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Determination of the Achievement of Self Sufficiency Rice in Meeting the Availability of Nation Rice

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Abstract

The priority of the Nawacita Program in the agricultural sector is to increase superior production, especially rice. In achieving these objectives, it is necessary to ensure the availability of national rice. The availability of national rice is fulfilled from 3 aspects, namely local rice production, government rice reserves and rice imports. Most of the previous research, the availability of rice only accounted for local rice production and rice imports. In this study, the government's rice reserves are counted as one of the main indicators. Because local rice production used to meet people's needs is always reduced in volume to meet the government's rice reserves. In achieving rice self-sufficiency, this study also observed how the ability of local rice production to be the only one to supply the availability of national rice, without bringing in from outside parties.

Research using the LS method with the Minitab 15.1 program shows the results that partially the availability of national rice is positively influenced by indicators, namely local rice production, rice imports, and the government's rice reserves. Forecasting the ability of self-sufficiency in rice by relying on local production in supplying the availability of national rice in the future, shows a positive trend meaning the value of the trend of forecasting increases with increasing time. The factors that influence the achievement of rice self-sufficiency are partially determined by rice supply, rice productivity, the gap in rice prices to grain prices, and the use of balanced fertilizers. But it is not influenced by the level of rice consumption in the community.

The result of this study indicates that the availability of national rice is still very dependent on local and foreign rice products. However, to achieve rice self-sufficiency in the future, where all needs are met from local products is not impossible, so that dependence on imported rice can be reduced.

Keywords: availability of rice, self-sufficiency in rice, production

1. Introduction

1.1. Background

Based on the results of the second quarter BPS survey in 2018, the contribution of the agricultural sector to the Gross Domestic Product (GDP) growth rate reached

13.63 percent. The results showed agriculture was in the top second position after the processing industry sector. The Nawacita program which was carried out in the framework of sovereign Indonesia since 2014 directed the agricultural sector to increase the production of strategic commodities, especially rice. In order to achieve the program, the adequacy of the availability of national rice is the main requirement for realizing food sovereignty.

The availability of national rice is the main driving factor for achieving food stability. According to (BPP, 2015) the provision of national rice availability depends on 3 aspects, namely:

1) Domestic rice production;

2) Procurement of rice reserves through Bulog; and

3) Policy for the procurement of rice from abroad (import).

According to Government regulations Number 18 of 2012 concerning Food, the source of food availability comes from domestic procurement, namely domestic rice production and national food reserves, but if the two sources cannot be met, rice imports can be lacked.

Based on the Act above, it has been stated that Indonesia does not depend on products from abroad. The ability to produce local potential to be consumed so that self-sufficiency is achieved is the main goal in the agricultural sector. But this is difficult to realize.

Indonesia has the potential of natural resources and large human resources so that it becomes the main capital to realize rice self-sufficiency. According to the FAO (2015), Indonesia is the third largest rice producing country in the world after China and India. China's rice production is 741 million tons, in India 153 million tons while rice production in Indonesia is 75.6 million tons. But on the other hand, Indonesia has a large population so that the country with the fourth largest rice consumption after Myammar, Vietnam and Bangladesh.

To see the balance between the availability of national rice and the needs in the community can be seen in the picture below.

