Journal of Agriculture and Crops
ISSN(e): 2412-6381, ISSN(p): 2413-886X
Vol. 9, Issue. 2, pp: 172-177, 2023
URL: https://arpgweb.com/journal/journal/14
DOI: https://doi.org/10.32861/jac.92.172.177

Academic Research Publishing Group

Original Research **Open Access**

Comparative Analysis of Rice Farming with Tabela and Tapin System in Tanjung Jabung Timur Regency, Jambi Province

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Article History
Received: 12 November, 2022
Revised: 7 January, 2023
Accepted: 13 February, 2023
Published: 19 February, 2023

Abstract

This study aimed to analyze the comparison of the Tabela system rice farming with the Tapin system. The research was conducted in East Tanjung Jabung Regency, Jambi Province. The sample villages are Lagan Ulu Village and Simbur Naik Village. The sample size was 90 farmers, 45 farmers with the Tabela system of lowland rice farming, and 45 farmers with the Tapin rice farming system. Sampling with Simple Random Sampling Method. The data analysis method used descriptive analysis, and the production function of Cobb-Douglass Stochastic frontier, the measure of farmer behavior refers to the Kumbhakar and X-square test. The results of the study explain that the use of production inputs for the two rice farming patterns of the Tabela system and the Tapin system is not significantly different except for the use of seeds. Tabela rice farming system is more responsive to the use of production inputs. Farmers' preferences for production risk are risk takers. The allocation of the use of urea fertilizer and pesticides is a risk averter, while the use of seeds, NPK fertilizer, and labor is a risk taker. Productivity, revenue, income, RC ratio, and profit were higher in the Tabela farming system than the Tapin system, and were significantly different.

Keywords: Rice farming; Tabela system; Tapin; Production response; Farming performance.

How to Cite: Saidin Nainggolan, Yanuar Fitri, Ardhiyan Saputra, 2023. "Comparative Analysis of Rice Farming with Tabela and Tapin System in Tanjung Jabung Timur Regency, Jambi Province." *Journal of Agriculture and Crops*, vol. 9, pp. 172-177.

1. Introduction

The agricultural sector plays an important role in the economy of developing countries. The role of the agricultural sector in economic development includes: 1) as a food provider, 2) as a job opportunity for the population, 3) as a source of capital for modern economic growth, especially in the early stages of development, 4) as a source of foreign exchange, and 5) rural communities are a source of income. market for products produced from the industrial sector in urban areas [1] The most important commodity in the agricultural sector is food. Food for Indonesia is identical to rice because rice is the main staple food, almost 95% of Indonesian people consume rice as a source of carbohydrate food. Balitbang [2] Indonesian people's rice consumption is 123 kg/capita/year, this value is much higher than the ideal consumption according to developed country standards, which is 80-90/kg/capita/year. The population of Indonesia, which has reached ± 272 million people and the growth rate is around 1.22% per year, the demand for rice from year to year will continue to increase.

Government policies in order to meet domestic rice needs are carried out in two ways, namely extensification and intensification. Extensification is more focused on increasing harvested area, while intensification is done by increasing crop productivity and Crop Index (IP). Since 2007 the government has rolled out a program to increase national rice production (P2BN) which aims to support food security and as a rice stock in Bulog (Logistics Affairs Agency). The background of the P2BN program is also the instability of the national rice availability caused by climate change that is difficult to predict, attacks by plant pest organisms (OPT), increasingly limited water resources and a decrease in planted area due to conversion of productive paddy fields [3].

