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## Financial Feasibility of Citronella in The Reforestation Area

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### Abstract

**Keywords:**  
*Citronella*  
*plant;*  
*Financial*  
*Feasibility;*  
*Reforestation*  
*area.*

Sawang District in North Aceh Regency, has a large forest area. During the sustained conflict in Aceh, most of forest areas were degraded and greatly affected the destruction of the forest ecosystem. The citronella plants on reforestation land have a high potential to be developed as intercropping plant because have a high economic value and could be cultivated during 5-7 years. The research is located in Riseh Tunong Village, Sawang District, North Aceh. This research was conducted from July to October 2022. The data was obtained using direct interviews with farmers who maintain forest reforestation with various annual plants and also cultivated citronella plants as intercropping plant. The population in this study were all farmers who cultivate citronella as intercropping plant in reforestation area. The respondents is amount 15 farmer. The financial feasibility analysis of citronella is showed that this comudity is very feasible to be cultivated on reforestation land in North Aceh Regency. The results of the financial feasibility analysis obtained that the NPV value is amount IDR. 43,179,262 which  $> 0$ , Net B/C value amount 2.54 which  $> 0$ , The acquisition IRR value is amount 57,44% which bigger than interest rates (10%). This research shows that the potential to develop citronella commodity is classified as very feasible. Communities can carry out forest and still get additional income from citronella commodities which have high economic value.

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## INTRODUCTION

Subdistrict Sawang which is located in North Aceh Regency is a part of the district which has a large forest area. During the protracted Aceh conflict, many forest areas became a illegal logging areas, so many areas of forest are degraded and give a damage of the forest ecosystem. Government of North Aceh Regency in recent years has promoted reforestation plants such as mahogany, trembesi and pine. For support this policy, the government gives the community the right to manage reforestation land in form of social forestry. The local community carried reforestation in the village forest to utilized land for planted plants with mix patterns. Premono & Lestari (2013) stated that mixed planting can increase the diversity of land and reduce costs . The people of North Aceh combine reforestation plants with short lived plants, such as citronella plant which is used for making essential oils.

Development citronella plants for reforestation program is very precise because this plant can be managed in period 5-7 years. This is because the reforestation plants still have not covered the citronella plants plantes on the sidelines. The demand for citronella oil as a type of essential oil is getting higher along with the growing demand from the industry in the fields of perfume, cosmetics, and medicine. The raw materials for essential oils are patchouli, citronella, nutmeg, cloves, and floweing plants including roses, seulanga, and jasmine. Although patchouli is considered very suitable as the best fixative/binding element for perfume products (Mangun et al., 2008) and patchouli is considered with very strong aroma wich can not be easily vanish (Sari & Hartono, 2010), the production of patchouli oil from patchouli Aceh is unstable due to fluctuations in patchouli oil prices. In patchouli production, the cultivation is conducted without good care so the plant will be easy to be attacked by pests/diseases. Sukamto & Djazuli (2014) state that the disease which mostly attack patchouli is very withered disease and buddog disease by nematodes which impact on the low production. So most farmer choose to switch in farming citronella, because more impervious to pests and weeds and could be cultivated in the former mine or marginal land (Dacosta et al., 2017).

Citronella is an essentials commodity that have a high agribusiness potential in North Aceh. Citronella oil have high demand with relative high price. The average productivity of fresh leaf of citronella is amount 20 tons/ha/ year at first three years and reached 60 tons/ha/year in next years. Citronella chosen as potential reforestation plants in North Aceh District . The Citronella in North Aceh can grow until 6 years old, however with good maintenance, citronella can hold up to 10 years. Harvested part of citronella plant is leaves and stems. Leaf of citronella is distillate to produce oil known as *Citronella oil*, where the stem could be used to produce seeds (Nabila & Nurmalina, 2019). Citronella oil in North Aceh can be produce amount 5 kg from 500 Kg of leaf fresh material of citronella plant with the price amount IDR. 120,000/Kg up to IDR 340,000/Kg. Citronella farmer in North Aceh Regency already start to develop the cultivation of citronella since year 2009. Planting citronella believed have low risk of pests/diseases attacke. The citronella farmer start cultivated citronella as intercropping plant in reforestation area because could added the economic value. This conducted from the perspective that citronella plant is easy to be cultivated and stand of pest/disease. However now, there is no detailed study yet which related to financial of citronella as intercropping plant of reforestation area

in North Aceh District . That is why observer interest to analyze the financial feasibility of citronella in North Aceh.

## RESEARCH METHOD

This study Located In Gampong Riseh Tunong, Sawang district North Aceh Regency. This area known as reforestation area which designated by the government with citronella as intercropping plant in the reforestation program. This is also supported by the availability suitable land and climate to develop the citronella plant.