One indicator of national rice availability is the procurement of government rice reserves carried out by Bulog partners. Rice reserves are purchased from farmers in the form of grain and issued to the community in the form of rice. Rice reserves are issued during the provision of rice for poor citizens every month (Rastra rice), during Market Operations (OP) to stabilize rice price volatility or during natural disasters. The purpose of the government issued rice reserves is to maintain the stability and supply
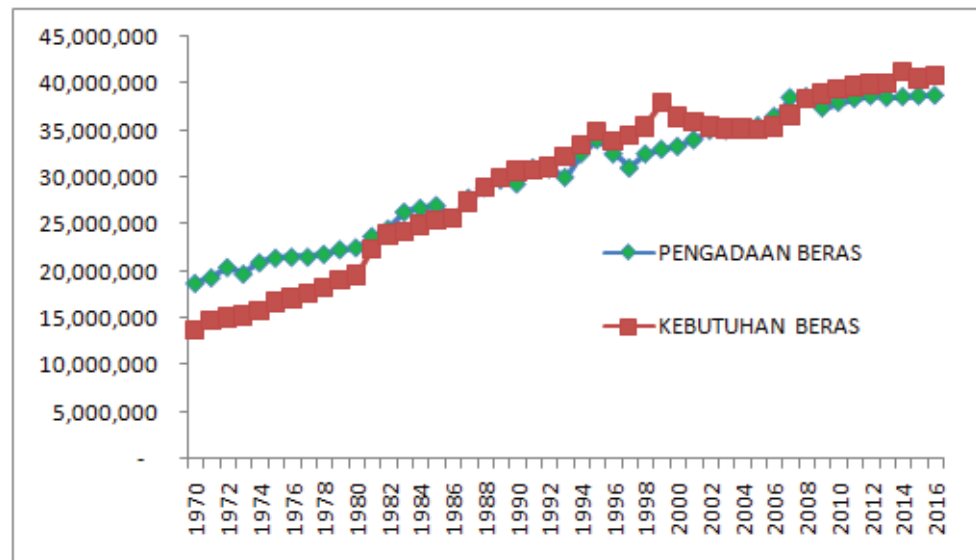
Figure 1: Availability of national rice and rice consumption needs in Indonesia 1970-2016 (Source: BPS and processed (2017)).

of rice in the country, the government must prepare rice reserves of 1.5 - 2 million tons every year (Isharyanto, 2013).

Increasing the number of residents who are not matched by adequate rice production capacity, the government seeks to procure imported rice. The purpose of importing rice is only to meet the shortage of domestic food stocks, but gradually the dependence on imported rice is increasingly high (Irawan, 2005). To see the development of rice imports, we can see the graph as follows.
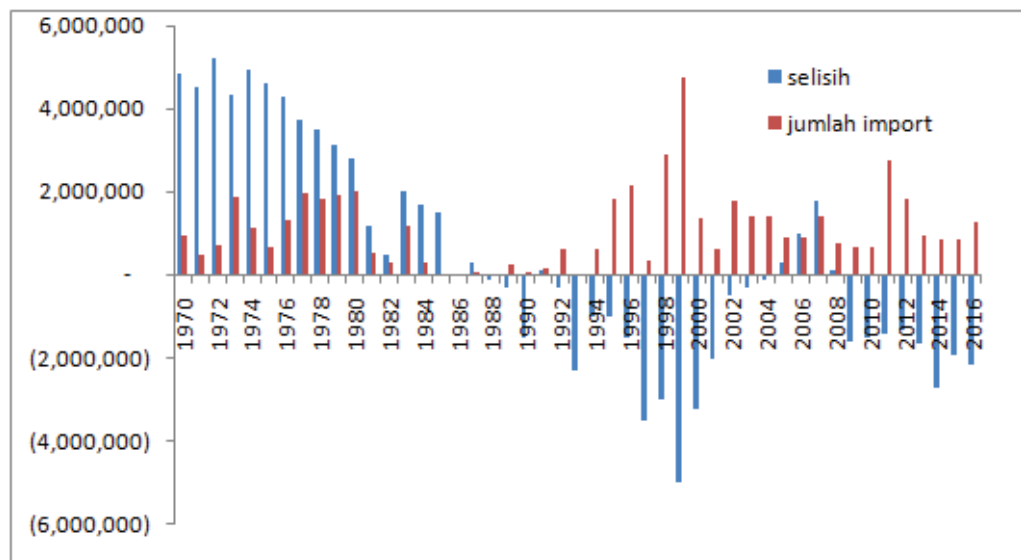

Figure 2: Graph of comparison of rice imports with the difference between domestic rice production and rice consumption needs in 1970-2016 (Source: BPS and processed (2017)).

Imported rice entering Indonesia if not anticipated by the government will eliminate the role of local rice products. Therefore the government's efforts to improve local rice products continue to be carried out, both by encouraging technological innovation, providing fertilizer / seed subsidies and guaranteeing the price of rice / rice that is feasible for farmers.

