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ECONOMIC IMPACT OF STIMULANTS APPLICATION ON RUBBER FARMING IN TANJUNG MAKMUR VILLAGE, OGAN KOMERING ILIR DISTRICT

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ABSTRACT

Rubber is one of Indonesia's leading plantation commodities. The main problem in natural rubber development is the low productivity level of rubber land. Based on the total area, Indonesia has a larger area than Thailand, but the rubber productivity in Indonesia is lower. One of the ways to increase rubber farming production is through a stimulant exploitation system. This study aims to compare income and the revenue ratio of rubber farmers who use stimulants and non-stimulants in Tanjung Makmur Village, Pedamaran Timur Sub-District. Sampling was done using the proportionate stratified random sampling method. The total sample for the analysis tool was 50 farmers. The data were processed using descriptive statistics and mathematics analysis. Based on the results, it is known that the production yield and income of rubber farmers who use stimulants are higher than those of non-stimulants. The difference in production is 15.08 kg/ha/month, and the difference in income is Rp. 20,973.22 per hectare per month. A small difference in income is due to the higher production costs of stimulant rubber farmers, while the price received is lower than that of non-stimulants. Based on the calculation of the R/C ratio, it is known that the R/C ratio of non-stimulants farmers is higher than that of stimulant farmers.

Keywords: *economic impact, stimulants application, rubber farming*

BACKGROUND

Rubber is one of Indonesia's leading plantation commodities. Rubber plants are widely spread throughout Indonesia, especially on the island of Sumatra, and on other islands cultivated by state, private, and community plantations. Many areas in Indonesia have conditions suitable for rubber plantations, mostly in Sumatra, including North Sumatra, West Sumatra, Riau, Jambi, and South Sumatra (Budiman, 2012). The main problem in natural rubber development is the low productivity level of rubber land (Riyadi et al., 2017). Based on the total area, Indonesia actually has a larger area than Thailand, but the productivity of rubber in Indonesia is only 836 kg/ha/year, while in Thailand, the productivity reaches 1,600 kg/ha/year. The low quality of bokar (rubber processed material) causes the competitiveness of Indonesian rubber to be relatively low and is valued at a lower price compared to rubber produced by Thailand, Malaysia, Vietnam, and India (Zahri, 2014).

One of the ways to increase rubber farming production is through a stimulant exploitation system. Exploitation of rubber plants is the act of harvesting latex from rubber trees so that maximum results are obtained in accordance with the production capacity of rubber plants in the planned

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Vol 7 (1): 155-162, March 2023

economic cycle (Wibowo, 2014). The use of stimulants will increase production and also production costs, it is finally will affect income. In addition to the technically influence of the use of stimulants on production, it is also necessary to look at the economic effect on income. In general, the novelty of this study is finding about economic impact of stimulants application on rubber farming by calculating income and the revenue ratio. There has been no previous research that compared the economic impact of stimulant use. Previous studies have discussed the impact more technically, such as about compared production, productivity and quality that researched by Njukeng et al. (2011), Herlinawati and Kuswanhadi (2012), Wibowo (2014), Riyadi et al. (2017), Hayata et al. (2019), Yosephine and Guntoro (2019), and Suherman (2020). Based on that, this study aims to compare income and the revenue ratio of rubber farmers who use stimulants and non-stimulants in Tanjung Makmur Village, Pedamaran Timur Sub-District.

RESEARCH METHODS

This research was conducted in Ogan Komering Ilir District, Pedamaran Timur Sub-district, Tanjung Makmur Village, by observing rubber farming using stimulants and non-stimulants. The location of the research was chosen deliberately, with the consideration that the majority of the population in Tanjung Makmur Village is as smallholder rubber farmer. Data collection was carried out in January 2021. The research was conducted using a survey method by collecting information from a sample of the population by compiling a list of questions asked of respondents to test the hypothesis (Fowler, 2009). The survey method was carried out directly through interviews with rubber farmers regarding rubber farming and how farmers used stimulants in Tanjung Makmur Village.

Sampling was done using the proportionate stratified random sampling method. There are 2 layers in the sample of farmers: farmers who use stimulants (layer 1) and non-stimulants (layer 2). The total population of rubber farmers was 399 households consisting of 325 stimulant farmers and 74 non-stimulants farmers. A sample of 13 percent was taken for each layer so that layer 1 amounted to 40 farmers and layer 2 amounted to 10 farmers, the total sample for the analysis tool was 50 farmers (Table 1).

