The International Journal of Social Sciences World
TIJOSSW is Available Online at:
https://www.growingscholar.org/journal/index.php/TIJOSSW
Vol. 6 No. 1 January-June 2024, pages: 146~152
DOI: https://doi.org/10.5281/zenodo.11177486
ISSN **2690-5167**
Growingscholar Publisher

Agroforestry System of Agarwood *Aquilaria Microcarpa*

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Article history:
Received: March 28, 2024; Accepted: April, 25 2024; Displayed Online: May, 11 2024; Published: June 30, 2024

Keywords

Agarwood;

Agroforestry system;

Farmer forest group;

Social forestry;

Abstract

Agroforestry systems have a role in gaining access to the device. It gets a special concern in its development while Agarwood is one of the most valuable market commodities, Non Timbel Forest Product (NTFP). That is why it needs to be cultivated with an agroforestry system. This research aims to find the production of vanilla, the maximum increment of Agarwood, and the financial analysis of the cultivation of vanilla combined with Agarwood. This research was conducted in Padang Laweh Village, Sijunjung Regency, West Sumatra Province. This research used stratified plot sampling and survey to calculate the composition of gaharu and non-gaharu trees and poles to determine the description of the agroforestry system. This analysis showed that the tree-level composition of agarwood was equal to 28,5% agarwood compared to 71,5% non-agarwood. Meanwhile, non-agarwood plantation was more than 43%. Meanwhile, the pole level composition of aloe plants is 54.5% compared to 45.5% of non-agarwood plants, with 9% more aloe. In order to maintain agarwood conservation, it is necessary to apply silviculture, including thinning or thinning non-agarwood plants and managing agarwood plants so that their growth will be higher and the harvest obtained will be greater in the future.

1. Introduction

The Aquilaria microcarpa type of agarwood plant is a native woody tree species in Indonesia and is a type that grows naturally and wildly in natural forests, especially in Sumatra and Kalimantan

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(Rahmat & Nurlia, 2015). The microcarpa type of agarwood tree is increasingly threatened by its population in natural forests. This has led to illegal harvesting carried out by the community without paying attention to conservation and sustainability aspects. Apart from that, the economic value factor is relatively high in harvesting agarwood trees, and harvesting is generally done destructively. Harvesting is done by taking parts in the form of copals and materials contained in agarwood trees, which are also the main factor in reducing natural agarwood plants. Another factor is the need for more public awareness about cultivating gaharu. The agarwood plant is included the IUCN Redlist (Suhartati, 2013); (Harvey, 2018). CITES is included in Appendix II, meaning that in official trade, Agarwood must be produced from cultivated trees, not from nature (Karlinasari et al., 2015); (Hidayat et al., 2020).

Efforts to domesticate gaharu trees have been carried out in several regions in Indonesia, including in Sijunjung Regency, West Sumatra Province. It was conducted to overcome the continuous extinction of gaharu. The commercial species of Agarwood that has begun to be cultivated by the local community is A. microcarpa. The cultivation of agarwood plants by the Sijunjung community has been carried out since the 1990s (Qiptiyah et al., 2021). The community considers that the agarwood plants have to wait a long time to be harvested, so planting is carried out by implementing a combination of agroforestry system patterns with other existing forestry plants. So, at the location of the agarwood plantation, various types of other commodity plants are also planted, such as durian (Durio zibethinus), kemiri/candlenut (Aleurites moluccana), jengkol (Pithecellobium jiringa), and other types of Multi-Purpose tree species (MPTS) or social forestry (Sumarna, 2012b); (Basyar & Qomar, 2023).

Agarwood plants can grow from lowland areas to hills at 0-750 meters above sea level with rainfall of less than 2,000 mm/year. The appropriate temperature is between 27°C and 32°C with a sunlight intensity of 70%. The Sijunjung Regency area is suitable for agarwood cultivation because it is dry or slightly damp land and does not require special treatment to cultivate it (Miulgauzen et al., 2017); (Subiakto & Santoso, 2016).

One farmer group that cultivates gaharu is the 'Putra Harapan' Forest Farmers Group (KPH). Agarwood cultivation in this group has been carried out on community-owned land covering an area of around five hectares, namely in Jorong Taratak Batung, Nagari Padang Laweh, Koto VII District, Sijunjung Regency. Initially, forest farmer groups only carried out farming and farming activities. The commonly planted trees, D. zibethinus, and A. moluccana, were because they were quick to harvest. The chairman of KPH, 'Putra Harapan' wants efforts to be made to conserve agarwood trees because agarwood plants have very high economic value (Jayaraj & Ahmed, 2023); (Sutomo et al., 2021); (Santoso et al., 2010).

