

Agroforestry Management with Vanilla and Agarwood in East Kalimantan

Kitai Kunio¹ Abubakar M. Lahjie²

1. Doctoral Students Forest Science of Mulawarman University

2. Forestry Professor of Mulawarman University
prof_abudir@yahoo.com

Abstract

Vanilla as an export commodity has a role to gain the devisa. It gets a special concern in its development while agar wood is a one of commercial valuable market commodity Hasil Hutan Bukan Kayu (HHBK). That's why it needs to cultivate with agroforestry system. This research aims to find the production of vanilla and maximum increment of agar wood and the financial analysis cultivation of vanilla which combined with agar wood. This research conducted in Bukit Raya Village, Kutai Kartanegara Regency, East Kalimantan province. Method of this research conducted by using theory of production, scientific principles to calculate the production of vanilla and the increment of agar wood by measuring the diameter and the highest of agar wood. To find out the financial worthiness by using Pay Back Period (PP), Net Present Value (NPV), Net benefit cost ratio (Net B/C) and Internal Rate of return (IRR). The result of this analysis showed that the maximum production of vanilla at the age of 9 years with the total production was 378 kg/ha, it can be harvested at the age 3 to 11 years while the increment of agar wood can be inoculated at the age 4-5 years with the age of inoculation during 2 years and gubal Agar wood can be harvested at the age 6 years to 25 years. The optimal increment of agar wood reached at the age 15 years with the total maximum was 14.5 m³/ha while the cultivation to 25 years because it can get the financial benefit yet. The financial cultivation analysis of vanilla which combined with agar wood by using NPV, Net B/C and IRR theory reaching profit 15%. It was 54,592,000 rupiah and 1.95. The total of IRR was 21.5%. Equivalent annual annuity is 8,445,350 rupiah and scale effort has 6 ha. It proved that the cultivation of vanilla and agar wood is feasible to cultivate by using Net present value, net B/C and IRR more than MAR. The future of forest industry would be better diverted to the non timber forest products by cultivating vanilla and Agar wood with agroforestry system. It because in economically was feasible to cultivate as a model of sustainable forest at East Kalimantan Province.

Keywords: Vanilla, Agarwood, Agroforestry, sustainable forest.

1. INTRODUCTION

The agroforestry which makes the crop for a livelihood and the wood for savings together are the method excellent for the local resident. Generally, in this system, a common crop is cultivated for cash, and the kind of fast-growing tree is planted for a production of wood. The culture of the cash crop is limited in about three years, and populations have forced a synthesis of the following agroforestry system. After the crop culture finishes, the work in this agroforestry shifts only to forestry management.

If the production of crop is possible under the tree's canopy, it will extend the income period of the landowner or residents in agroforestry. And if the price of the wood for a harvest is high, those people will get a still better income. Then, we thought up the combination of a vanilla and Gaharu. Vanilla is a plant required the shade, and is a crop suitable for cultivation under the canopy. The market price of a deflection is high as a food flavor. Gaharu is a heartwood with the fragrance which an *Aquilaria* tree produces, and is also called agarwood, oud or oodh. The product price as a source of a perfumery is high.

According to FAOSTAT in 2013, the production of the vanilla of Indonesia was the top of the world, and was 3,200 (ton/year). The Indonesian export of vanilla in 2003 reaches 663 ton. It was \$ 18.351.272 (Anonymous, 2000). This result can not be found the quality export, while in 1998 (ministry of Commerce, 1999) shared the quality export 27,25%, the second quality was 44,69% and the third quality was 28,16%.

Agar wood is one of commercial marketable commodity of Hasil Hutan Bukan Kayu (HHBK). The natural forest production of agar wood it can be chopped, wad or powder. The commercial value of agar wood is determined by fragrance when it burned and the society know the class and quality of gubal, wad and powder while in terms wood chip (raw material) and nowadays, it can produce marketable agar wood essential oil.