Table 1. Sampling Framework

Layer	Population	Sample	Percentage (%)
Layer 1	325	40	13
Layer 2	74	10	13
Total	399	50	26

Note:
Layer 1 : Farmers who use stimulants
Layer 2 : Farmers who are non-stimulants

The data were processed using descriptive statistics and mathematics analysis. Data processing is done using the computer programs Ms. Excel and SPSS. To analyze the comparison of income and analyze the revenue ratio of rubber farmers who use stimulants and non-stimulants

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http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 7 (1): 155-162, March 2023

answered by using the formula income, t-student, and R/C ratio analysis (Kurniawan and Made, 2015).

$$I = R - TC = (Py.Q) - TC$$

Information:

I : Income of rubber farmers (Rp/ha/mo)
R : Revenue of rubber farmers (Rp/ha/mo)
Py : Rubber price (Rp/kg)
Q : Quantity of rubber production (Kg/ha/mo)
TC : Total cost (Rp/ha/mo)

To account total cost by using the formula:

$$TC = FC + VC$$

Information:

TC : Total cost (Rp/ha/mo)
FC : Fixed cost (Rp/ha/mo)
VC : Variable cost (Rp/ha/bln)

To compare the difference in income of rubber farmers using stimulants and non-stimulants, using a t-test (free sample t-test) (Nuryadi et al., 2017).

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{Sp\sqrt{(1/n_1) + (1/n_2)}}$$

$$Sp = \frac{\sqrt{(n_1 - 1){s_1}^2 + (n_2 - 1){s_2}^2}}{(n_1 + n_2) - 2}$$

Information:

t : t test
$\bar{x}_1$: Average income of stimulants rubber farming
$\bar{x}_2$: Average income of non-stimulants rubber farming
μ_1 : Estimated value of stimulants income
μ_2 : Estimated value of non-stimulants income
n_1 : Number of farmers using stimulants
n_2 : Number of farmers without stimulants
s_1 : Standard deviation of income using stimulants
s_2 : Standard deviation of income without stimulants
Sp : The combined estimated value for the population standard deviation

The hypotheses proposed in this study are:

H_0 : there is no significant difference in the income of rubber farmers using stimulants and non-stimulants.
H_1 : there are significant differences in income of rubber farmers using stimulants and non-stimulants.

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Vol 7 (1): 155-162, March 2023

If the value of Sig. > α = 0.05, then accepting H_0 means that there is not significantly different if Sig. ≤ α = 0.05, then reject H_0 means that there is a significantly different.

To analyze the revenue ratio of rubber farmers who use stimulants and non-stimulants using R/C ratio analysis, where R is the income and C is the total cost (fixed cost and variable cost).

RESULT AND DISCUSSION

Respondent Characteristics

The age of the sample farmers who used the stimulant in Tanjung Makmur Village, Pedamaran Timur District, was in the age range of 18-55 years, while the non-stimulants were in the age range 21-54 years. The characteristics of sample farmers are as follows: the average age of farmers stimulant rubber is 37 years old while non-stimulants is 38 years old; the average education degree of farmers stimulant rubber is primary school while non-stimulants is senior high school; the average arable land of farmers stimulant rubber is 1.14 ha while non-stimulants is 1.13 ha, and average plant age of farmers stimulant rubber is 17.13 year while non-stimulants is 12.70 year. The rubber plantations of the sample farmers in Tanjung Makmur Village have different characteristics with different ranges. Rubber farmers who use stimulants have a plant age of 7-30 years, while non-stimulants rubber farmers have a plant age of 7-20 years.

Table 2. Characteristics of Respondent

Description	Layer 1	Layer 2
Age of farmers (year)	37	38
Education degree	Elementary School	Senior High School
Arable land (ha)	1.14	1.13
Plant age (year)	17.13	12.70

Stimulant Application Technique

A stimulant is a mixture consisting of vegetable oil (for example, palm oil), natural fat (called a carrierstimulant), and the active ingredient etephone. Rubber agribusiness actors have long known stimulant technology to increase crop productivity. The popular stimulant is a type of liquid with the active ingredient etephon. This type of stimulant is used in almost all natural rubber-producing countries. Giving etephon can increase production mainly due to its effect on latex flow and regeneration, etephon can increase the stability of the lithoid so that the blockage index decreases. The positive effects of using stimulants are: making cell walls elastic, accelerate and increase the activity of enzymes in the biosynthetic latex; accelerates the flow of latex. Apart from positive effects, the use of stimulants also has negative effects, namely: inducing irregularities in metabolic processes, such as thickening of the bark, necrosis, the formation of cracks in the skin, and the appearance of unproductive parts; excessive use of etephon also results in cessation of latex flow; and shorten the economic life of plants (Njukeng et al., 2011; Sumarmadji and Atminingsih, 2011).