Rice self-sufficiency, namely the ability to meet its own food needs, sourced only from local rice production. This condition was once achieved by Indonesia in 1984. But self-sufficiency achieved only went on for a moment so that in the following year it was still dependent on foreign products (M Husein Sawit, 2013).

With natural resources and human resources owned, it does not rule out the possibility of realizing self-sufficiency in rice in the future.

1.2. Research purposes

Rice consumption is increasingly high because of the increasing population and the increasing dependence on people's consumption of rice so that local rice production is unable to meet those needs. One effort is to procure imported rice. Currently, the volume of rice imports in the market is feared to be greater than the local rice production. Based on this, the objectives of this study are:

1. To find out the factors that influence the availability of national rice,

2. Knowing forecasting and factors that influence the achievement of self-sufficiency in rice in meeting the availability of national rice.

2. Literature Review

2.1. Theoretical Framework

To maintain the availability of rice in Indonesia, the role of the community and local government needs to be increased in order to maintain the availability of rice at the national level. One way to increase the role of the community in maintaining the availability of rice at the regional and rural level is to continue to grow rice and increase production. While the role of the government is to maintain the availability of supporting materials to make rice production. The availability of rice will affect the price of rice, besides that the price of rice is also influenced by the prices of other goods and policies from the government (Agus, 2006).

Darmanto (2005) in his research on Production-Based Food Resilience and Farmer Welfare with the aim of knowing the factors that influence rice availability and the level of contribution of these factors to the growth of national rice availability. As for answering the study using empirical studies and multiple linear regression analysis. The results of research to ensure food security through increased availability of rice need long and short term policies. In the long run, import restriction policies are gradually reduced, policies to increase domestic production are still being pursued, food diversification policies with reduced dependence on rice continue to be encouraged. For the short term, farmers support by issuing import restriction policies, efforts to increase productivity, especially areas outside Java, there is a shift in contribution to the availability of rice, from domestic production (43 percent) before the crisis and import (45 percent) after the crisis. This condition has an impact on the welfare of farmers, which before the crisis had contributed 13 percent and after the crisis it was reduced to 0.8 percent.

According to Alie Sadikin et al., 2008 in the Identification of Factors influencing Food Security viewed from the perspective of the availability of rice in East Java, the availability of rice was significantly influenced by farmer exchange rates, rainfall and land area. However, it is significantly influenced by the price of rice.

Unbalanced conditions in fulfilling the availability and needs of rice have caused a large dilemma for Indonesia. To boost domestic rice production is very unlikely because it requires no short time and it is feared that it will harm farmers even worse. Because rice production in Indonesia's central rice regions is actually more technology based and relatively leads to capital-intensive and / or land production sectors through the provision of superior seeds and fertilizers compared to a labor intensive economic sector.

The decrease in the level of community rice consumption is a program that can help reduce imports and create food security. In 1995 a program to accelerate food diversification was carried out, namely to divert rice as staple food to other alternative food items, thereby reducing dependence on rice (Silvia, 2017).

2.2. Framework

This study looks at the supply side of fulfilling the availability of national rice. The fulfillment comes from local rice production, procurement of government rice reserves and procurement of foreign rice. Although exports affect the availability of national rice, but its nature reduces stock availability so it is not examined in research.

So that the availability of rice is expected to be always stable to meet the living conditions of the people, the most important factor is the fulfillment of domestic sources. Sufficient fulfillment of rice is manifested in the form of achieving rice self-sufficiency.
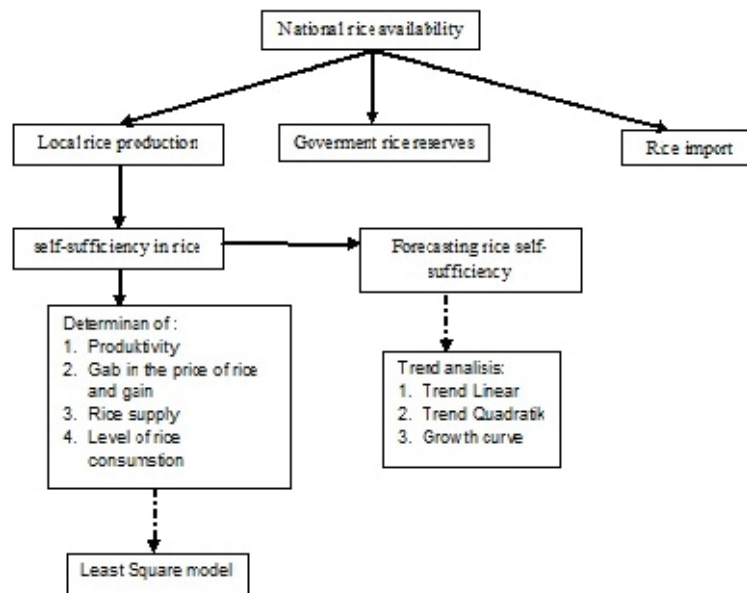