Agroforestry is a sustainable land system management which increase all the forest production, combined the production of plants (include trees) and forest plantation or animals altogether, in the same unit and using appropriate management based on the culture of the society (King 1980).

This research conducted to find out how the score of agar wood maximum increment, the production of agar wood and vanilla in the optimum age and to find out the feasible analysis financial of agar wood and vanilla in Kutai Kartanegara Regency.

2. METHODE

This research conducted in Bukit Raya Village Kutai Kartanegara Regency. This research held on May to September 2010. The activities of this research were field oriented, the research plan, research realization, data collecting, and result data analysis. The research object is the society who cultivate agar wood and vanilla by using agroforestry system.

The agarwood growth were measured at the age 2,5,10,15,20 and 25 years. And the vanilla growth measured at the age 3,4,5,6 and 8 years. The inoculation to agar wood was performed two years after planting. The element used for the analysis was calculated by the following formula.

The wood volume : $V = 1/4\pi d^2 h f$ (m^3), d = diameter(cm), h = height(m), f : shape factor, by Spurr(1952), Mean annual Increment (MAI) : $MAI = V_i/t$ ($m^3/ha/years$), V_i = total volume(m^3), t = age (years), by Prodan(1968). Current annual Increment (CAI) : $CAI = (V_{tn} - V_{tn-m})/m$ ($m^3/ha/years$), V_{tn} = total volume in age tn years (m^3), m = interbal(years), by Prodan(1968).

The feasible financial analysis used Pay Back Periods (PP), Net Present Value (NPV), Net B/C and IRR.

3. RESULTS AND DISCUSSION

3.1. Agarwood products

The space between agar wood cultivation is 3x6m or about 550no./ha. At the age 3-5 years the dead cases were 50 individual, then at the age 5-10 years there are 25 trees dead cases and thinning are 50 trees.

At the age of 8-15 years there are 56 dead trees and 44 trees occurred thinning. Age 15-20 years there are 100 trees in the infection due to inoculation, and age 20-25 are 200 trees inoculated while 25 trees not inoculated. Death is due to the quality of the seedlings, pests and diseases of plants and thinning.

Table 1 and figure 1, 2 showed about the growth of gaharu. The figure 1 showed the total volume growth, the figure 2 showed CAI and MAI in it. In growth of this gaharu. CAI and MAI had a peak at the age ten years.

The intersection of the MAI and CAI at the age of 15 years in figure 3-45 showed the maximum increment of $14.5 m^3/ha/years$. After that, these kept a certain amount of growth level.

The table 2, figure 3, 4 showed the condition of inoculation into the gaharu and the agarwood products. The inoculation for the gaharu is able to start at the age 4-5 years or 2 years with diameter 14-15 cm. The figure 3-46 showed that the increasing of total agar wood products.

After inoculation, although 240 months, i.e., 21 years, passed, it continued the favorable increase. The mean increment and the current increment had a peak at after-inoculation 96 months, i.e., eight years. There is the intersection of the mean increment and current increment at the 160 month i.e., about 13 years. After that, After that, these kept a certain amount of growth level.

3.2. Agroforestry cultivation of vanilla with gaharu

The table 3-5, figure 3-48, figure 3-49 showed the condition of vanilla production. The figure 3-48 showed the total growth, the figure 3-49 showed the annual production and the mean production.

The annual production had a peak at 8 years age, the mean production had a peak at 7 years age. The intersection of the mean production and the annual production at the 9 years in figure 3-49 showed the optimal increment of $42.0(kg/ha/years)$ with the total productions is $378(kg/ha)$. After that, the annual production of vanilla is decreased.

Based on the chase flow of Gaharu and vanilla, it can be arranged the simple calculation, profit and discount factor (DF). In the level of 15% profit of agar wood and vanilla produces Pay Back Period, Net Present Value (NPV) and Net B/C are 7.5 years; 54,592,000 rupiahs and 1.95.