The stimulant or growth regulator used by farmers in Tanjung Makmur Village is a liquid stimulant made from the active ingredient etephon with the trademark Guela. The technique used by farmers in Tanjung Makmur Village uses the groove application technique. This technique is used

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Vol 7 (1): 155-162, March 2023

for the lower tapping field by applying a stimulant to the tapping field that has dried using a paint brush or toothbrush. After the stimulant was applied, tapping was not done for one day. The tapping system used by farmers in the location is mixed of downward and upward tapping systems. The height of the tapping channel carried out by rubber farmers using stimulants and non-stimulants is 1-1.5 meters for the down tapping groove, while for the upper tapping channel, the height can reach 2 meters. Farmers who use stimulant tapping are carried out 3-4 days a week, while non-stimulants tapping are carried out for 5-6 days. The intensity of rubber tapping that uses stimulants is less time tapping due to the influence of Growth Regulating Substances, which can produce more rubber production. Therefore tapping is rested for one day in order to prevent the rubber tree from experiencing stress.

The mechanism of action of stimulants with the active ingredient etephon in rubber plants is decomposed into ethylene, hydrochloric acid, and phosphoric acid. The stimulant with the active ingredient etephon has an indirect effect. The increase in production only reaches less than 50%. Meanwhile, stimulants with active ingredients in ethylene gas are absorbed directly by the stems of rubber plants in greater numbers and provide higher production than etephon (Herlinawati and Kuswanhadi, 2012). Land productivity and productivity per tapping of gas stimulant systems are significantly higher than liquid stimulant systems such as etephon (Riyadi et al., 2017).

Rubber farmers in Tanjung Makmur Village apply stimulants one to two times a month, the average use of stimulants for sample farmers is 1.65 times per month. This is in line with the results of other research (Atminingsih, 2015), based on the results of her research, it is known that the use of stimulants is carried out twice a month. Table 3 shows that farmers in Tanjung Makmur Village used stimulants not according to GAP (Good Agricultural Practices) recommendations. Farmers use stimulants on rubber plants that are still young and productive, whereas the recommendation for the use of stimulants should be made when the rubber plants have entered a less productive age, which is more than 25 years.

Table 3. Comparison of the Use of Stimulants by Farmers and GAP Recommendations

Stimulant Farmers	GAP
1. Technique: groove application	1. Technique: groove application
2. Use of the plant starts at 8 years of age or <25 years	2. Recommendations to be used at the age of rubber plants entering a less productive age, namely> 25 years

Comparison of Income and Revenue Ratio of Rubber Farmers

Based on the results of mathematical calculations, it is known that the production yield and income of rubber farmers who use stimulants are higher than those of non-stimulants rubber farmers. The difference in production is 15.08 kg/ha/month, and the difference in income is Rp. 20,973.22 per hectare per month (Table 4). The existence of a small difference in income is due to the higher production costs of stimulant rubber farmers, while the price received is lower than that of non-stimulants farmers. The difference in production costs is in the variable cost component, where stimulants rubber farmers have to pay additional costs to buy stimulants fluids.

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Vol 7 (1): 155-162, March 2023

The average price of rubber farmers using stimulants is Rp. 8,663.75 per kilogram, while non-stimulants is Rp. 8,957.50 per kilogram. The difference in price is due to the low quality of latex which is produced by rubber farmers who use stimulants. The latex produced from the use stimulants has a high water content texture, while non-stimulants tend to have less water content. The quality of latex will affect the price, low latex quality will lower the price (Andelia et al., 2022). Besides production and the price, the difference in the plant's age causes differences in farmers' production and income. At the economic age of the plant, the old plants have lower production than young plants.

Table 4. Comparison of Stimulants and Non-stimulants Rubber Farming

Description	Layer 1		Layer 2		Differences	
	Arable area/mo	ha/mo	Arable area/mo	ha/mo	Arable area/mo	ha/mo
Production (kg)	314.43	286.65	275.70	271.57	38.73	15.08
Price (Rp/kg)	8,663.75		8,957.50		-293.75	
Revenue (Rp)	2,731,987.50	2,492,504.00	2,463,320.00	2,423,023.33	268,667.50	69,480.67
Production Cost (Rp)	116,768.13	108,101.90	65,377.50	59,594.44	51,390.63	48,507.45
Income (Rp)	2.615,219.38	2,384,402.10	2,397,942.50	2,363,428.89	217,276.88	20,973.22
R/C Ratio (%)	23.40	23.06	37.68	40.66	-14.28	-17.60

The two layers of sample farmers have an R/C ratio value greater than 1, which means that the farm is feasible to be cultivated. Based on the calculation of R/C ratio, it is known that the R/C ratio of non-stimulant farmers is actually higher than that of stimulant farmers. This means that non-stimulants rubber farming is more profitable than using stimulants.