Jambi Province is a potential area for the development of lowland rice farming. The planted area in 2015 was 148,966 ha and became 121,869 ha in 2020. The average decrease in harvested area during this period was 11.22% per year. Rice production in the 2015-2020 period averaged 643,398 tons per year, with stagnant productivity at 4.62 tons/ha [4]. One of the centers for the development of lowland rice farming in Jambi Province is East Tanjung Jabung Regency. Efforts that have been carried out by the East Tanjung Jabung Regency Government to increase rice production include Bimas, Inmas, Insus, Supra Insus, SL-PTT (Integrated Crop Management Field School), GP-PTT (Integrated Crop Management Application Movement), Upsus Planting System Program Direct Seeds (Tabela) and the Twice-Yearly Movement of Rice Planting (Tapin). Pandawani and Putra [5], grain production produced by direct seed planting system (Tabela) rice farming can produce 6.0 - 6-5 tons/ha while the shifting cultivation system (Tapin) only produces 4.5 - 5.5 tons /ha, and the labor required in the Tabela system is relatively less. While the weaknesses of the Tabela system compared to the Tapin system are (1) the cultivation of the Tabela system is only suitable for flat and perfectly cultivated rice fields, (2) the need for seeds per unit area is more, and (3) seeds planted in paddy fields are easily washed away. by water. However, in this regard, it is necessary to analyze the comparison of the two farming systems from the aspect of the use of production inputs, production functions, behavior of rice farmers with the Tabela and Tapin system, technological feasibility, RC ratio and profitability of the two farming systems.

2. Material and Methods

This research was carried out in East Tanjung Jabung Regency by taking two sub-districts, namely Geragai District with the sample village, Lagan Ulu Village and East Sabak Muara District with Simbur Naik Village. The selection of this location was carried out purposively with the consideration that this area is included in the development area of the Tabela rice farming system and Tapin until now. The number of respondents was 90 farmers, namely 45 farmers who applied the Tabela system and 45 farmers who applied the Tapin system. Sampling is done by Simple Random Sampling Method.

The method of analysis using the average production function and the productivity variance of lowland rice is as follows:

$LnY = \beta_0 + \beta_1 (\text{Ln Seed}+DX_1) + \beta_2 (\text{NPK Fertilizer}+DX_2) + \beta_3 (\text{Urea Fertilizer}+DX_3) + \beta_4 (\text{Pesticide}+DX_4) + \beta_5 (\text{Labor}+DX_5) + \beta_6 (\text{Area Land}+DX_6) + \varepsilon$

Productivity variance function:

$Ln\sigma^2Y = \Theta_0 + \Theta_1(\text{Ln Seed}+DX_1) + \Theta_2(\text{NPK Fertilizer}+DX_2) + \Theta_3(\text{Urea Fertilizer}+DX_3) + \Theta_4(\text{Pesticide}+DX_4) + \Theta_5(\text{Labor}+DX_5) + \Theta_6(\text{Land Area}+DX_6) + \varepsilon$

Productivity variance:

$\sigma^2Y = (Y^* - \hat{Y}i)^2$

Information:

Y = Lowland rice production (kg)
$X_1,X_2,\ldots,X_8$ = Factors of Production
X_1 = Seed (Kg)
X_2 = NPK Fertilizer (kg)
X_3 = Urea Fertilizer (kg)
X_4 = Pesticides (ml)
X_5 = Labor (HKSP)
X_6 = Land Area (Ha)
σ^2Y = Productivity Error Variance
Y^* = Frontier Production
$\hat{Y}$ = Actual Production
ε = error
β,Θ = Constant
$\beta_1,\beta_2,\ldots,\beta_8$ = Coefficient of estimated parameters $X_1,X_2,\ldots X_8$
$\Theta_3,\Theta_4\ldots,\Theta_{10}$ = Coefficient of estimated parameters $X_1,X_2,\ldots X_8$

The behavior of farmers in responding to production risks can be obtained from Θ and λ obtained from the equation [6]. The two functions can be added together to get the risk choice measure ($\Theta + \lambda$). Soekartawi [7], Tasman [8], and Kumbhakar [6] Alternatively, Θ and λ can be viewed as components of overall risk preference, farmer behavior in facing production risk is indicated by Θ and λ obtained from Maximum Likelihood estimation. the second stage, with the following criteria:

1. If $\Theta = 0$ and $\lambda = 0$ then the farmer is neutral to risk.
2. If $\Theta > 0$ and $\lambda > 0$ then the farmer is a risk taker.
3. If $\Theta < 0$ and $\lambda < 0$ then the farmer is a risk averter..

3. Results and Discussion

3.1. Use of Factors of Production

Rice farming is carried out by farmers on their own land. The condition of the paddy fields is tidal land type C and D. The use of production inputs for the two systems of rice farming can be seen in Table 1.

