also increases the value of rice production in the model significantly and positively. In line with the previous research, it has the scientific evidence that the application of returning straw to the field is a common management practice for improving fertility [19], and increased rice production [20, 21].

The land use, the use of urea fertilizers, the use of organic fertilizers, and the application of return the straw to the land have elasticity values of the short-run and long-run <1. This shows that this factor is inelastic to rice production both in the short and long term.

4 Conclusion

The farmers perceive that the availability of subsidized fertilizer is frequently rare especially for N-fertilizer and P-fertilizer, so they have to wait until it is available again. The factors influencing the rice production at the farmer level was affected by land use, the application of subsidized urea fertilizer, the application of organic fertilizer, and the application of returning the straw to the paddy field. All of these significant factors on rice production were inelastic in the short term and long term. It is important to decrease agricultural land conversion, optimizing input especially subsidized fertilizer, and returning the straw to the paddy field to maintaining rice production in Tangerang.

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