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Comparative Analysis of the Use of Ant and Alum Freezers on the Income of Rubber Farmers in Lubuk Raja District, South OKU Regency

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A B S T R A C T

Rubber farmers in Indonesia produce lump slabs using ant acid, with some still employing freezing agents such as alum, which can degrade rubber quality. In addition to compromising the rubber's quality, alum emits a foul odor that greatly disturbs nearby residents. This pungent smell results from bacteria that biodegrade proteins into ammonia and sulfide compounds. OKU Regency is the fifth largest district for rubber plantations in South Sumatra Province. Given the land's suitability, rubber plantations are a promising sector for development, with rubber being a key commodity in Ogan Komering Ulu (OKU) Regency. This research will be conducted in Lubuk Raja District, OKU Regency, which was chosen purposively due to its significance as a major rubber-producing area in South Sumatra. The survey method will be employed to investigate the primary issue of rubber farmer income in Lubuk Raja District. The study will utilize income analysis and comparative analysis to address this problem. The research findings indicate that farmers using ant acid earn an average of IDR 5,093,515.15 per hectare per month. In contrast, farmers using alum as a freezing agent earn significantly more, averaging IDR 20,234,572.46 per hectare per month. An Independent Sample t-test, with a sig value (2-tailed) of 0.04 (<0.05) at a 95% confidence level, confirms a significant difference in income between farmers using ant acid and those using alum. This leads to the acceptance of H_1 and rejection of H_0, indicating a notable income disparity based on the freezing agent used.

1. INTRODUCTION

1.1. Research Background

In South Sumatra, the plantation sector is a vital part of the agricultural industry, significantly contributing to the province's regional income. Key plantation commodities in South Sumatra include rubber, palm oil, coffee, pepper, and cocoa, all of which make substantial contributions to the Gross Regional Domestic Product (GRDP). Among these, rubber stands out as a crucial commodity, driving the local economy and supporting the industrial sector by being processed into semi-finished and finished products such as foam rubber, tires, shoes, and other goods. This processing not only absorbs labor but also boosts export volumes [1].

OKU Regency ranks as the fifth largest district in terms of rubber plantation area within South Sumatra. The suitability of the land makes plantations a promising sector for development, with rubber being the predominant commodity in Ogan Komering Ulu Regency. Other supportive commodities in the region include coconut, pepper, and cinnamon [2].

Lubuk Raja District in OKU Regency is notable for its high rubber production, with annual production values consistently increasing. This district sees a greater use of alum than ant acid for coagulating rubber latex. Income differences influence farmers' adoption of new technologies; thus, the choice between ant acid and alum affects their earnings [3]. Many rubber farmers are reluctant to use ant acid because traders often purchase rubber based on wet weight rather than dry rubber content (DRC). Additionally, small-scale sales of alum-coagulated rubber can result in mixing with lower-quality rubber, reducing its market value.

These challenges lead to a lack of confidence among farmers in improving quality, as bokar (processed rubber) treated with ant

acid tends to be lighter due to its inability to retain water. Consequently, most farmers prioritize higher bokar weight over quality.

This research aims to address these issues by exploring the rubber farming activities in the region, analyzing the income from rubber farming, and comparing the income levels of farmers using ant acid versus those using alum for latex coagulation in Lubuk Raja District, OKU Regency.

1.2. Literature Review

1.2.1. Rubber

Rubber is a type of HTI (Industrial Plant Products) plant that has been widely planted and successfully developed, especially in the industrial world. In Indonesia, rubber is one of ten strategic agro-industrial commodities [4]. The rubber plant (Hevea brasilliensis Muell Arg) is a latex plant. It is so named because this group has plant tissue that contains a lot of sap (latex), and the sap flows out when the plant tissue is injured [5]. Rubber is a basic necessity for daily needs; this is related to human mobility and goods that require components made of rubber, such as vehicle tyres, transmission belts, rubber shoes and sandals.