Figure 3: Research flow framework.

Description of research flow

1. Local rice production is a series of activities to provide added value so that it can meet needs. Rice production is calculated from rice production converted to rice (BPS 2014). How to calculate as follows:

   - Production of rice reduced grain scattered and used non-food by 7.3 percent

   - Production of rice reduced by 62.74 percent to total rice production (non-food and food)

   - Rice for food is reduced by 3.33 percent of total rice production

2. Government rice reserves are the purchase of rice / rice by the government through Bulog both directly and through farmers that are used to meet the national rice supply needs.

3. Import of rice is the volume of imported rice for consumption that enters Indonesia from various exporting countries.

4. Productivity of rice is rice production per unit area of land used for farming, measured in tons / ha.

5. Stock of rice supply of goods occurs when it is in sufficient quantities, affordable and ready to be released at any time in a forced state (Ministry of Agriculture, 2016).

$$\text{Supply of rice} = \frac{\text{distribution of rice in Bulog's warehouse}}{\text{Domestic rice production}}$$

6. Gap The price of rice to grain is a disparity in grain prices at the farm level and the price of rice in consumers causes a long supply chain. The higher the gap between the two illustrates the effectiveness of the distribution chain and the smaller the profit received by the farmer.

$$\text{Gap price} = \frac{\text{Price of rice in consumers}}{\text{Farmer level grain prices}}$$

7. The use of fertilizers is the technology used in aquaculture which includes 3 aspects, namely the use of better methods, the use of the right tools and the addition of inputs to farming (fertilizer).

$$\text{Use of fertilizers} = \frac{\text{Amount of fertilizer subsidies in circulation}}{\text{The amount of fertilizer needed}}$$

8. The level of rice consumption is the need for rice consumed in a certain period of time

$$\text{Level of rice consumption} = \frac{\text{Amount of rice consumed in a year}}{\text{Total population a year}}$$

3. Method

In this study using secondary data comes from the Central Statistics Agency (BPS), FAO (Food Agriculture Food) statistics, IRRI (International Rice Research Institute), Ministry of Agriculture. The sample used for population collection was from 1970 to 2016.

The variables observed in this study are

1. Availability of national rice (dependent variable) with independent variables consisting of local rice production, procurement of government rice reserves and rice imports.

$$Y = \beta o + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3$$

Information:

Y: national rice availability

x1: local rice production

x2: government rice reserves

x3: number of rice imports

2. Trend of local rice production capabilities (the trend of rice self-sufficiency)

$$TR_{beras} = \alpha + \beta t_1 + \mu i$$

Information:

TR$_{beras}$: Trend of the ability of local rice production to the availability of national rice

α: constant / intercept

β: the trend of the proportion of the supply of local rice production to the availability of national rice

t_1: 1970 to 2016

3. The ability of local rice production (self-sufficiency in rice) as a dependent variable with independent variables consisting of rice productivity, rice supply stock, rice price gap to grain prices, balanced fertilizer use and community rice consumption levels.

$$Y_t = \beta o + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5$$

Information:

Y_t: Rice self-sufficiency

x_1: Rice productivity

x_2: rice supply

x_3: rice price gap against grain prices

x_4: use of balanced fertilizers

x_5: the level of consumption of rice by the community

This study uses the Least Square (LS) multiple linear regression method with the Minitab 15.1 program through classical assumption tests and correlation regression tests.

