Nira Production In Terms Of Slope Level In South Tapanuli District

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Abstract.

South Tapanuli is located at an altitude of 0 to 1,985 m above sea level, where almost at all levels of this altitude we will find sugar palm plants growing wild. The purpose of this study was to evaluate the relationship between slope gradient and sugar palm plant productivity in South Tapanuli Regency. The research method used was the field survey method on sugar palm stands used as sample plants with various levels of slope gradient. Furthermore, the data obtained in the field were tabulated and processed using linear regression. The results of the study showed that the slope gradient was negatively correlated with sap production, meaning that the higher the slope gradient, the lower the sap production. The highest sap production was found at an altitude of 400 - 800 meters above sea level with a slope gradient of 8 - 15% with a sap production of 14.27 liters / day.

Keyword : *Nira Production, Slope and South Tapanuli.*

I. INTRODUCTION

Sugar palm (*Arenga pinnata* Merr) is a type of palm plant, a potential plantation plant for food (1) and can be found in almost all regions of Indonesia (2) . Sugar palm plants are one of the plantation plants that grow wild and easily adapt well to various agroclimates ranging from an altitude of 0 - 1,500 m above sea level (3) . The estimated area of sugar palm plants in Indonesia is 61,924 ha, and is spread across 26 provinces. With a production growth rate of 1.9 percent per year, where the area of sugar palm plants increases by an average of 2.0% (4) .Sugar palm is a plant that has long been known by the Indonesian people (5) . Sugar palm plants have great potential for cultivation, because sugar palm plants are multipurpose plants (6) where almost all parts of the plant can be used as products of economic value, starting from the fruit which can be processed into sugar palm fruit, the sap from tapping can be processed into vinegar and sugar, the fibers as brooms, the leaves can be made into roofs and the brooms and the stems can be processed into sugar palm flour (7) .South Tapanuli is a Regency in North Sumatra Province that has great natural resource potential to be developed, one of which is in the agricultural sector (8) . South Tapanuli is at an altitude of between 0 and 1,985 m above sea level, where at all these altitudes we will find sugar palm plants growing wild. As many as 62.45% of the population still depend on the agricultural sector for their livelihoods, so this sector must receive great attention from the government and be arranged in such a way that natural resources can be utilized optimally and sustainably, which of course will be able to improve the welfare of the community.

(9) .This wild growing sugar palm causes this sugar palm to also grow in areas that have sloping topography. The change in height from the lowlands to the highlands is quite sharp, making South Tapanuli Regency have a lot of sloping topography and one of the plants that we often find in the area is the sugar palm plant.Sugar palm does not really require specific climate and soil conditions to support its growth, for example loose soil, volcanic soil on mountain slopes, and sandy clay. Sugar palm can also be used as an alley plant on land that has a high degree of slope (10) .Slope gradient is a factor that determines the topographic characteristics of an area. Slope gradient very important in influencing the occurrence of erosion because these factors determine the speed and volume of runoff water. The speed of large runoff water is generally determined by the slope gradient, while the position of the slope determines the size of erosion (11) Slope is

a land characteristic that can affect soil fertility, a slope that is too steep can cause the soil to erode more easily so that nutrients in the soil can be reduced. Therefore, one of the factors that must be considered in relation to slope is the suitability of plant types in areas with certain slopes. This study aims to evaluate the relationship between slope gradient and sugar palm productivity in South Tapanuli Regency.

II. METHODS

This research was conducted in the month of The location of the research study was South Tapanuli Regency, whose forests have sugar palm plants growing on several levels of slope.The materials used in this study were aren stands on a slope in South Tapanuli Regency. While the tools used include hoes, knives, meters, liters, scales, ropes, GPS, altimeters and stationery.Before data collection in the field, a preliminary survey was conducted to determine the presence of sugar palm plants. Observations on the development of sugar palm plants in the field were conducted by survey.