Table-1. Use of Production Factors in Paddy Rice Farming in the Research Area, 2021

Production Factors	Rice Farming		
	Unit	Tabela System	Tapin System
Seed	kg/ha	41.32	30.50
NPK Fertilizer	kg/ha	92.50	100.00
Urea Fertilizer	kg/ha	75.00	82.35
Pesticide	Ml/ha	560.75	485.20
Labor	HKSP/ha	72.40	85.42
Land Area	Ha	1.45	1.30
Production	**kg/ha**	**4,950**	**2,585.96**

Table 1 shows that the use of seeds for the Tabela system farming is more than the tapin system and is significant. The recommendation for lowland rice farming seeds is 15-20 kg/ha, if technically irrigated farming is only 12.5-15 kg/ha [9]. The use of NPK fertilizer, urea fertilizer, pesticides, and labor in Tapin farming uses more inputs but is not significant. Constraints in the use of inputs occur due to limited capital, access to fertilizer procurement and limited technological guidance to farmers.

3.2. Analysis of Production Functions and Risk Preferences for Rice Farming

3.2.1. Cobb-Douglass Production Function Analysis

The production function is intended to describe the production response to production inputs. The estimation results of Cobb Douglass production function can be seen in Table 2.

Table-2. Estimation of Production Function with Dummy Slope Rice Farming in the Research Area, 2021

Variable	Coefficient	Std.Error	t-Statistic	Prob.
Seed	0.1354	0.0362	3,7403	0.0041
D_Seed	0.2675	0.0455	5,8791	0.0246
NPK Fertilizer	0.2451	0.0275	8,9127	0.0032
D_NPK Fertilizer	0.1364	0.0824	1,6553	0.0572
Urea Fertilizer	0.2973	0.0563	5,2806	0.0426
D_Urea Fertilizer	0.0854	0.0433	1,9722	0.3271
Pesticide	0.1446	0.0512	2,8241	0.0263
D_Pesticide	0.0261	0.0135	1,9333	0.4385
Labor	0.1875	0.1766	1,0617	0.0634
DXS_Labor	0.2357	0.0823	2,8639	0.0348
Land Area	0.2554	0.0667	3,8290	0.0064
D_Land Area	0.0835	0.0223	3,7443	0.0583
C	4.5634			0.0000
R-squared **Adjusted R-squared**	**0.9148** **0.8912**	**F-statistic** **Prob(F-statistic)**	**19.3562** **0.00000**	

Table 2 explains that the value of Adj.R^2 = 0.9142 means that the precision of the model is 91.42%, with prob. 0.000 < α (0.01) means that simultaneously the use of production inputs has a very significant effect on rice production. The value of Σb_i = 0.8857 < 1, it means that the production scale is in area II (Decreasing Return to Scale). Consistent with Malik, *et al.* [10], Nainggolan, *et al.* [11], Nainggolan, *et al.* [12], that in Muaro Jambi and Kerinci districts, the production scale of lowland rice farming is also in the regions II (Decreasing Return to Scale). Partially, the elasticity of production inputs to rice production is 0.1354, 0.2451, 0.2973, 0.1446, 0.1875, 0.2554. This means that each additional 1% of production input will result in an increase in rice production of 1.35%, 2.45%, 2.97%, 1.45%, 1.88%, 2.55% respectively. The use of seeds, urea, NPK, pesticides, labor, and land area resulted in a dummy coefficient which was positive for the Tabela system rice farming but not significant, meaning that the Tabela system rice farming system was more responsive to the use of production inputs than the Tapin system rice farming system but not significant.

3.2.2. Rice Farmers' Production Risk Preferences

The results of the estimation of the frontier production function are used to analyze the risk preferences of farmers [6]. Consistent with Nainggolan, *et al.* [13], that the average risk preference of farmers is risk taker. The results of the risk preference analysis of lowland rice farmers using the risk preference analysis model [6] produce values of 0 and λ which can be seen in Table 3.