4. Results and Discussion

4.1. Factors that influence the availability of national rice

Factors that influence the availability of national rice consist of 3 variables, namely local rice production, government rice reserves and rice imports. Based on the research conducted with the Minitab 15.1 program and the LS method, the following results are obtained:

Based on the results of the study there was no serious relationship or multicollinearity between the 3 independent variables because the VIF value of each variable was less than 5 The value of R-Sq or (R2) was 98 percent meaning that the three independent

Predictor	Coef	SE Coef	T	P	VIF
Constant	- 0,00002	0,000045	- 1,59	0,0000	
Lokal rice production	117,894	0,02489	47,37	0,009	2,952
Goverm rice reserves	49,586	0,4687	10,58	0,023	2,913
Rice import	1,813	1,250	1,45	0,015	1,044
S = 1108812		R-Sq = 98%		R-Sq(adj) = 95%	
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	3	275,910	275,910	2244,15	0,000
Residual Error	43	553,259	122,946		
Total	46	281,443			

variables could explain the dependent variable (Y) by 98 percent while the rest, 2 percent is explained by other variables not included in this study.

The model of equality of national rice availability is:

Y = -0,00002 + 1,17894 local rice production + 4,9586 government rice reserves + 1,1813 rice imports

Based on the above equation, the availability of national rice (Y) will experience a deficit of 0.00002 tons if the three independent variables (local rice production, government rice reserves and rice imports) are considered to be constant.

The F test results obtained at 2244.15 with p value of 0.000 so that the significant value is smaller than the real level (α = 5 percent). H1 is accepted and Ho is rejected. This means that the independent variables together have a significant effect on the availability of national rice (Y).

4.1.1. Local rice production

In this study the value of p value of the partial t test is 0.009 with a level of α = 5 percent so that H1 is accepted and H0 is rejected, the local production variable has a significant effect on Y. The regression coefficient = 1.17894 with a positive sign on the coefficient indicates that if production The local market experienced an increase of 1 ton, so that the availability of national rice would increase by 1.17894 tons.

4.1.2. Government rice reserves

In this study the value of p value from the partial t test is 0.023 with a level of α = 5 percent so that H1 is accepted and H0 is rejected. Regression coefficient = 4.9586 with

a positive sign shows that if the government's rice reserve supply increases by 1 ton, the availability of national rice will increase by 4.9586 tons.

4.1.3. Import of rice

In this study the value of p value from the partial t test is 0.015 with a level of α = 5 percent so that rice imports have a significant effect on the availability of national rice. Regression coefficient = 1.1813 with a positive sign indicates that if rice imports increase 1 ton then availability National rice will increase by 1.1813 tons.

4.2. Trend of self-sufficiency in rice analysis

To get forecasting results with the best results, the estimation stage is measured by measuring three types of models, namely linear, quadratic and growth curves. The results of the MAPE, MAD, and MSD values for the 3 trend analysis models are as follows:

TABLE 1: Value of MAPE, MAD and MSD on Analysis of Trend of rice self-sufficiency.

Type of Model	MAPE	MAD	MSD
Linear	2,6198	0,02305	0,00077
Quadratik	2,60718	0,02294	0,00075
Growth curva	2,61619	0,02303	0,00077

Source: processed Minitab Program 15

Based on table 2 above for the three measurements (MAPE, MAD, MSSD) the quadratic model gives the smallest value while the best model for forecasting this data uses a quadratic model.

The model of the equality trend in rice self-sufficiency analysis is:

$$Y = 0.9070 - 0.00187 * t + 0.000025 * t ** 2$$

Information:

Y = predicted value

t = time

Based on the equation above, it can be seen forecasting the value of local production capabilities for the next few years