The use of etephone stimulants can increase the yield of latex, but the size of the rubber plant's response to stimulants, among others, depends on the type of clone, the age of the rubber plant, the concentration of stimulants, and the tapping system, especially the intensity of the tapping. Application of latex stimulants that do not follow the recommendations can cause side effects, including decreased dry rubber content, decreased stem convolution rate and increased tapping groove dryness. Stimulants are generally given to rubber plants that have entered their productive period (producing rubber plants that have reached the age of 15 years), because stimulants to young plants can affect plant growth if applied without reducing tapping intensity. The application of stimulants is also not recommended for 25 years old rubber plants (Boerhendhy, 2013; Suherman et al., 2020).

The results of observations at the research location indicated that there were side effects caused by the use of stimulants that were not according to the recommendations, namely a decrease in the rate of sticking and the occurrence of dead skin, it is inline with another research by Boerhendhy (2013). According to the results of research by the Jambi Agricultural Technology Research Institute (2014), stem convolution is used to determine the growth of rubber plants, because the rubber plant yields in the form of latex are obtained from the stems (stem bark). Rubber plants are classified as ripe for tapping when the trunk reaches 45 cm or more. As a result of the use of stimulants, the growth rate of stem convolution is inhibited. Meanwhile, dead skin is not the release of latex from the rubber tree. Factors that cause skin death in rubber plants are the result of continuous use of stimulants without any care and maintenance on plants such as routine fertilization. Another factor that causes skin death is tapping on a rubber tree that is still wet so that it is infected by a fungus and due to

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http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 7 (1): 155-162, March 2023

severe sprinkling of vinegar on the tapping grooves. There are two types of dead skin, namely total dead skin and partial dead skin. Total bark death is the rubber tree can not permanently release latex.

Meanwhile, partially dead skin is a condition where only some of them have dead skin and have to make a new tapping line. Several rubber plantations in Tanjung Makmur Village are affected by skin death of around 2-5%. This negative impact will only be seen in about 4-5 years. Statistical analysis of rubber farmers' income differences using stimulants and non-stimulants was carried out by testing the independent sample t-test (Table 5). Before the t-test is carried out, the population variant testing is first carried out. Based on the results of the calculation, the value is 0.188 > 0.05, it means that the variety of the first population is considered the same as the variety of the second population. The results of the t test calculation on the income of rubber farmers using stimulants and non-stimulants obtained a significance value of 0.903 > 0.05, so the conclusion accepts Ho, which means there is not significantly different in the income of rubber farmers who use stimulants and non-stimulants. Based on the results of mathematical calculations, there is very small income difference among stimulants and non-stimulants rubber farmers. The existence of a small difference in income is due to the higher production costs of stimulant rubber farmers, while the price received is lower than that of non-stimulants farmers. The difference in production is not much among stimulants and non-stimulants rubber farmers. Based on the other research, the magnitude of the rubber plant response to the stimulant ethepon among others depending on the type of clone, age rubber plant, stimulant concentration, and tapping system especially the intensity tapped (Boerhendhy, 2013).

Table 5. Result of Independent Sample t-test Analysis

		F	Sig.	t	Sig. (2-tailed)	Mean Difference
Income	Equal variances assumed	1.782	.188	.122	.903	24889.925
	Equal variances not assumed			.101	.921	24889.925

CONCLUSION AND SUGGESTION

Based on the results of the study, it is known that stimulant farmers' rubber production was 5.56 percent higher than non-stimulant farmers, while the difference in income was only 0.89 percent. It can be ruled out that giving stimulants to plants in Tanjung Makmur Village has a little economic impact in terms of production and farmer income. The higher production costs of stimulant rubber farmers make the little economic impact among them. The R/C ratio of non-stimulant farmers is higher than that of stimulant farmers, meaning non-stimulants rubber farming is more profitable than farming rubber using stimulant. In order to increase income, it is recommended to rubber farmers to use stimulants according to GAP recommendations and farmers should maintain the quality of produced latex.

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Vol 7 (1): 155-162, March 2023

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