Ant Acid (formic acid or formic acid) is the simplest carboxylic acid. Formic acid is naturally found in bee and ant stings, so it is also known as ant acid. Formic acid is an important intermediate in the synthesis of many chemicals. The chemical formula for formic acid can be written as HCOOH or CH_2O_2.

Formic acid, or methanoic acid is the simplest and smallest of all organic acids. Formic acid is also known as methanoic acid, and its molecular formula is HCOOH, which has only one hydrogen atom bonded to a carbon atom. The name formic acid comes from the word formica, which in Latin means ant. Naturalists of the 15th century discovered that certain types of insects (formicids), such as ants, termites, bees, and beetles, secrete this compound which is responsible for their painful bites [6]. Also, these insects use formic acid for attack, defense, and chemical signalling mechanisms. They have poisonous glands that secrete this and other acids (e.g., acetic acid) as an outward spray. Formic acid is stronger than acetic acid (CH_3COOH); therefore, dissolved in the same amount of water, formic acid produces a solution with a lower pH value. English naturalist John Ray achieved the isolation of formic acid in 1671, distilling it from a large number of ants [7]. On the other hand, the first successful synthesis of this compound was carried out by the French chemist and physicist Joseph Gay-Lussac, using the reagent hydrocyanate (HCN).

Alum is a white crystal in the form of gelatin and has properties that can attract other particles so that its weight, size and shape become larger and it settles easily. In nature, alum can be found in two forms, namely solid and liquid [8]. Alum is formed from the weathering process of rocks containing sulfide minerals in volcanic areas (sol fatara) or occurs in areas of clay, shale or slate containing pyrite (Fe) and marcasite (FeS2). Most alum is found in solid form in clay rock, shale, or slate [9]. Alum is another name for aluminium sulfate which has the chemical formula $Al_2(SO_4)_3$.

1.2.2 Comparative Analysis

Comparative Research is research intended to find out or test the differences between two or more groups. It is also research carried out to compare a variable (research object) between different subjects or different times and find a cause-and-effect relationship. The comparative method is a method used to compare data and draw new conclusions. Comparative itself comes from English, namely compare, which means to compare to find similarities between two or more concepts.

1.3. Research Objective

This research aims to determine differences in income from rubber processing systems that use acid and alum in Lubuk Raja District, OKU Regency.

2. MATERIALS AND METHODS

The research method used in this research is a survey method, and the sampling method used is disproportionate stratified random sampling. The sample at this research can be seen in Table 1.

Table 1 Sample of the research

No	Farmers	Population (person)	Sample (person)
1	Using ant acid	44	22
2	Not using ant acid	92	46
Total		136	68

Source : Primary Data (2023)

Analysis of the data processed in the research is primary and secondary data. Primary data is used for comparative analysis. Secondary data is used to analyze data on the number of rubber farmers. To answer the formulation of the big problem of income for rubber farmers in Lubuk Raja District, use the following formula:

$$Y=TR-TC$$
$$TR=P \times Q$$
$$TC=TFC+TVC$$

Where :

Y : Income (Rp/year)
TR : Total Revenue (Rp/year)
TC : Total Cost (Rp/year)
Q : Quantity (Ton)
P : Price (IDR/Ton)
TFC : Total Fixed Cost (Rp/Ton)
TVC : Total Variable Cost (Rp/Ton)

To answer the first problem of the research, using hypotesis and Independent Separated Varlans [12] with the formula :

$$t_{hit} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where:

n_1 :Amount of respondent who using ant acid
n_2 : Amount of respondent who using alum
x_1 : Income rate of farmers who using ant acid
x_2 : Income rate of farmers who using alum
S^2_1 : Rate of variant of farmers income who using ant acid
S^2_2 : Rate of variant of farmers income who using alum

The test conclusion is carried out by comparing t_{count} with t_{table} as follows:

- If $t_{count} \leq t_{table}$ H0 is rejected and H1 is accepted as true, it means that the income from rubber farming using ant acid is significantly different from the income from using alum.
- If > H cannot be rejected, it means that the income from rubber farming using ant acid is not significantly different from the income from rubber using alum.