Based on table 3 the trend of self-sufficiency in rice for the future tends to rise even though at present the achievement of local production capabilities still tends
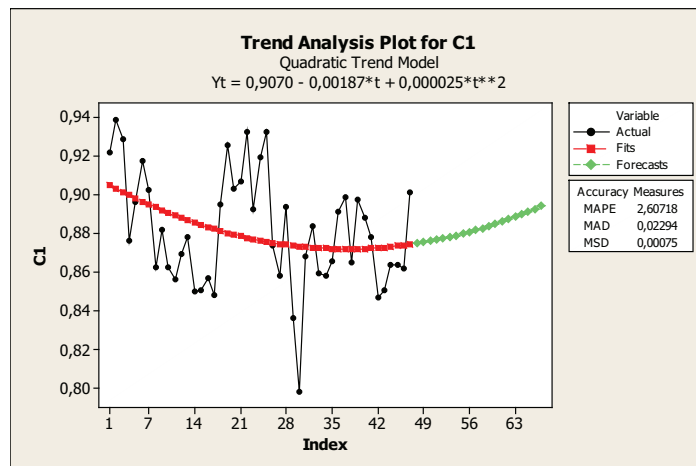
Figure 4: Quadratic trend models for analysis of rice self-sufficiency (Source: processed Minitab Program 15).

TABLE 2: Local Production Capability Forecast from 2018 – 2027.

Tahun	Yt (Nilai Peramalan)
2018	-0,93916
2019	-0,93861
2020	-0,938
2021	-0,93735
2022	-0,93664
2023	-0,93584
2024	-0,93508
2025	-0,93432
2026	-0,93332
2027	-0,93237

Source: Minitab 15 program processed

to fall compared to the era of the 1980s. The upward trend was triggered by the possibility of increasing rice productivity by optimizing the application of appropriate technology, especially fertilizer use, to achieve incentive agriculture, expansion of paddy fields outside Java as well as government policy support by reducing rice imports. If the government and society consistently achieve self-sufficiency in rice, it can reduce dependence on external products.

4.3. Determinants of achieving self-sufficiency in rice

Rice self-sufficiency illustrates the extent to which the ability to produce food, especially local rice in accordance with the natural potential in the region, is sufficient to meet food needs.

In this study the factors that are self-sufficient in rice are determined by 5 independent variables, namely rice productivity, rice price gap to grain, rice supply, fertilizer use, rice consumption level in the community. To see the effect of the five independent variables used multiple linear regression analysis with the following results:

Predictor	Coef	SE Coef	T	P	VIF
Constant	0,92661	0,07921	11,70	0,000	-
Productivity	0,00265	0,0007982	3,33	0,002	4,580
The gap in the price Of rice and gain	-0,03559	0,02961	-1,20	0,237	1,427
Rice supply	-0,005499	0,001356	-4,06	0,000	2,528
fertilizer	0,0002637	0,0002188	2,21	0,035	2,808
Level of rice consums	-0,004265	0,006870	-0,62	0,538	4,703
S = 0,0197857		R-Sq = 61,8%		R-Sq(adj) = 54,9%	
PRESS = 0,0228017		R-Sq(pred) = 42,94%			
Analysis of Variance					
Source	DF	SS	MS	F	P
Regression	7	0,0246935	0,0035276	9,01	0,000
Residual Error	39	0,0152675	0,0003915		
Total	46	0,0399609			

Based on the results of the study there was no serious relationship or multicollinity between the 5 independent variables because the VIF value of each variable was less than 5. The value of R-Sq or (R2) was 61.8 percent meaning that the five independent variables used could explain the dependent variable (Y) of 61, 8 percent while the remaining 38.2 percent is explained by other variables not included in this study.

The model of equality of rice self-sufficiency is:

Y = 0.927 + 0.00266 productivity - 0.0356 price gap - 0.00550 supply - 0.000264 fertilizer - 0.00426 consumption level

The constant in the above equation is 0.927, meaning that if all the independent variables are zero then the Y value is 0.927. This can illustrate that without productivity, price gaps, rice reserves, fertilizer use, and consumption levels, rice self-sufficiency can still be a surplus of 0.927 tons from other factors outside the research variable.

The F test results obtained at 9.01 with p value of 0.00 so that the significant value is smaller than the real level (α = 5 percent), H1 is accepted and Ho is rejected. This means that the independent variables have a significant effect on rice self-sufficiency (Yt).

The relationship of each individual variable to Y can be seen as follows:

4.3.1. Rice productivity

In this study the value of p value of the partial t test is 0.002 with a level of α = 5 percent so that H1 is accepted and H0 is rejected, the productivity variable has a significant effect on Y. The regression coefficient = 0.0026 with a positive sign on the coefficient shows that if the productivity of rice increases, self-sufficiency in rice will rise.