The data collected in the field were data on sugar palm sap production at 5 classes of slope levels: Class 0 - 8% (flat); Class 8 - 15% (gentle); Class 15 - 30% (rather steep); Class 30 - 45% (steep) and Class > 45% (very steep) (12) The data obtained in the field were then tabulated and to study the relationship between land slope and the production of sap produced, a simple linear regression analysis was carried out with the mathematical equation: $\hat{Y} = \alpha + b_1 X_1$, where Ŷ = dependent variable (sap production); X = For the independent variable (land slope); a = intercept of the line on the Y axis and b = linear regression coefficient. The average production of sap is then calculated against the sap produced/tree for 1 (one) week.

III. RESULTS AND DISCUSSION

3.1. Relationship between Slope Gradient and Nira Production

Based on data from field observations and interviews with sugar palm farmers about sap production, it shows that there are differences in the response of slope gradients at different altitude levels to sap production. The level of influence of slope gradients at different altitudes to sap production can be determined by finding the correlation value or closeness of the relationship between each slope gradient and sap production.

Data on slope classes and sap production at various altitude levels can be seen in Table 1.

Table 1. Average Nira Production (liters/day) in Relation to Slope in South Tapanuli Regency

Slope Slope	Palm Oil Production		
	0 – 400 masl	400 – 800 masl	➢ 800 masl
0 – 8%	6.99	11.88	7.68
8 – 15 %	6.39	14.27	8.03
15 – 30 %	7.09	13	6.77
30 – 45%	6.68	10.29	6.71
>45 %	6.15	7.05	6.37

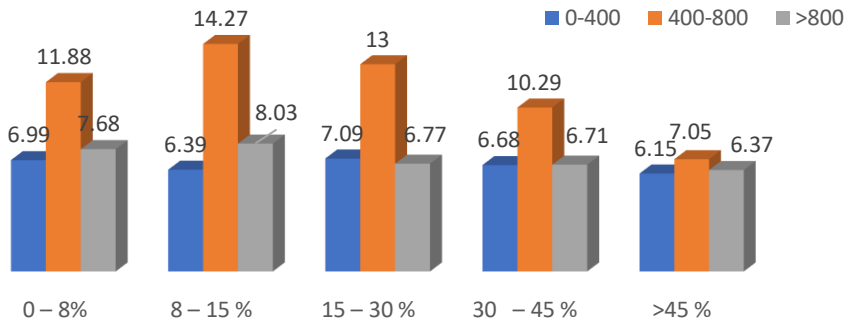

Fig 1. Average Nira production in relation to slope in South Tapanuli District

In Figure 4, it can be seen that the highest sap production was found at an altitude of 400-800 meters above sea level with a slope of 8-15% with an average sap production per day of 14.27 liters/day. While the lowest was found at an altitude of above 800 meters above sea level on a slope of >45% with an average sap

production per day of 6.15 liters/day. Regression analysis is used in this study with the aim of determining the relationship between slope gradient and palm sap production in South Tapanuli Regency. The following are the results of regression analysis at the altitude level in South Tapanuli Regency as in table 2.

Table 2. Results of Regression Analysis of the Relationship Between Slope and Nira Production in South Tapanuli District

Height Place	Multiple R	R Square	Adjusted R Square	Standard Error	F Count	F Significance
0 – 400	0.556	0.308	0.077	0.380	1,335	0.331
400 – 800	0.773	0.598	0.464	2,043	4.456	0.125
> 800	0.882	0.778	0.704	0.384	10,533	0.047

Based on table 2 above, it can be seen that the regression analysis model formed at altitude levels of 0 - 400 masl and 400 - 800 masl shows that the significant value of $\alpha \geq 0.05$ where the slope has no significant effect. While at altitudes above 800 masl shows that the significant value of $\alpha \leq 0.05$ which means that the slope has a significant effect on the production of sap produced.The following is a graph that illustrates the relationship between slope gradient and palm sap production in South Tapanuli Regency.