Apart from that, farmer groups also want their 'Nagari' or village to become the best and largest producer of agarwood in Sijunjung. The agarwood planting system is carried out in combination with the planting of other woody trees. Agarwood conservation efforts that forest farmer groups have carried out are interesting to research. In connection with this agricultural system and to find out what the composition of agarwood plants is with a combination of agroforestry systems carried out in the Forest Farmer Group in Sijunjung Regency, this research was carried out in order to find out the form of effort to cultivate agarwood plants using an agroforestry system in Sijunjung Regency (Idris et al., 2013); (Sumarna, 2012a).

2. Materials and Methods

This research was conducted at the 'Putra Harapan' Forest Farmers Group (KTH) in Jorong Taratak Botung, Padang Laweh District, Sijunjung Regency, West Sumatra Province, in December 2018. The

research location is at coordinates 00 34' 29" to 00 34' 30.8" Latitude South and at 1000 53' 10.6" to 000 53' 11.4" East Longitude, an altitude of 209 m above sea level with a climate classified as Type A.



Figure 1. Forest Farmers Group nameplate (left) and location map (right) at the Padang Galomo location, Padang Laweh, Sijunjung

The tools and materials used in this research were diameter tape, tally sheet, measuring tape, stationery, camera, and interview guide. The research method used was to create plots for the composition and structure of vegetation at tree and pole levels for gaharu and non-agarwood types and a survey method to obtain qualitative data on the agroforestry system being carried out. On an agarwood field with an area of 5 (five) hectares, a nested plot method was created using a random system with ten plots measuring 20x20 m to obtain data on trees and poles of agarwood and non-agarwood plants. Each plot measured the stem diameter, free height of branches, height of trees and poles, and types of agarwood and non-agarwood plants. A survey was conducted to obtain a description of the agroforestry system by interviewing members of forest farmer groups using snowball sampling techniques (Susilo et al., 2014).

3. Results and Discussions

'Nagari' Padang Laweh is located in Jorong Taratak Botung, Koto VII District, which has a population of around 1,479 people with an area of 1,234 Ha at an altitude of around 221 m above sea level. There is a Forest Farming Group called KTH 'Putra Harapan', which has superior commodities, namely agarwood plants combined with rubber (Havea brasilensis), candlenut (Aleurites moluccana), and other social forestry plants, with a land area of around 5 Ha.

Based on their interviews, they stated that several main commodities are a source of livelihood for the local community, including gaharu, durian (Durio zibethinus), kemiri/candlenut (Aleurites moluccana), rubber (Havea brasilensis), pinang/areca nuts (Areca catechu). Their main source of livelihood comes from rubber latex, and the leading commodity is gaharu. Agarwood is a superior commodity, and the management of agarwood plants and the time to harvest Agarwood is quite long, namely around 5-8 years to harvest agarwood products in the form of sapwood 'kemedangan' (bark) from trees trunk agarwood. The price of agarwood is quite high on the market. They still choose rubber farming because the results are fast and management is easy (Kunio & Lahjie, 2015).

The farmer group obtains agarwood seeds from the parent tree by natural extraction. The seeds are then transferred in polybags and taken to the nursery to maintain their development. After the

seeds are around 6-7 months old, they are planted at a spacing of 3x3m and given manure. Agarwood can be harvested when it is eight years old. Before harvesting, this Agarwood is injected with a certain liquid first to get good results, which the farmer group themselves formulates. Harvesting is carried out manually to obtain optimal results.