4.3.2. Supply of rice

The value of p value from partial t test is 0,000 with a level of α = 5 percent so that H1 is accepted and H0 is rejected, so that the supply of rice reserves has a significant effect on Y. Coefficient value = -0.00549 with a negative sign on the coefficient indicates that the rice supply is inversely proportional with rice self-sufficiency. This is understood because the supply of rice is provided to be released at any time in an emergency so that increased stability of supply will reduce the achievement of self-sufficiency in rice. With these results it can be seen that the main source of rice supply stock is originating from the supply of grain from farmers rather than being fully fulfilled or imported from imported rice.

4.3.3. Gap in rice prices to grain prices

The value of p value from the partial t test is 0.237 with the level of α = 5 percent so that H1 is rejected and H0 is accepted variable price gap does not significantly affect Y. Price fluctuations do not affect rice self-sufficiency. Regression coefficient = - 0.03559 with a negative sign on the coefficient shows that the price gap is inversely proportional to the achievement of rice self-sufficiency. When there is a large gap between the price of rice and grain, the ability of local production will decline. The existence of a high gap reflects the stability of the price of rice in consumers and the price of grain in farmers is neglected. The trend of high grain prices raises farmers' reluctance to grow rice so that domestic production shrinks. High price disparities that do not benefit farmers

certainly hamper the government's program to increase rice production so that rice self-sufficiency is not achieved.

4.3.4. Use of fertilizers

The value of p value from partial t test is 0, 0325 with a level of α = 5 percent so that Ho is accepted and H1 is rejected, fertilizer use variable has a significant effect on Y. Regression coefficient value = 0,00026 with a positive sign on the coefficient indicates that fertilizer use is proportional straight with rice self-sufficiency. This means that the provision of subsidized fertilizer to the overall fertilizer needs affects proportional rice production. The existence of fertilizer subsidy policy turned out to have a large impact as expected, especially in increasing rice production.

4.3.5. The level of consumption of rice

The value of p value from the partial t test is 0, 538 with a level of α = 5 percent so that Ho is rejected and H1 is accepted The level of rice consumption does not have a significant effect on Y. Regression coefficient = -0.00426 inversely proportional to rice self-sufficiency. This means that the fulfillment of rice consumption in the community is not solely supplied by local rice production, but the shortcomings are met from imports or other sources. With the high demand for rice consumed and some of the fulfillment obtained from import procurement, it is difficult to achieve rice self-sufficiency.

5. Conclusions and Suggestions

5.1. Conclusion

The availability of national rice is still very much influenced by the fulfillment of rice imports while the increase in local rice production and the guaranteed supply of government rice reserves must continue to be increased in order to achieve solid food security.

To find out the extent to which local rice production supplies are capable of fulfilling the availability of national rice, forecasting is carried out in the future. Based on research, the trend of rice self-sufficiency analysis tends to increase in the future. The hope of achieving rice self-sufficiency can still be realized even though it needs improvement from various sectors.

The factors that influence rice self-sufficiency are examined through 5 variables. Significant variables are rice productivity, rice reserve supply, rice price gap on grain prices and fertilizer use. While the level of public consumption has no significant effect.

5.2. Suggestion

To achieve rice self-sufficiency, things that need to be considered are:

1. Government support to subsidize the needs of farmers in increasing rice productivity is still continuing. Because farmers cannot afford to finance massive intensification of farming, especially the certainty of subsidized fertilizer stocks and prices.

2. Ensure that the government's stock of rice reserves is stable through the purchase of rice / rice in farmers, especially during harvests, thereby reducing dependence on rice imports.

3. The Government Purchasing Price Policy (HPP) for rice and rice must always be assessed in line with the development of the dynamics of rice prices at the market level so that the HPP policy becomes a reference and is not left behind by rice market players.

4. Improving the welfare of farmers by increasing the purchasing power of farmers through providing certainty that harvested products are bought at high prices so that farmers are able to buy basic necessities at affordable prices, reducing the gap between prices at the level of farmers and consumers.

Acknowledgement

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