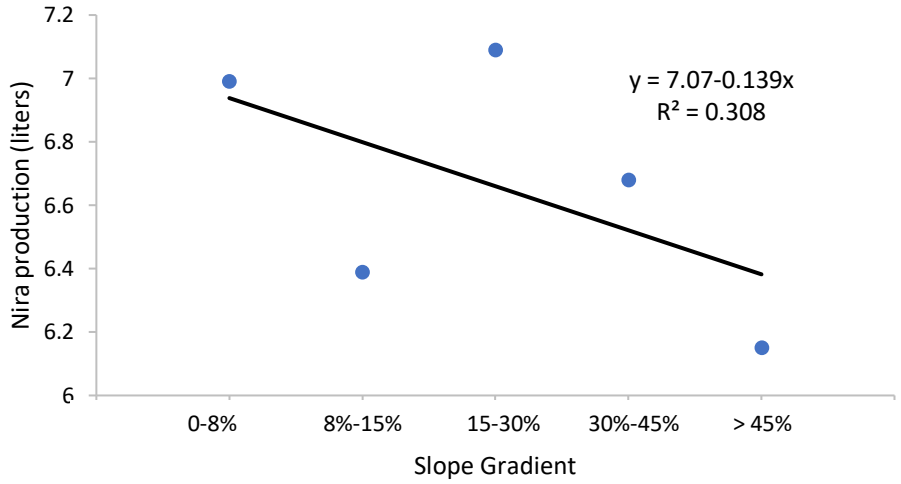

Fig 2. Relationship Between Slope and Nira Production at 0 - 400 meters above sea level

From Figure 2 shows the relationship between slope gradient at an altitude of 0 - 400 m above sea level to sap production is negatively correlated, which means that the higher the slope gradient, the sap production will decrease. This can be seen from the regression equation where Y = 7.07 - 0.139x with a correlation coefficient of 0.308 which means that 30.8% of the slope gradient affects sap production, while the rest is influenced by other factors. The highest production is found on a slope gradient between 15 - 30% (7.09 liters)), while the lowest is on a slope gradient > 45% (6.15 liters).

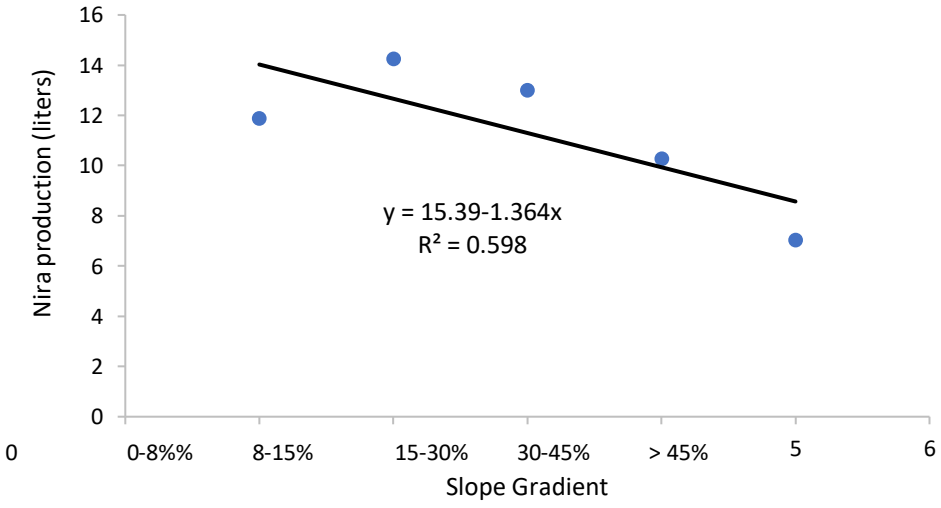

Fig 3. Relationship between Slope Gradient and Nira Production at 400 - 800 meters above sea level

From Figure 3 shows the relationship between slope gradient at an altitude of 400 - 800 m above sea level to sap production is negatively correlated, which means that the higher the slope gradient, the sap production will decrease. This can be seen from the regression equation where Y = 15.39 - 1.364x with a correlation coefficient of 0.598 which means that 59.8% of sap production is influenced by the slope gradient factor, while the rest is influenced by other factors. The highest sap production is found on a slope gradient between 15 - 30% (14.07 liters), and the lowest on a slope gradient > 45% (7.05 liters).

