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ANALYSIS OF MUNG BEAN FARMING PRODUCTION, INCOME, AND DEVELOPMENT POTENTIAL IN NON TIDAL SWAMP LAND OF INDONESIA: A STUDY ON DETERMINANTS AND CONSTRAINTS

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ABSTRACT
This study aimed to analyze the production and income of mung bean farming in non tidal swamp land, Tanjung Lubuk Village, Ogan Komering Ilir, Indonesia. This study also analyzed the determinants or factors affecting mung bean production, as well as examined the potential and constraints in the development of mung bean farming. Census was conducted among 40 farmer respondents, and data were analyzed using various methods. The agricultural analysis and the Cobb-Douglas regression were adopted for the first and second purpose, respectively. Meanwhile, the third purpose was analyzed descriptively with tabulation. The results showed that the average mung bean production by sample farmers was 236.94 kg/ha/year, while the average total income obtained was IDR 1,362,463.20/ha/year. It was discovered that the number of insecticides and the area of origin as a dummy variable significantly affected the production of this plant. The potential for developing mung bean farming in non tidal swamp land includes land that had not been optimally utilized, high demand for mung bean, the relatively high selling price of the product, and the transfer of farming technology or experience from experienced farmers. Meanwhile, the constraints included low productivity, limited capital owned by farmers, unpredictable changes in seasons, and the lack of skilled field extension workers.

KEY WORDS
Mung bean, planting index, non tidal swamp land.

Non tidal swamp, located in South Sumatra Province, is a sub-optimal land with great potential for development. The development of this land typology is quite extensive, estimated at 2.98 million hectares (ha). However, the land utilized for rice farming is only around 0.37 million ha, consisting of 0.07 million ha of shallow or embankment swamp, 0.13 million ha of medium swamp, and 0.17 million ha of a deep swamp (Waluyo and Suparwoto, 2014). The vast potential of swamp land can be useful in increasing agricultural production and farmers' income. It is increasingly beneficial in replacing the role of other agroecosystems during drought caused by "El-Nino" (Alkasuma et al., 2003; Simatupng and Nazemi, 2009; Simatupang and Rina, 2019). Additionally, efforts to maximize the use of swamp land for food production are necessary due to the shrinking of rice fields on Java Island, as a result of land conversion (Suprwoto and Waluyo, 2022).

Increasing agricultural production in swamp land through extensification, such as creating new rice fields, is not an easy task due to many constraints, including low natural land fertility and high soil acidity of pH <4.0 to 5.0, fluctuating water regimes causing water inundation during high tides or floods and drought during the dry season, limited land and water infrastructure, carefully and specifically performed land management techniques and patterns, high land management cost, and low farmer knowledge. These are in line with Suryana (2016) that the main constraints for rice farming in swamp land are high water regime fluctuations, inadequate supporting infrastructure, limited drainage channels, and limited farmers' capital. The numerous constraints make it difficult to increase agricultural production in swamp land through the creation of new rice fields.

Low production has an impact on the low income received by farmers (Emalia et al, 2021; Wahyuni et al, 2022). Therefore, increasing food production is a key objective for reducing poverty and improving food security (Syuhada, 2020; Junedi et al, 2017). Furthermore, the government has implemented various measures aimed at improving the income and welfare of farmers as well as national agricultural production. One of such is the swamp land optimization program launched by the government in 2019 to support the Serasi (Save Swamps, Prosper Farmers) activity. This program seeks to enhance the planting index (PI) through the optimization of water system arrangements and land utilization by farmers (Ministry of Agriculture, 2019). Its primary objective is to improve PI, productivity, and participation of the Water User Farmers Association/Federation of Water User Farmers Association/Farmer Groups/Farmers Groups Association in the management of swamp land (Ministry of Agriculture, 2019). PI is known as the frequency of using a piece of land for farming (Lestina et al, 2022).

The rice PI improvement program in non tidal swamp land has received more attention since the UPSUS (Special Efforts) program was launched in 2016. Subsequently, farmers have tried to achieve PI200, which was previously only PI100. During the initial phase of the program, productivity in the second planting season was low, and crop failure was not uncommon, resulting in losses for farmers. Over time, farmers have adapted and enhanced their knowledge, aided by government-provided facilities, leading to improved productivity during the second planting season. This was evidenced in the report of Januarti et al (2021) where the productivity of non tidal swamp rice in the second and first planting seasons were 4,100 kg/ha/year and 4,145.26 kg/ha/year.