3. RESULT AND DISCUSSION

3.1. The analysis of the income rate of the farmers

The success of farming can be seen in the income earned from farming. According to Ref. [12], income is the result of a reduction between sales proceeds and all costs incurred from the planting period until the product is in the hands of the final consumer. Rubber farming income is the difference between the amount of income from rubber farming and the costs incurred as production costs. Income is defined as the difference between the amount of revenue and the costs incurred. The income obtained by respondent farmers is the amount of bokar production multiplied by the selling price of bokar which is then reduced by the total costs incurred in the production process. To find income, you must first calculate the total production costs. Total farming costs are the sum of all farming expenses in one year. According to Ref. [13], costs incurred in the production process can be classified into 2 categories, namely fixed costs and variable costs. Rubber farming costs, namely fixed costs (depreciation costs for long-lasting equipment) and variable costs (production facilities and calculated labor costs), can be seen in the following table:

Table 2. The analysis of the income rate of the farmers who use ant acid in OKU Regency

Item	Ant Acid	Tawas
A. Revenue		
Land (Ha)	1.32	2.96
Production(Kg)	817,73	2010,43
Price (Rp)	12,700	12,700
Amount of revenue	**10,385,136.36**	**25,532,521.74**
B. Fixed cost		
Depreciation cost (Rp)	166,803.03	573,712.11
Amount of fixed cost (Rp)	**166,803.03**	**573,712.11**
C. Variable cost		
Fertilizer (Rp)	928,000.00	2,081,391.30
Pesticid and acid (Rp)	4,060,000.00	2,306,086.96
Maintenance cost (Rp)	78,181.82	363,478.26
Harvest cost (Rp)	58,636.36	272,608.70
Amount of Variable cost (Rp)	**5,124,818.18**	**5,023,565.22**
D. Amount of cost	**5,291,621.21**	**5,297,949.27**
Income (Rp/Ha/month)	**5,093,515.15**	**20,234,572.46**
Income (Rp/Ha/year)	**611,221,181.82**	**242,814,869.52**

Source : Primary data (2024)

The average total production cost of respondent farmers who use ant acid per hectare per month is IDR 5,124,818.82/ha/month. In contrast, the average total cost of respondent farmers who use alum is lower than farmers who use ant acid per hectare per month, namely IDR 5,023,565.22/ha/month, because farmers who use ant acid freezers are farmers with land areas of 1 to 2 hectares, with an average production of 817.73/kg/month on a land area of 1.32 hectares. Meanwhile, farmers who use alum have an average land area of 1 to 4 hectares with an average area of 2.96 hectares, with an average production of 2010.43 /kg/month.

Rubber production is the result obtained by farmers from the processing or management of their farming business. This production is the measure of the size of profits that farmers will take into account [13]. The average monthly production obtained from respondent farmers who used ant acid freezing was 817.73 kg/month, and for farmers who used alum freezing liquid was 2010.43 kg/month. The income from community rubber farming referred to in this research is the total amount of income originating from rubber farming which is valued in money. Revenue is the product of the amount of output or physical production results obtained during the production period and the selling price [14]. So, the income of rubber farmers is the lump produced (kg) multiplied by the price of rubber rubber used by ant acid and alum rubber farmers. The price of rubber latex received by farmers who use alum is higher than farmers who use ant acid, so the average income of farmers who use alum freeze is higher than the income of farmers who use ant acid.

The average income of rubber farmers who use ant acid is IDR 10,385,136.36/ha/month. Meanwhile, the average rubber farmer who uses alum freezer is IDR 25,532,521.74/ha/month. One of the factors that influences rubber farming revenues is the price of rubber latex. The price of rubber latex received by respondent farmers who use ant acid and alum freezers ranges from IDR 12,000 – IDR 12,700/kg depending on how long the rubber latex is stored or depending on the level of dry rubber produced by the farmer. People's Rubber Farming Income, Income is the result of calculating revenues and production costs

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incurred in the farming business; the success of the farming business can be seen from the farming income obtained.