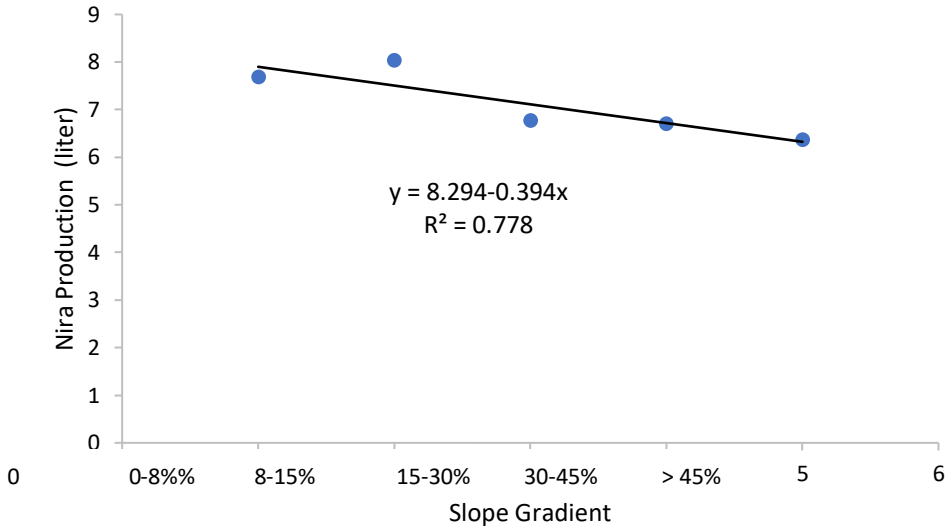

Fig 4. Relationship between Slope Gradient and Nira Production at >800 meters above sea level

From Figure 4 shows the relationship between slope gradient at an altitude of >800 m above sea level to sap production is negatively correlated, which means that the higher the slope gradient, the sap production will decrease. This can be seen from the regression equation where Y = 8.294 - 0.394x with a correlation coefficient of 0.778 which means that 77.8% of sap production is influenced by the slope gradient factor, while the rest is influenced by other factors. The highest sap production is found on slope gradients between 15 - 30% (8.03 liters), and the lowest on slope gradients > 45% (6.37 liters).In general, it can be seen from the linear regression equation produced at all levels of slope slope that the slope slope is negatively correlated with sap production, meaning that the higher the slope slope, the lower the sap production. (13) The steeper the slope, the more it will affect the growth and production of a plant. This can be caused by damage to the ground cover plants. In addition, land with a slope can be more easily disturbed or damaged because it is affected by rainfall which can cause landslides and fertile topsoil will be washed away. (14) Rain that falls on the surface of the soil has great kinetic energy and has the potential to destroy soil particles and will make the soil condition unstable.

Furthermore, (15) explains that steeper and longer slopes will increase erosion, where if the slope is steeper, the speed of surface flow increases so that its carrying capacity also increases.In general, the highest production of sap is found on slopes of 8-15%. This is thought to be because the aren land found in the field generally has denser ground cover plants compared to plants on other slopes, which allows the canopy density to be denser than other plant locations. With such land conditions, when it rains, the water that falls on the ground surface does not directly hit the ground surface so that the water will be absorbed into the soil and can be used by plants and will reduce erosion.(16) Land that has thick grass ground cover is not easily destroyed by rainwater plants, so that there is no blockage of soil pores. In addition, dense forest vegetation results in canopy density which will also reduce the impact of rainwater directly on the ground surface. Differences in vegetation characteristics, canopy density and the thickness of the layered canopy cover can reduce the damaging effect of rainwater impact on the ground, so that water can be absorbed into the ground and can be used by plants.Furthermore, according to (17), soil that has macro pores will have a low bulk density value, conversely if there are few macro pores it will have a high bulk density value.

IV. CONCLUSION

1. Slope gradient has a negative correlation with sap production, meaning that the higher the slope gradient, the lower the sap production will be.
2. The highest production of sap is found at an altitude of 400 – 800 meters above sea level with a slope of 8 – 15% with a sap production of 14.27 liters/day.

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