Table-3. Production Risk Preference of Rice Farmers in the Research Area, 2021

Tabela System Rice Farming			Tapin System Rice Farming		
Production Input	**Average 0**	**Average λ**	**Average 0**	**Average Λ**	**Preferensi**
Seed	0.0667	3.4530	0.2113	3.4533	*Risk Taker*
Urea Fertilizer	-0.0531	3.4472	-0.6663	3.5577	*Risk Aveter*
NPK Fertilizer	0.0470	3.4543	0.0888	3.7656	*Risk Taker*
Pesticide	-0.0230	3.4325	-0.1012	3.2188	*Risk Aveter*
Labor	0.0522	1.2374	0.0431	2.7435	*Risk Taker*
Average	**0.01796**	**3.00488**	**-0.08486**	**3.34778**	***Risk Taker***

Table 3 explains that the average risk behavior of lowland rice farmers to production inputs is risk taker. The risk behavior of farmers on urea fertilizer and pesticides is risk aveter. Farmers are afraid to allocate Urea fertilizers and pesticides in larger quantities so that their use is still below the recommended dose. For inputs of seeds, NPK fertilizers, and farmer's labor, risk taker behavior means that farmers dare to allocate these inputs in larger quantities to their farms.

The risk preference of farmers who are risk takers for seed input is shown by the average use of seeds of 38.47 kg/ha. Farmers dare to use large amounts of seed apart from the availability of seeds that are easily obtained at nearby kiosks, some farmers can also produce their own seeds. Rahayu [14], that farmers' risk preferences for seeds are risk averse.

The risk behavior of lowland rice farmers to urea fertilizer is risk averter. The behavior of farmers who are risk averter tends to use these inputs, the allocation of their use is below the recommended dose. This can be seen from the production function and the risk function that the addition of urea fertilizer use can still increase production and reduce risk. The behavior of farmers who are risk averter tends to use inputs that are not as recommended. Ambarsari, *et al.* [15] that farmers behave risk averse to urea fertilizer.

The risk behavior of lowland rice farmers' production of NPK fertilizer is a risk taker. Farmers tend to dare to allocate NPK fertilizer according to the recommended dose. The risk preference of lowland rice farmers to pesticides is risk averter or farmers avoid using pesticides as recommended. This is indicated by the low level of pesticide use. Consistent with Ambarsari, *et al.* [15], that farmers behave risk averse towards liquid insecticides.

The risk preference of lowland rice farmers to labor is the risk taker. Farmers tend to allocate more labor. In addition, the availability of labor in the family also supports the use of labor. Consistency with Rahayu [14] farmer's risk preference towards labor is risk taker.

Farmers' risk preferences will influence farmers' decisions in the allocation of input use. The risk preferences of risk takers have an effect on the use of more production inputs. Nainggolan, *et al.* [16], Nainggolan, *et al.* [12], Pujiharto and Wahyuni [17], with the nature of rice farmers who are risk averse, namely farmers who avoid risk so that the allocation of inputs by farmers who do not dare to allocate inputs in large quantities to produce production optimal.

3.3. Relationship between Farmer Behavior and the Tabela Program.

The preference component is the tendency of farmers' behavior towards the Tabela program. The relationship between farmer behavior and the implementation of the Taba system rice farming program can be seen in Table 4.

Table-4. Contingency of Farmer Behavior with the Implementation of theTabela Program in the Research Area, 2021

Rice Farming	Farmer Behavior		Amount
	Risk Taker	**Risk Averter**	
Tabela System	39	6	45
Tapin System	13	32	45
Total	**52**	**38**	**90**

Table 4 explains that the contingency of farmers' preferences in responding to the production risk of the Taba system is a risk taker, while the preference of farmers in the Tapin system is a risk averter. The Chi square test obtained the value of X^2hit = 38.66 and the value of X^2table = {α = 5% db = 1} 3.841, then the decision to accept H1 reject Ho means that there are differences in farmers' preferences for the risk of lowland rice farming production in the Tabela and Tapin systems very significantly .