This statement used analysis of Internal Rate of return (IRR). The score is 21.5%. This score showed that the cultivation of agar wood and vanilla with agroforestry system in the level profit is 15%. It is feasible to effort because the value of IRR (21.5%) is more than Minimum Acceptability Rate (MAR = 5%). While Equivalent annual annuity was 8,445,350 rupiahs. If it is assumed that the head of household consumption expenditure of farmer/year (5 people/families) of 50,000,000 rupiahs each families/years, then the vanilla and agar wood cultivation each household requires at 6 ha of land area to be able to meet their needs.

4. CONCLUSIONS

1. The maximum increment reaches at the age 15 years. It is $14.5 m^3/ha/years$ and vanilla reaches the optimal production at the age 9 years. It is $42 kg/ha/years$.
2. Financially the cultivation of agar wood and vanilla with agroforestry system in the profit level is 15%, the value of Pay Back Period, NPV, Net B/C and IRR are 7.5 years; 54,592,000 rupiahs; 1.95 and IRR value is 21.5%.
3. Equivalent annual annuity is 8,445,350 rupiahs and scale effort has 6 ha.

Table 1. Growth of Agar Wood

| Age (year) | number of trees (number) | stem diameter (cm) | total volume (m ³ /ha) | MAI (m ³ /ha/years) | CAI (m ³ /ha/years) |
|------------|--------------------------|--------------------|-----------------------------------|--------------------------------|--------------------------------|
| 3 | 425 | 12.6 | 18.3 | 6.1 | |
| 5 | 375 | 17.6 | 40.1 | 8.0 | 10.9 |
| 10 | 350 | 27.4 | 145.4 | 14.5 | 21.0 |
| 15 | 330 | 32.2 | 217.1 | 14.5 | 14.4 |
| 20 | 300 | 37.8 | 272.1 | 13.6 | 11.0 |
| 25 | 225 | 47.0 | 315.4 | 12.6 | 8.7 |

MAI : Mean Annual Increment standing stock (m³/ha/years),
 CAI : Current Annual Increment (m³/ha/years)