Despite only a small number of non tidal swamp land farmers have succeeded in increasing their PI100 to PI200, the government remains optimistic and has even started trying to achieve PI300 (rice-rice-rice) in 2020. However, the trial for PI300 (rice-rice-rice) has not been successful. According to a pre-survey conducted in the field, the failure was due to the inability to plant rice in the third planting season, as the variety required more than 4 months of farming activities. Furthermore, this condition was exacerbated by extreme climate change.

The pre-survey identified 40 farmers in Tanjung Lubuk Village, Tanjung Lubuk Sub-district, Ogan Komering Ilir Regency, who have successfully implemented PI300 with a combination of rice-mung bean-rice plants since the government deepened the river in the area in 2018. The implementation of PI300 (rice-mung bean-rice) farming activities in non tidal swamp land by farmers in Tanjung Lubuk Village was the first in South Sumatra Province. The development of this model and the transfer of knowledge to other areas can support the optimization of swamp land use as well as increase farmers' income and welfare.

In addition to exploring the novelty of the object, this study incorporates a dummy variable of regional origin in the regression equation of mung bean production, which has not been examined by others. This approach was based on the theory of migration, which refers to the movement of people from one place to another across national or administrative boundaries in a country to settle (Munir, 2010; Todaro, 2011; Mulyadi, 2014; Goldbach 2018). According to Andrieko et al (2004), migration is influenced by per capita income, unemployment rate, poverty, education, and the provision of public goods. It can be stated that economic factors such as income are a greater driver. To obtain income, rural residents mostly engage in production activities. Therefore, this study includes a dummy variable of regional origin for its potential impact on mung bean production.

Based on the previous discussion, there is a need for an in-depth study on "The Potential and Constraints of Mung Bean Farming as an Alternative for Increasing Planting Index in non tidal swamp land, Tanjung Lubuk Village, Tanjung Lubuk Sub-district, Ogan Komering Ilir Regency". This study aims to analyze the production and income of mung bean farming. It also analyzes the determinants or factors affecting mung bean production, as well as examines the potential and constraints in the development of this crop as an alternative for increasing PI in non tidal swamp land.

MATERIALS AND METHODS OF RESEARCH

This was a case study in which primary data were collected through a survey using a questionnaire and direct interviews with mung bean farmers in non tidal swamp area of Tanjung Lubuk Village, Tanjung Lubuk Sub-district, Ogan Komering Ilir Regency. The census sampling method was used, where 40 rice farmers who grow mung bean were selected as respondents.

Both primary and secondary data were used in this study. Primary data were collected by distributing a questionnaire to the selected sample, Meanwhile, secondary data were obtained from relevant agencies or institutions such as the Central Statistics Agency and monograph data.

Interviews were conducted to collect data from the sample through question-and-answer communication using a questionnaire. Additionally, this study used qualitative and quantitative analysis, where the data were processed using Microsoft Excel and Eviews computer programs. The first aim of this study was achieved by analyzing farmers' revenue, cost, and income.

Before calculating the income, the initial step involved computing the farming cost consisting of fixed and variable costs. According to Husin and Lifianti (2008), the following shows the formulation of total farming costs:

$$BT = BVT + BTpT$$

Where, BT: Total Cost (IDR/lg/year); BTpT: Fixed Cost (IDR/lg/year); BVT: Variable Cost (IDR/lg/year). Furthermore, mung bean farming revenue was calculated according to the procedures of Husin and Lifianthi (2008).

The mung bean farming income was obtained by calculating the difference between farming revenue and production cost. Mathematically, it was computed using the following formula:

$$Pd = PNT – BT$$

Where, Pd: Rice farming income (IDR/lg/year); PNT: Rice farming revenue (IDR/lg/year); BT: Total rice farming cost (IDR/lg/year).