This Study was conducted in July until October 2022. The data is obtained by Interview method with the farmers who do the reforestation program by planting various plant in the forest. The population of this research is whole farmers who cultivate citronella as intercropping plant which amount 15 farmers. The data is collected by census method which take whole population as respondents. This study used primary data and secondary data. The primary data consists of production cost, price of citronella oil and other cost. Then, secondary data consist of interest rate and government regulation to complete the research data.

This study was approach by descriptive qualitative and quantitative method. The identification of agribusiness development potential of citronella was approach by descriptive qualitative method, whereas financial feasibility of citronella was analyzed with feasibility analysis with NPV, Net B/ C, IRR , and BEP as the criteria. The analysis covers technical and financial aspect in farming citronella plant.

**Net Present Value ( NPV )** is the difference between the present value of cash inflows and the present [value](#) of cash outflows over a period of time (Shinta & Ainiyah, 2010). The formula is:

$$NPV = \sum_{t=1}^n \frac{B_t - C_t}{(1 + i)^t}$$

Description :

$B_t$  = Total revenue in year to -t ( IDR )

$n$  = Business age ( year )

$t$  = Year to 1, 2, 3,... , n

$i$  = Discount rate (%)

$C_t$  = Total cost in year to -t ( IDR )

The decision criteria is : if NPV value > 0, farming citronella is feasible ; if NPV value < 0, farming citronella is not feasible; and if NPV = 0, farming citronella is in break even state.

**Net Benefit Cost Ratio ( Net B/C )** is comparison between positive NPV with negative NPV (Gray et al., 1988), the formula is:

$$Net\ B/C = \frac{\sum_{t=1}^n \frac{B_t - C_t}{(1 + i)^t}}{\sum_{t=1}^n \frac{C_t - B_t}{(1 + i)^t}}$$

Description :

$B_t$  = Total revenue in year to -t ( IDR )

$n$  = Business age ( year )

$t$  = Year to 1, 2, 3,... , n

$i$  = Discount rate (%)

$C_t$  = Total cost in year to -t ( IDR )

The decision criteria is : if Net B/C value > 1 farm citronella is feasible and if Net B/C value < 1, farming citronella is not feasible. \_Whereas if Net value B/C = 1 means farming is in break even state.

**Internal Rate of Return (IRR)** is the discount rate that makes the net present value (NPV) of a project zero (Indrajaya et al., 2013):

$$IRR = i_1 + \frac{NPV_1}{NPV_1 - NPV_2} (i_2 - i_1)$$

Description :

$i_1$  = Discount rate on positive NPV

$i_2$  = Discount rate on negative NPV

$NPV_1$  = Positive NPV value approach zero

$NPV_2$  = Negative NPV value approaching zero

**Break Even Point (BEP)** , tis used to count return time of capital of citronella farming with formula:

$$BEP = T_{p-1} + \frac{\sum_{t=1}^n TC - \sum_{t=1}^n B_{icp-1}}{B_p}$$

Description :

$T_{p-1}$  = Year Return capital-1

TC = Total net cost that has been discounted

$B_{icp-1}$  = The number of benefits that have been discounted up to year return capital-1

$B_p$  = Amount of benefit on year return of capital

**Analysis Sensitivity** was conducted to see the continuity effort level if occur changes in input prices , output prices or changes to both.

- Output prices fell 15% and inputs remained
- Prices increase 10% and output remains
- Output prices fall 15% and input prices increase 10%

## RESULT AND DISCUSSION

### A. The potential of Agribusiness Development of Citronella

During the protracted Aceh conflict between the republic of Indonesia and the independence of the aceh movement (gam), much of the region has illegal logging by obtaining forest products (wood) for the benefit of certain parties. To date, many of these lands remain unused and will be adversely affected by such natural disasters as landslides and floods. For this reason the northern government of aceh collaborated with the people of ong riseh tunong for reforestation on the land. So that the activity would also benefit the people directly, the government gave the people the right to use the land for 5-7 years to grow citronella plants between reforestation.

The citronella commodity has the potential to be developed as a forest reforestation commodity in North Aceh Regency, especially in Riseh Tunong Village,

both from the land, agro-industry, market and economic aspects. The development of citronella commodity includes its function as an intercropping plant with timber forest plants. Lemongrass is very suitable for cultivation because it has the potential for both domestic and international markets. Lemongrass is one of the essential oil-producing plants which is now widely cultivated by farmers because it is easy to cultivate and does not require special care. Citronella farming has good prospects for development in North Aceh Regency because it has extensive barren forest areas and is supported by climatic conditions suitable for the growth of citronella plants. On the other hand, this plant has the potential to be planted or can grow well on less fertile lands, such as forest lands that have long been barren and rocky.