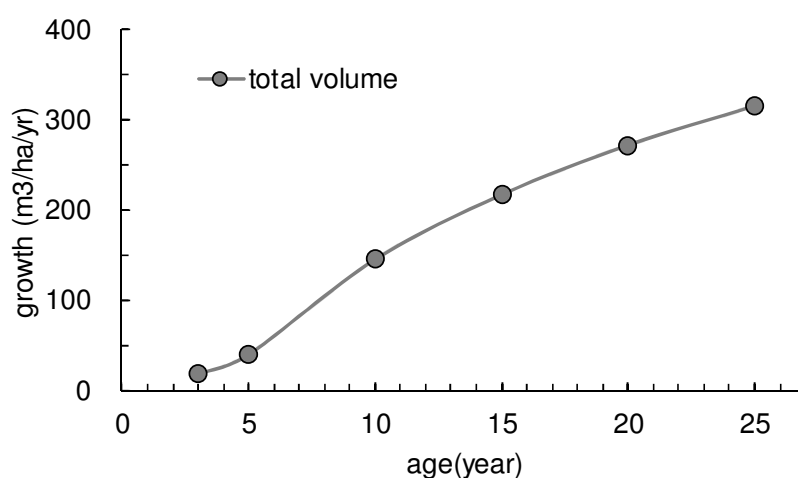


Figure 1. Total volume growth for 25 years of Gaharu

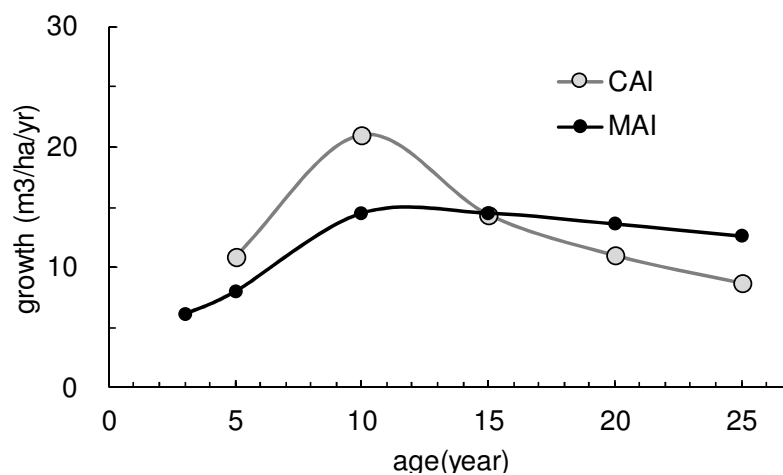


Figure 2. CAI and MAI in volume growth for 25 years of Gaharu

Table 2. Increment of agarwood Wood products

| tree age (year) | Inoculation age | | diameter (cm) | agarwood products (kg) | mean increment (g/month) | current increment (g/month) |
|--------------------|-----------------|---------|------------------|------------------------------|--------------------------------|-----------------------------------|
| | (years) | (month) | | | | |
| 6 | 2 | 24 | 20 | 0.17 | 7.08 | |
| 8 | 4 | 48 | 22 | 0.42 | 8.75 | 10.42 |
| 12 | 8 | 96 | 33 | 1.44 | 15.00 | 21.25 |
| 19 | 15 | 180 | 36 | 2.27 | 12.61 | 9.88 |
| 24 | 20 | 240 | 45 | 2.92 | 12.17 | 10.83 |
| 25 | 21 | 252 | 47 | 3.08 | 12.22 | 13.33 |