The analytical tool used to analyze the determinants or factors affecting mung bean production was a Cobb-Douglass regression. Furthermore, the model was solved using the ordinary least squares (OLS) technique. The factors affecting mung bean production in non tidal swamp land were analyzed using the following formula:

$$\ln Y = a_0 + a_1 \ln X_1 + a_2 \ln X_2 + a_3 \ln X_3 + a_4 \ln X_4 + a_5 \ln X_5 + a_6 D + e$$

Where, Y = Production (kg/lg/mt); X_1 = Land area (ha); X_2 = Number of seeds (kg/lg/mt); X_3 = Number of fertilizers (kg/lg/mt); X_4 = Number of pesticides (ltr/lg/mt); X_5 = Number of workers (HOK/lg/mt); D = Dummy of regional origin (1=the local community, 0=immigrant).

The final aim of this study, pertaining to the potential and constraints of developing mung bean farming as an alternative for increasing the planting index in non tidal swamp land, was obtained from the observation and in-depth interview results which were further analyzed descriptively.

RESULTS AND DISCUSSION

The respondents in this study are non tidal land rice farmers who also engage in intercropping of mung bean in Tanjung Lubuk Village, Tanjung Lubuk Sub-district, Ogan Komering Ilir Regency. The sample comprises 40 people, and some characteristics to be discussed are age, education, land area, farming experience, and the number of family members. The age variable is calculated from the year of birth to the study time. According to

Mulyadi (2014), persons less than 15 years are usually still in school and not yet part of the workforce, while those over 64 years are no longer productive and cannot perform heavy work.

The 77.50% of the sample farmers are in the productive age range of 15-64, with an average age of 53.33. Given that these farmers meet the age criteria for productivity, they can work optimally in managing their farmland.

Table 1 – Age of Sample Farmers, 2022

No	Age (years)	Number of Farmers (people)	Percentage (%)
1	25-29	1	2,50
2	30-34	1	2,50
3	35-39	2	5,00
4	40-44	7	17,50
5	45-49	6	15,00
6	50-54	3	7,50
7	55-59	4	10,00
8	60-64	7	17,50
9	65-69	3	7,50
10	≥70	6	15,00
Total		40	100,00
Average (years)		53,33	

The land used by farmers for mung bean farming is partly privately owned and rented. The cultivated land area ranges from 0.50 ha to 2 ha. About 50.00%, 40.00%, and 10% of the farmers have cultivated land areas of 0.76-1 ha, 0.50-0.75 ha, and 1.76-2 ha, respectively. Therefore, the average cultivated land area of farmers is 0.90%.

Table 2 – The Cultivated Land Area of Sample Farmers, 2022

No	Cultivated Land Area (years)	Number of Farmers (people)	Percentage (%)
1	0,50 – 0,75	16	40,00
2	0,76 – 1,00	20	50,00
3	1,01 – 1,25	0	0,00
4	1,26 – 1,50	0	0,00
5	1,51 – 1,75	0	0,00
6	1,76 – 2,00	4	10,00
7	> 2,01	0	0,00
Total		40	100,00
Average (ha)		0,90	

The Mung bean farming on non tidal swamp land began in 2018 until now, resulting in 4 years of experience by farmers.

Table 3 – Farming Experience of Sample Farmers, 2022

No	Farming Experience (years)	Number of Farmers (people)	Percentage (%)
1	<10	40	100,00
2	>10	0	0,00
Total		40	100,00
Average (years)		4	

The family members of farmers included in this study consist of a husband, wife, children, and others who are still dependents and live together in the household. Furthermore, 47.50%, 40.00%, and 12.50% of farmers have family members in the range of 2 to 3, 4 to 5, and 6 to 7 people.

The fixed cost in this study consists of land rent and tool depreciation which is associated with the agricultural tools used, including machetes, sickles, hoes, sprayers, and lawnmowers. It is calculated using joint cost, as the use of land and agricultural tools is performed together with non tidal rice farming in 1 year. Meanwhile, variable cost includes the cost of seeds, fertilizers, pesticides, and workers used in mung bean farming activities.

Farmers engage in PI300, a cropping system that involves the cultivation of rice-rice-mung bean plant. As a result, the fixed cost calculation takes into account the joint cost incurred. The average fixed cost in mung bean farming is IDR 257,762.50/ha, which constitutes 15.74% of the total production cost. Meanwhile, the average variable cost is IDR 1,380,380.33/ha, implying that its contribution to the total production cost is 84.26%.

