UTILIZATION OF ACID SULFATE SOIL IN RANTAU RASAU-JAMBI PROVINCE FOR CULTIVATION OF GAHARU *(Aquilaria sp)*

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ABSTRACT

During 30 years transmigrants from Java Island living at new peatland area of Rantau Rasau, Jambi Province, Indonesia for rice cultivation, the soil changed gradually to become degraded acid sulfate soil. Some farmers still hold out the land by rice cultivation with very low productivity while the others changed their landuse from rice to oil palm and rubber plantation. However, the productivity of both plants are also low. To increase farmer income, therefore, high economical value plants should be selected and cultivated. We have selected gaharu plant /agarwood (Aquilaria sp) to be cultivated among home garden plants. In 2005, with supporting of Moyai Foundation-Japan, some 7000 seedlings were planted by farmers in three villages at Rantau Rasau. After 4 years transplanting, about 80% of cultivated gaharu trees grow very well. The average of plant diameter reached 7.4 cm with plant height of 7.3 m. Some gaharu trees naturally have been infected by fungi as indicated by good smell released when the wood was burnt.

***Keywords**: degraded acid sulfate soil, gaharu/agarwood (Aquilaria sp.), high economical value plant*

INTRODUCTION

Efforts to increase farmer welfare by introducing agricultural activities at Rantau Rasau, Jambi Province, Indonesia have been introduced. The efforts include increasing rice production, introducing rubber and oil palm plantation, cultivation of horticultural crops, animal husbandry aid, etc. However, after 30 years, transmigrants from Java Island lived at Rantau Rasau areas, their welfare did not increase significantly. The production of rubber and oil palm as well as other crops are still low. Moreover, after 10 years, the peatland areas changed gradually to become degraded acid sulfate soil. The soil is characterized by very low pH due to pyrite oxidation and low nutrients. To increase the income of farmers at Rantau Rasau area, we looked for high economical plants adapted to acid sulfate soils.

The criteria of adapted plants at degraded acid sulfate soil are endure to very low soil pH, low nutrients, and prolonged flooding. Gaharu/agarwood (*Aquilaria sp*) is one of trees adapted to acid sulfate soils. The tree produce gaharu, one of non timber forest products that has high economical value used for many uses especially for religion related ceremonies. Gaharu is annual plant producing gaharu resin after infected by fungi. The resin produce good smell when burning. Not all of gaharu trees grow in the forest pruduce gaharu resin depending on fungi infection. However, there is a technique for fungi innoculation to gaharu trees for stimulating gaharu resin. Recently, most of gaharu was collected by local people in the natural wet tropical forest. The extraction of gaharu from natural forest bringing on the availability of gaharu decrease drastically. Meanwhile, the demand of gaharu from Asia and Meadle East such as Japan, India, China, Saudi Arabia, etc is continously increase. Therefore, it is very important to produce gaharu resin by cultivating gaharu plant for fulfill market demands.

This paper will describe the experiences of gaharu cultivation at acid sulfate soils in Rantau Rasau. The discription consists of condition of agriculture at Rantau Rasau, gaharu plant and its aroma, preparation of seedling and transplanting, and condition of gaharu trees after 4 years transplanting.

Condition of Agriculture at Rantau Rasau

Formerly, Rantau Rasau was coastal peat swamps where the government opened for the transmigration. The soils were used for paddy cultivation but the soils tend to become toxic to any plants in six to seven years after reclamation. This is because the acid sulfate soils which are predominant in the area release sulfuric acid once the soils are dried. Consequently, soil pH becomes strongly acid to toxic level, and make most mineral elements to be leached out. In this condition, most crops tend to die immediately, and only resistant wild plants can survive.

Improvement of degraded acid sulfate soils for paddy as well as cultivating adapted plants at acid sulfate soils are needed. Based on our research results, we suggest renovation of acid sulfate soil as follows (1) Flushing and mitigation of the toxic acidity, (2) Selection of suitable rice varieties, (3) Application of macro- and micro-nutrients fertilization, and (4) Pest and disease control, and (5) Water management (Suwardi, et al., 2007). With 5 keys of improvement of acid sulfate soils, the production of rice could be maintain at 3-4 tons/ha. With those production levels, the farmers can hold out their daily lives. However, when the rice cultivation fail, their lives will become suffered.