Agroindustry is an industry that produces a product using agricultural products as the main raw material. At the location of the citronella cultivation business in Sawang District, North Aceh Regency, there is already a citronella agro-industry business operating from 2018 until now. Oil processing uses two boilers with a processing capacity of 40 kg of raw materials. The availability of agro-industry in North Aceh Regency is relatively limited considering the limited raw materials for citronella. Distiller still using an oil drum so that the quality of the resulting oil allows it to contain iron carotene.

The marketing of citronella oil from the village of Riseh Tunong is generally done through traders in Central Aceh Regency with an oil price range of IDR. 160,000/kg up to IDR. 450.000/kg. The price of citronella oil tends to fluctuate according to the market price. This makes citronella farming only a side business for farmers other than oil palm, rubber, and rice. Based on market potential, citronella oil still occupies the second position after Aceh patchouli oil. Citronella oil is used as raw material for making insect repellent, pesticides, rubbing oil, and its waste can be used for animal feed and as a growing medium for edible mushrooms (Silva et al., 2011; Nakahara et al., 2013).

## B. Financial Feasibility of Citronella

Financially, business should be assessed by means of a few approaches or analysis indicators that include break even point, benefit cost ratios (net b/c), internal rate of return (IRR), payback period, and others (nature, 2012). According to the economic growth target of 6.5 percent for 2007, the government's director of the house of representatives DPR said here on Tuesday. Assuming that no more plant was made for another six years except by vegetative development.

The cost of investment is the first cost incurred before an effort produces. The cost of investment is used to finance all the maintenance of the needs and needs of a fixed business, or it can be used for a considerable length of time. As for the details of the cost of investment can be seen on the following table 1.

**Table 1. Details of Investment Costs for Lemongrass Farming for 1 Hectare Land Area**

No	Activity	Tool				
		Physic	unit	Price (IDR)	Quantity (IDR)	Using
1.	Land Lease	1	Ha	1.500.000	1.500.000	1 Year
2.	Guard building	1	Unit	5.000.000	5.000.000	6 Years

3.	Miniature Hoes	2	Unit	30.000	60.000	3 Years
4.	Cleaver	2	Unit	70.000	140.000	3 Years
5.	Sickle	2	Unit	60.000	120.000	3 Years
6.	Clearing Ground	1	Ha	2.500.000	2.500.000	
<b>Total</b>				<b>9.320.000</b>		

Source : Primary data

Operational costs is the total cost which expended to produce citronella oil, such as the cost of land, scythe, miniature hoes and costs-other expenses incurred in a citronella. Cost-these costs consist of fixed costs and variable costs. Operational costs of businesses consist of fixed costs and variable costs of IDR. 100,910,000, over a period of 6 years.

Income (Benefit) is the result of multiplication between with citronella leaf price with amount production of produced. The productivity of citronella leaf is amount 60.000 Kg/heactres/year (4 times harvest in a year) with stable selling price amount IDR. 500/Kg. The purpose of feasibility analysis is to find out the farming ability to give the provide for farmer in various risk of farming as well as being benchmark for whether feasible or not to be developed, either with a wider scale of land nor with addition of farm input (Timisela, 2010). Therefore, the data of farming cost is important, include investment costs and operational cost as well as benefits (revenue) from citronella farm. Based on benefit and costs incurred as well as level of discount factor is 10% obtained financial farm feasibility analysis is NPV, Net B/C, IRR dan BEP. The value of criteria can be seen in table 2 below.

**Table 2. Financial Feasibility analysis of Citronella**

<b>Analisis Finansial</b>	<b>Hasil</b>	<b>Keputusan</b>
Net Present Value (NPV)	43.179.262	Feasible
Net Benefit Cost Ratio (Net B/C)	2,54	Feasible
Internal Rate of Return (IRR)	57,44%	Feasible
Break Even Point (BEP)	3,48 tahun	Feasible

Source : Primary data

The result of feasibility analysis are obtained that the citronella leaf farm has NPV value at an interest of rate of 10% amount IDR. 43.179.262,- which means that farmer will receive profit amount IDR. 43.179.262,- during 6 years according to present time value. Therefore citronella farm in Sawang, Nort Aceh is feasible to continued because NPV value > 0. Meanwhile the value of Net B/C is amount 2,54 which means that every expenditure costs farm amount IDR. 100,- can be obtained acceptance amount IDR. 254,-. This value showed that citronella is very feasible to cultivated as intercropping in reforestation area in sawag because the Net B/C value > 0. This research shows that the development potential of citronella commodity is feasible. The communities in sawang could maintain the forest area and still get additional income form citronella as intercropping plant which has high economics value.