Table 4 – The average production cost of mung bean farming in non tidal swamp land

No	Cost Description	Number (IDR/lg/year)	Number (IDR/ha/year)
1	Fixed Cost		
	a. Land rent	179.166,67	179.166,67
	b. Tool depreciation		
	- Machetes	13.250,00	13.250,00
	- Sickles	5.208,33	5.208,33
	- Hoes	3.816,67	3.816,67
	- Sprayers	23.570,83	23.570,83
	- Lawnmowers	32.750,00	32.750,00
	Total Fixed Cost	257.762,50	257.762,50
2	Variable Cost		
	a. Seeds	75.700,00	84.111,11
	b. Fertilizer		0,00
	- Urea	244.500,00	271.666,67
	- TSP	24.375,00	27.083,33
	- NPK	65.750,00	73.055,56
	- Liquid fruit fertilizer	71.875,00	79.861,11
	c. Pesticide		0,00
	- Herbicides	95.875,00	106.527,78
	- Insecticides	14.000,00	15.555,56
	d. Workers	650.000,00	722.222,22
	Total Variable Cost	1.242.075,00	1.380.380,33
	Total Production Cost	1.499.837,50	1.637.845,83

Revenue was generated through the sale of mung bean seeds, calculated by multiplying the number of units produced (output) with the prevailing selling price. Table 6 provides a detailed account of the average revenue generated by farmers for mung bean farming in non tidal swamp land, specifically in Tanjung Lubuk Village.

The sample farmers were able to produce an average of 213.25 kg/lg/year of mung beans or 236.94 kg/ha/year. The mung bean production in the study location was lower compared to Gunung Sari Village at 523 kg per hectare (Wulandari et al., 2021). At the prevailing selling price of IDR 12,662.50 per kilogram, the average revenue generated from the sale of mung bean was IDR 2,700,278.13 /lg/year or IDR 3,000,309.03 /ha/year.

Table 5 – Production and revenue of mung bean farming in non tidal swamp land

No	Description	Per Cultivated Area (lg)	Per Hectare (Ha)
1	Production (kg/lg)	213,25	236,94
2	Selling price (IDR/kg)	12.662,50	12.662,50
3	Revenue (IDR/year)	2.700.278,13	3.000.309,03

Farmers obtain their income from mung bean farming by subtracting the total production cost from the total revenue generated. The total revenue received by farmers of IDR 2,700,278.13/lg/year is reduced by the average total production cost of IDR 1,499,837.50/lg/year, hence, an income of IDR 1,200,440.63/lg/year is obtained.

Farmers earn an average income of IDR 1,362,463.20/ha/year, with revenue and production costs of IDR 2,700,278.13/ha/year and IDR 1,499,837.50/ha/year. The average mung bean farming income in the study area tends to be quite low compared to Desaloka Village, West Sumbawa Regency, which was IDR 4,554,223/ha (Fitri, 2022). However, the cultivation of mung beans in the study area is expected to improve household food security, regardless of the income generated.

The analysis used to determine the factors affecting mung bean production in non tidal swamp land is multiple linear regression, and the computer program used is Eviews. In this study, the factors affecting mung bean production are land area, number of seeds, number of urea, number of herbicides, number of insecticides, and a dummy variable of regional origin.

Table 6 – The average income from mung bean farming

No	Description	Number (IDR/lg/year)	Number (IDR/ha/year)
1	Production cost	1.499.837,50	1.637.845,83
2	Revenue	2.700.278,13	3.000.309,03
3	Income	1.200.440,63	1.362.463,20

The data analysis results indicated that the equation for mung bean production in non tidal swamp land has an R^2 value of 0.8191. This implied that 81.91% of the production variable could be explained by the variation in land area, number of seeds, number of urea, number of herbicides, number of insecticides, and regional origin.

Table 7 – Estimated Results of Mung Bean Production Equation in Non tidal Swamp Land, 2022

Variable	Notation	Estimated Parameter Value	t-Statistics	Probability
Constant	C	7,2199	7,2563	0,0000
Land Area	Ln LL	-0,0793	-0,3006	0,7657
Number of Seeds	Ln BE	0,0817	0,4159	0,6803
Number of Urea	Ln PU	-0,2020	-1,1259	0,2689
Number of Liquid Fruit Fertilizers	Ln PBC	-0,0171	-0,4625	0,6470
Number of Herbicides	Ln HE	-0,0196	-0,2480	0,8058
Number of Insecticides	Ln INS	0,5008	4,6116	0,0001***
Number of Workers (HOK)	Ln HOK	0,0355	0,4167	0,6798
Dummy of Regional Origin	DAsal	-0,4771	-1,7646	0,0875*
R-squared R-squared (adj)	0,8191 0,7724			
F-statistics	17,5416			
Prob (F-stat)	0,0000			
Durbin-Watson	2,8033			