The degree of contingency of the farmer group with the farmer's preference for risk is C_{hit} = 0.53 and C_{max} = 0.70. The degree of contingency of the sample group of farmers affects differences in farmers' preferences for production risk, the C_{hit} value = 0.52 (between 0.353-0.707). Meanwhile, the degree of correlation between the different sample groups and the farmer's preference for risk was obtained r = 0.75. The results of the r coefficient test obtained t_{hit} = 10.93 and t_{table} = (α/2 = 5%) (db) = 88 = 1.662, then accept H1. This means that there is a real relationship between farmer groups and farmers' preferences in responding to the risk of lowland rice farming production at the 95% confidence level. The cause of farmers not participating in the Tabela program is because most farmers assume that participating in the Tabela program is the same as hoping for crop failure in farming so that farmers are reluctant to participate in the Tabela program.

3.4. Rice Farming Income

The performance of the tabela rice farming system and the tapin system can be explained by the amount of farm income, see Table 5

Table-5. Revenue, Income, R/C, Profitability, Tables and Tapin Rice Farming in 2021

Description	Tabela Farming (Rp/ha)	Tapin Farming (Rp/ha)
A. Revenue (Rp)	17.460.000	14.830.715
B. Cost (Rp)		
B_1. Fees Paid (Rp)		
1. Seed	459.555	264.841
2. Fertilizer	993.372	1.381.628
3. Herbicide	453.630	438.541
4. Insecticide	270.763	239.126
5. TKLK	1.999.222	3.522.555
6. Land Rent	747.755	1.925.555
7 . Hand tractor Rent	549.872	670.555
8. Power Thereser Rent	1.095.555	949.483
9. Cash	145.555	145.555
Total fee paid	**6.715.279**	**9.537.839**
B_2. Fee not paid (Rp)		
1. Tool shrinkage	233.027	319.903
2. TKDK	2.059.888	2.683.555
B_2. Total cost not paid	**2.292.915**	**3.003.458**
C. Total cost (B_1+B_2) (Rp)	**9.008.194**	**12.541.297**
D. Income (A-C) (Rp)	**8.451.806**	**2.289.418**
E. Profit (A-B_1)	**10.744.721**	**5.292.876**
F. R-C Rasio (A/C)	**1,938**	**1,182**
G. Profitability (π/TC)	**1,192**	**0,422**

Table 5 shows that the Tabela system farming provides greater and significant revenue than the Tapin system, and at a lower but insignificant cost, so that the Tabela system farming is able to generate greater and very significant profits compared to the Tapin system farming. The RC ratio of the Tabela system farming is 1.94 and the Tapin system is 1.18. This figure shows that both farming systems are feasible because R/C > 1. The profitability of the Tabela system farming is 1.19 (119 %), and the Tapin system farming is 0.42 (42 %). This figure is much larger than the prevailing bank interest rate of 18% per year, meaning that it is financially profitable for farmers. Consistent with Sukisti [18], the productivity of the Tabela system rice farming is 8.1 tons GKP/ha, while the Tapin system is 6.6 tons GKP/ha. Arfah, *et al.* [19], that the income of farmers who apply the Tapin system is Rp. 14.71 million per hectare, while for farmers who apply the Tabela system, Rp. 11.91 million per hectare. Aruan and Mariati [20], that the income of the rice farming system of the Tabela system and the Tapin system is not significantly different.

4. Conclusions

The implementation of the Tabela program is running well and provides more profitable farming performance for farmers. The use of production inputs in both the Tabela system and the Tapin system did not match the recommended dose and did not differ significantly except for the use of seeds. The simultaneous production response was influenced by the use of production inputs. Tabela rice farming systems were more responsive to the use of production inputs. The average behavior of rice farmers is a risk taker or a fan of risk. Farmers' behavior towards the allocation of input use of urea fertilizer and pesticides is a risk averter, while the use of NPK fertilizer inputs for seeds and labor is a risk taker. There is a significant relationship between farmer participation in the Tabela program and farmers' risk preferences for production risk in lowland rice farming. Productivity, revenue, income, RC ratio and profit were higher in the Tablea system of rice farming than the Tapin system, and were significantly different.

Declaration

Acknowledgements

This work supported by Jambi University research and community service institue which has provided a source of funding for the implementation of data collection in this research.

Confict of Interest

All authors declare that there is no conflict of interest.

Authors' Contribution

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

Ethics Statement

This article does not contain any studies with human participants or animals performed by any of the authors.

Available of Data

All datasets generated or analysed during this study are included in the manuscript.

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