The acquisition IRR value is amount 57,44% which bigger than interest rates (10%), which mean citronella is feasible. It also shows if the interest rates increasly higher than 57,44% then citronella farm will be not feasible to cultivated. The result of

Break even Point (BEP) analysis explain that citronella can return the capital after 3,48 years or 3 years and 5,76 month. Meaning after return cost then on after subsequent periods the business will earn a net profit. In line, research of Aziz et al (2021) showed that in Gayo Lues Regency, the results of feasibility analysis citronella in interest rate 14% is obtained NPV IDR. 84.815.557, IRR is 58,38, Net B/C 2,94 and BEP 2,57 which all criteria shows that it is feasible cultivated. The sensitivity analysis is neded to find out whether citronella leaf farm is feasible or not if there are changes at output price and input price. This study also showed that the output prices (citronella leaves) often occur at 15%, adjusting to the price of citronella oils. The input price increases by 10%.

**Table 3. Sensitivity Analysis of Citronella**

<b>Indikator</b>	<b>NPV</b>	<b>Net B/C</b>	<b>IRR (%)</b>	<b>BEP (thn)</b>
Base line (Before change)	43.179.262	2,54	57,82	3,48
output price decrease 15%	23.701.427	1,79	37,44	4,03
Input price increase 10%	35.511.965	2,07	45,47	3,78
Output price decrease 15% and input price increase 10%	15.034.130	1,44	26,47	4,50

Source : Primary data

According to the above table 3, the output price decline by 15%, the increase in input price by 10%, and the decrease in output price by 15% at the same time as the increase in the input price by 10%, all of which would be viable, while showing the higher levels of feasibility. From these three sensitivity analyses, it is best if the input price increases by 10% and the output price is fixed (a reduction of worthiness that is smaller than others). Whereas if output prices fall 15% at the same time as the input price increases by 10%, it impacts by decrease the NPV, B/C, and IRR. The growth of citronella commodities is proven to be an additional income for farmers growing them as a intercropping plant in the forestry reforestation area of aceh. Farmers worked with local governments to cultivate citronella crops as a crop of citronella plants in a land of reforestation so that farmers could maintain forests and receive additional income from the commodity's business.

The study aligns with the study of mirsha et al. (2018) which does research on the economic value of fiber oil in India with a sarong system. Studies show citronella is an annual plant with a broad range of crops. Sari is an appropriate technique for increasing the output of agricultural and risk management from the commodity. The sari system is showing increased production results, net profit, and net b/c. Results have shown that different growing systems have been found indicating significant variations for increasing the financial worthiness of the perfumed commodity.

Furthermore, the research that is also in line is the research of Bintio et al. (2020) who conducts the analysis starting from the production/cultivation process. This process is expected to be able to produce high-quality yields, not cause damage to raw materials, and produce good quality products in maximum quantities. Economic feasibility is measured by parameters ROI, BEP, and Net B/C. The results showed that this cultivation process was economically feasible in a sustainable

manner with a Net B/C value of 1.15, a production BEP of 2,086 kg, a BEP price of Rp 275,352/kg, and an ROI value of 50.68%,

## **CONCLUSION**

This Study concluded that citronella plant is feasible to develop as intercropping plant on reforestation area in Gampong Riseh Tunong, Sawang district, North aceh base on land, agroindustry, market and economics aspect. The development of the citronella included a function as intercropping plant in reforestation area. Citronella are well suited to cultivation because they have both domestic and international markets. The citronella was one of the atsiri oil - producing plants that are now widely cultivated by farmers because they are easy to cultivate and do not require special treatment. Citronella had good prospects for developing in the north aceh because it has extensive barren forest areas and it is supported by climatic conditions which suitable for the growth of citronella plants. The potential for reforestation land could be used for citronella plants over a period of 5-7 years. As for the financial expediency of citronella oil it is perfectly feasible to be cultivated on reforestation area in the north aceh with NPV value is amount IDR. 43,179,262 which  $> 0$ , Net B/C value amount 2.54 which  $> 0$ , The acquisition IRR value is amount 57,44% which bigger than interest rates (10%). This research shows that the potential to develop citronella commodity is classified as very feasible/high enough. Communities can maintain the forest and still get additional income from citronella commodities which have high economic value. This study could be a model for other commodity farmers to start developing a fragrant sewai plant that is easily cultivated in forest reforestation.

## **RECOMMENDATION**

The suggestion of this research is the agriculture extension and government should be include to give the farmers the right to cultivate the citronella commodity as intercropping plant of reforestation area so that the productivity of the citronella will increase. This calls for continuing to be done so that farmers reforesting their land was motivated by increased incomes from increased productivity of the citronella leaves that were produced. The weakness of the study was the unassigned variables that saw only the feasibility of citronella without the economic value of forest plants. It is also hoped that the study will be a guide for further reflection. The researchers, in turn, were able to do a complete financial analysis of the spiky juice and the forest plants.

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