The average income of farmers who use ant acid per hectare per month is IDR 5,093,515.15/ha/month. Meanwhile, the average income of rubber farmers who use alum freezers is higher than the income of farmers using ant acid freezers, namely IDR 20,234,572.46/ha/month. Based on the average income of farmers who use alum freezers per hectare, the average income of rubber farmers who use ant acid freezers is higher. This is because the land area and production of rubber farmers who use alum freezers are greater than the costs incurred by rubber farmers who use ant acid freezers. This is in line with research [15], which states that there is a difference and also provides benefits to farmers who get a high selling price. It is environmentally friendly and reduces the bad smell of rubber, which is elastic and can increase rubber content. dry (K3).

3.2. The difference between farmers who use ant acid and using alum at Lubuk Raja District of OKU Regency

To answer the second objective in this research, the difference in income of rubber farmers who use ant acid and alum freezers was carried out using an independent sample t-test. Analysis of the difference between two means (t-test) is comparing the average value along with a certain confidence interval from two populations. In this study, a t-test was used at a confidence level of 95% (t-table 0.05%) to determine whether or not there were differences (similarities) between the rubber farming income of farmers who used deorub and the income of farmers who did not use deorub. From the results of the data processing output, the standard deviation value for the rubber farming income of farmers who use deorub is obtained and the standard deviation for the rubber farming income of farmers who do not use deorub, the calculated t value and the level of significance. Before carrying out the analysis with the t test, first carry out a test for equality of variance (homogeneity) with the F test (Levene's Test), meaning that if the variances are the same then the t test uses Equal Variance Assumed (assumed to be the same variance) and if the variants are different use Equal Variance Not Assumed (assumed different variants), the test was carried out using SPSS 24 to prove whether the difference was significant (real) or not real, it can be seen in Table 3.

Table 3. The result of the Independent Sample t-test

		Independent Samples Test			
		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	T	Sig. (2-tailed)
Income of rubber farmers	Equal variances assumed	2.282	0.143	3.194	.004
	Equal variances not assumed			3.145	.004

Source : Primary data (2024)

Based on Table 3 in the Equal Variances Assumed section, the sig value. (2-tailed) of 0.04 < 0.05 (95% confidence level). So, as the basis for making the decision for the unpaired t-test, it is concluded that H1 is accepted and H0 is rejected, which means there is a difference in the income of rubber farmers who use ant acid and alum. With the results of the Independent Sample t-test, it can be concluded that the income of rubber farmers who use ant acid and alum freezers is significantly different.

According to rubber farmers in Lubuk Raja District, based on laboratory tests, the bokar produced using ant acid is visually thinner than the bokar which uses other freezing materials; however, when the bokar is split, the bokar which uses alum as a freezing material is denser and the bokar is more elastic than the bokar which is Do not use ant acid freezing agent. This shows that even though visually the bokar that uses ant acid is thinner, the inside content is solid so the weight of the bokar will be the same as the bokar which is thicker but hollow inside.

4. CONCLUSION

Based on the analysis of the results of the research that has been carried out, conclusions can be drawn: (1) Based on research results, the average monthly income of farmers who use ant acid per hectare is IDR 5,093,515.15/ha. Meanwhile, the average income of rubber farmers who use alum freezers is higher than that of farmers using ant acid freezers, namely IDR 20,234,572.46/ha/month; (2) Using the Independent Sample t-Test in the Equal Variances Assumed section, the sig value (2-tailed) is 0.04 < 0.05 (95% confidence level). So it is concluded that H1 is accepted and H0 is rejected, which means there is a difference in the income of lump rubber farmers who use ant acid and alum freezers

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