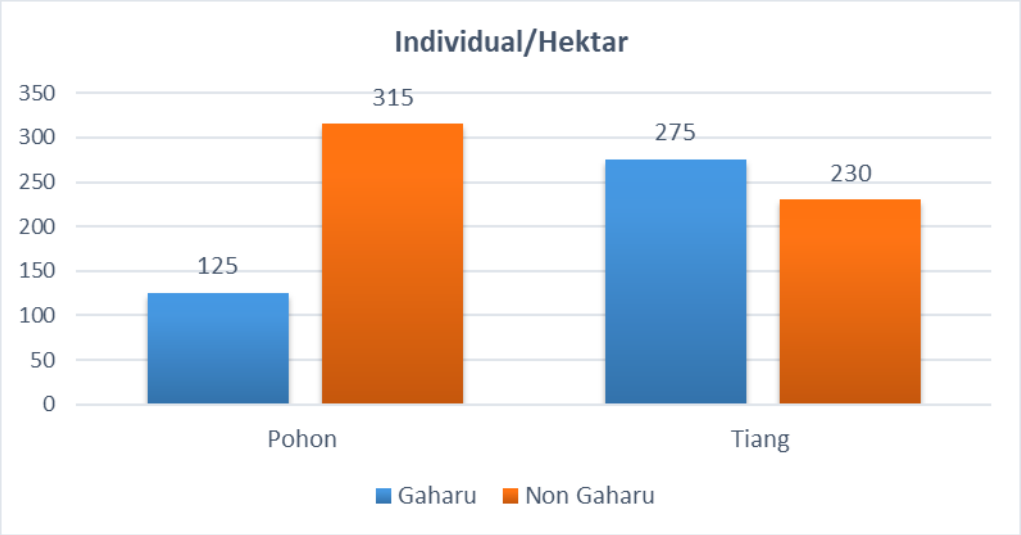


Figure 2. Composition of the number of agarwood and non-agarwood plants for tree and pole levels at the research location

The research results show an aloes composition at a tree level of 125/ha and a pole level of 275/ha with a total of 42.% aloes compared to 57.6% non-agarwood. It is hoped that a higher pole composition will be obtained in the next three to five years. Meanwhile, the composition of non-agarwood plants at the tree level of 315/ha is 72% higher compared to 28% for agarwood trees. The high number of non-agarwood trees is likely to support the economy of farming families over time.

Meanwhile, the composition of the pole level is 230/ha, which is lower at 45% compared to the pole level for agarwood plants of 55%. It is hoped that the growth of non-agarwood plants will require thinning or thinning by the farmer group so that they can manage growth by allowing the agarwood plants to grow more in the future. Adequate silvicultural knowledge is needed to maintain the sustainable growth of agarwood and non-agarwood plants on farmer group land. Compared with the survey results of Santoso et al. (2015) in Ipuh, North Bengkulu, it was found that 0.31% of trees and 1.06% of A. malaccensis poles, of all 642 trees, 751 poles from various types of trees per hectare. This indicates that the population of A. malaccensis is very small, and its distribution is uneven.

Based on the results of interviews with members of KTH 'Putra Harapan', five main commodities are a source of livelihood for the local community, including agarwood, durian (Durio zibethinus), kemiri/candlenut (Aleurites moluccana), rubber (Havea brasilensis), pinang/areca nuts (Areca catechu), and jengkol (Pithecellobium jiringa). Meanwhile, the main livelihood source for forest farmers is rubber latex. Agarwood planting started in 1980, and gaharu can grow well at the location. Next, a farmer group comprised 20 people whose superior commodity was Agarwood. Marketing of agarwood products: Usually, buyers come directly to the location, namely the KTH Chairman's house, which is the place where the agarwood products are collected, both sapwood, 'kemedangan', and agarwood tea (Admaja, 2015). The majority of traders who buy Agarwood come from Riau Province and Malaysia. The price for sapwood offered ranges from IDR400,000-Rp800,000/kg and even

reaches IDR1,000,000/kg, while 'kemedangan' ranges from IRD200,000-400,000/kg, and agarwood tea IDR10,000-15,000/pack. The income from the agarwood harvest for each group member is estimated at around IDR30 million in three years for two gaharu harvests. This value does not include non-agarwood plantation forest products.



(a)



(b)

Figure 3. Stands of agarwood and non-agarwood trees at the research location (a) and medium-quality bark of agarwood ('kemedangan') (b).

Based on the research results above, it can be concluded that the number of aloes at tree level is 125 trees/ha, which is still less, only around 44%, compared to non-agarwood, which is 315 trees/ha. In comparison, the number of aloes at pole level is 275 trees/ha, 10% more than non-agarwood plants. The composition of pole-level agarwood plants for the future must be increased to be higher than that of non-agarwood plants (Nath et al., 2023).

4. Conclusion

Based on the research results above, it can be concluded that the number of aloes at tree level is 125 trees/ha, which is still less, only around 44%, compared to non-agarwood, which is 315 trees/ha. In comparison, the number of aloes at pole level is 275 trees/ha, 10% more than non-agarwood plants. The composition of pole-level agarwood plants for the future must be increased to be higher than that of non-agarwood plants. Additional knowledge is needed regarding the silviculture management of agarwood plants combined with non-agarwood plants on one land in an agroforestry system. The production and sustainability of agarwood plants must be managed so that the number of tree levels in the future will increase and become higher than non-agarwood plants.

Acknowledgements

Thanks are expressed to the Faculty of Forestry, Universitas Muhammadiyah of West Sumatra, and the Regional Government of Sijunjung Regency, who have facilitated this research, and all the community 'KTH Putra Harapan' Jorong Taratak Botung, 'Nagari' Padang Laweh, Sijunjung Regency, West Sumatra Province.

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