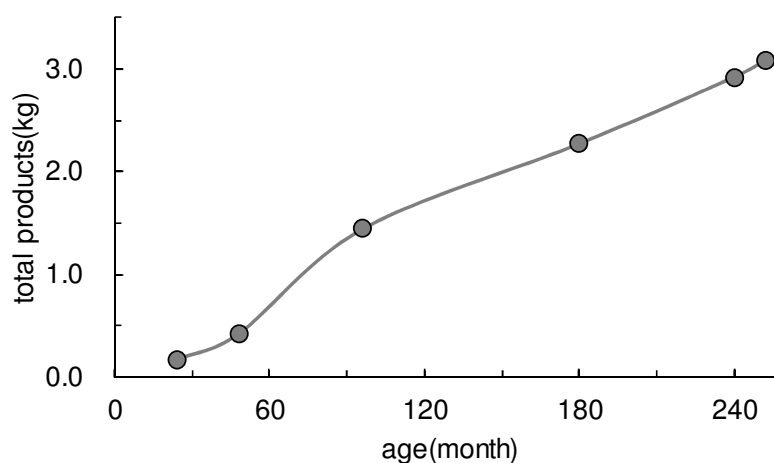


Figure 3. Total agarwood products for 25 years

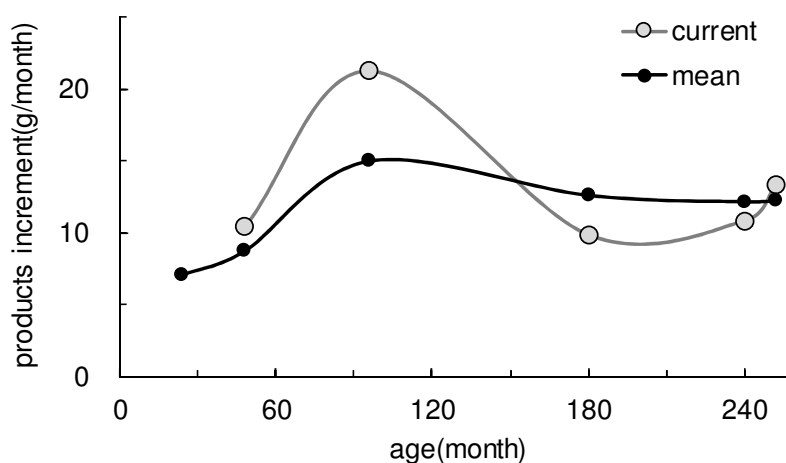


Figure 4. Current and Mean increment of agarwood products

Table 3. Vanilla Productions with space 3x6 m

| age (years) | total production (kg/ha) | annual production (kg/ha/years) | mean production (kg/ha/years) |
|----------------|--------------------------------|---------------------------------------|-------------------------------------|
| 3 | 74 | 24.5 | - |
| 4 | 116 | 28.9 | 42.0 |
| 5 | 165 | 32.9 | 49.0 |
| 6 | 217 | 36.2 | 52.5 |
| 7 | 280 | 40.0 | 63.0 |
| 8 | 336 | 42.0 | 56.0 |
| 9 | 378 | 42.0 | 42.0 |
| 10 | 406 | 40.6 | 28.0 |
| 11 | 420 | 38.2 | 14.0 |
| 12 | 427 | 35.6 | 7.0 |

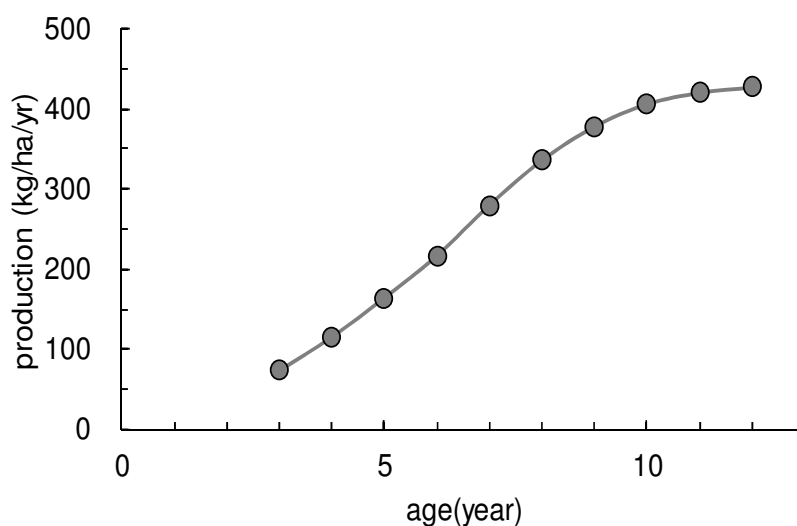


Figure 5. Total production of vanilla for 12 years

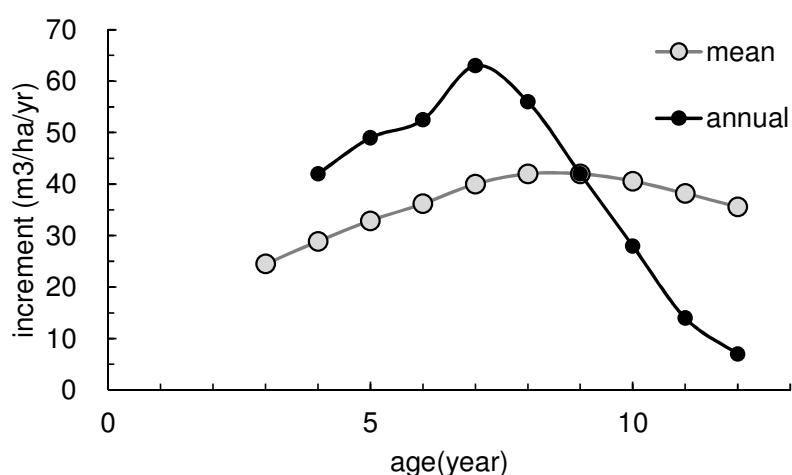


Figure 6. Increment of Vanilla production 12 years

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