*Description: *** = significant at α = 0,01; ** = significant at α = 0,05; * = significant at α = 0,10.*

The number of insecticides has a significant effect on mung bean production in non tidal swamp land, with a 99% confidence interval. Specifically, increasing the number of insecticides by 1% leads to a 0.50% rise in mung bean production. This result is consistent with Muflihah (2019) that pesticides have a significant positive effect on the productivity of this crop. The application in agriculture is expected to yield abundant results with better quality (Ignatowicz, 2008; Ignatowicz, 2009; Lozowicka, 2010; Głowacki et al., 2014; Ignatowicz, 2020).

2. Dummy of Regional Origin

The dummy variable of regional origin has a significant effect on mung bean production in non tidal swamp land, with a 90% confidence interval. Furthermore, production will reduce by 0.48 times when farmers come from local ethnic groups (Komering).

Mung bean plant can be grown on shallow and medium swamp land during the dry season. This makes it an ideal crop for the Tanjung Lubuk Village, which has a portion of swamp land with high potential. According to Saufie (2020), this plant easily thrives in ample light and nutrients to support leaf and pod growth.

The study area has a considerable demand for mung beans, which is evident from the consistent sale of its products and the even higher demand from buyers. The selling price of this crop is also relatively high, ranging from IDR 12,000 to IDR 15,000. In addition to its high domestic demand, mung bean is considered one of the most important agricultural plants to fulfill the global need and can be grown in the year (Mohamed et al., 2008).

Mung bean is a highly sought-after commodity in the food market due to the delicious and crunchy taste, as well as the high nutritional content (Salinas-Ramirez et al., 2011; Satriani et al., 2015; Darkwa et al., 2016). Additionally, it is one of the most important legumes consumed by people around the world, owing to its excellent nitrogen-fixing abilities in biomass production (Gencoglan et al., 2006).

Farmers in this study are already experienced in mung bean cultivation, having planted the crop previously. With proper guidance, they can improve their cultivation practices and transfer the technology to other farmers who have not yet grown mung beans.

Based on the above description, the following are some potential for developing mung bean farming:

- The large potential of land that has not been used optimally;
- High demand for mung bean;
- The relatively high selling price of the product;
- The presence of experienced mung bean farmers who can share their farming knowledge and technology with other cultivars.

The results from the survey showed that mung bean productivity in non tidal swamp land was 236.94 kg/ha. This productivity can be considered quite low compared to the national productivity of 900 kg/ha.

The limited capital of farmers is also one of the constraints in mung bean farming. Many farmers have been unable to follow the proper farming techniques due to the lack of capital to purchase necessary inputs.

Other factors impeding mung bean farming in non tidal swamp land include unpredictable changes in seasonal water levels, which can affect crop yields. Additionally, there is a lack of skilled extension workers in the field. As a result, farmers only rely on their own experience and other farmers who have grown this crop.

Based on the previous description, the following are some constraints in developing mung bean farming in non tidal swamp: low productivity; limited capital owned by farmers; unpredictable changes in seasons; the unavailability of skilled extension workers in the field, specifically for mung bean plant.

CONCLUSION

Mung bean production of farmers was 213.25 kg/lg/year or 236.94 kg/ha/year. Meanwhile, the average total income earned was IDR 1,200,440.63/lg/year or IDR 1,362,463.20/ha/year.

The data analysis results showed the number of insecticides and the dummy of regional origin were the determinants that significantly impacted the production of mung bean.

The potential for the development of mung bean farming in non tidal swamp land included (1) the large potential of land that had not been used optimally, (2) high demand for mung bean, (3) relatively high selling price of the product, and (4) farmers who are experienced in planting mung bean, hence, they can transfer their farming technology or knowledge to others. Meanwhile, the constraints are (1) low productivity, (2) limited capital owned by farmers, (3) unpredictable changes in seasons, and (4) the unavailability of skilled extension workers in the field, specifically for mung bean plant.

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