Another way to increase farmer incomes is by cultivation of adapted plants at acid sulfate soils. Oil palm and rubber are two kinds of relatively adapted plants those can grow at low pH soils. Some farmers at Rantau Rasau have converted their rice field to oil palm and rubber plantation. In general, the farmer income from rubber plantation is better than that from oil palm plantation. Rubber plant seemly is more tolerant than that of oil palm at acid sulfate soil. Another plant that having high economical value and adapted at acid sulfate soil is gaharu. In natural condition, that plant grow well under tropical peat swamp forest, such as in Rantau Rasau before reclamation.

Gaharu Plant and its Aroma

Gaharu or agarwood is an evergreen tree having smooth bark with grayish to dark grey. Gaharu is plant having some species such as *Aquilaria malaccensis, A. agallocha, and A. Beccariana*. The branchlets are sparsely covered with hairs when young. The gaharu leaves are alternate, leathery, obovate to elliptic with 5 to 10 cm long and 2 to 4 cm wide. The apex of each leaf is short acuminate and the base is broadly cuneate, with entire and smooth margins. Its flowers are yellowish green. The fruit is a woody obovoid capsule with an outer covering of short grey hairs 2.5 to 3 cm long, opening in two flat valves when ripen.

The gaharu tree produces resin accumulated in fragrant wood used for incense, medicine, and religion related ceremonies. The resin can be extracted in large quantities by natural fungal infection or by external wounding. Sustainable harvesting of the resin can be induced by opening a wound 3 to 4 cm into the bark, and with the resin collected a few years later after accumulation. A small quantity of resin can be extracted from wood blocks by heating or burning.

Agarwood produces unique aroma depend on regional origin and can even differentiate slight variances from within one region. The essence of agarwood is a complex compounds called sesquiterpenes and chromones. The type and quantity of the many diverse compounds in the resinous wood create the fragrance. These compounds are produced as a defense mechanism in the living tree to ward off microbial attack and are developed only under very specific circumstances. New methods to cultivate agarwood in plantation grown trees stimulate these naturally occurring compounds. Normally gaharu resin produced in old growth trees in the forest and taking decades to accumulate, the resin can now be produced in young trees. Cultivation of gaharu tree in small plantations or in home gardens are being used to produce gaharu.

Preparation of Seedling and Transplanting

The first step for introducing gaharu cultivation at home garden at Rantau Rasau was conducted by socialization to the farmers directly. Before introducing to the village people, we discussed with village head and influencing people. Some feedbacks and suggestions have been obtained during our discussion with the village leaders. Based on our knowledges of gaharu and the suggestion from the village leaders we prepared the materials for socialization of gaharu cultivation. Socialization conducted three times in different villages. The topics of socialization covered general information of gaharu, economic value of gaharu, and how to transplanting, cultivating and and harvesting of gaharu. Many questions and intensive discussion have been done during socialization (Suwardi, *et al.*, 2006).

The gaharu seedling were obtained from Sarolangun, Jambi Propince. Small gaharu seedling were collected by farmers under the gaharu trees. After withdrawing from the soil, the gaharu seedlings were transplanted to polybag containing fertile soils. In March 2005, some 700 small gaharu seedlings were transported to Rantau Rasau by truck and then continued by speedboat. Before transplanting to farmer home gardens, the gaharu seedling were cultivated in paranet for acclimatization for 6 months (Figure 1). To obtain good performance, the seedling were maintained carefully by addition of fertilizers, growth hormone, and regular watering. After six months under the very intensive cultivation, most of seedlings showed good vigor having average of 50 cm height.

The gaharu seedlings distributed to more than 500 transmigrants in Rantau Rasau for transplanting to their home garden. Each farmer received 10-20 gaharu seedlings depend on the availability of home garden lands. Farmers received gaharu seedlings are obligated to transplanting and to maintain the plants in their home gardens and regularly report to farmer group organization.

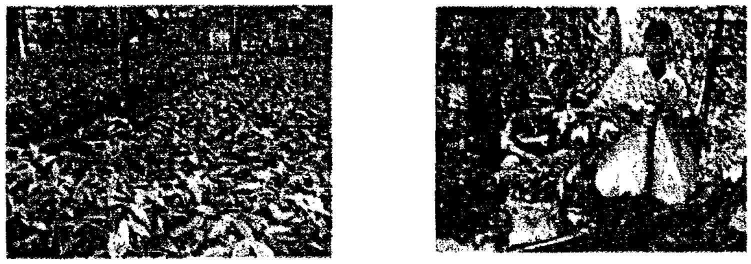

Figure 1. Gaharu seedlings and farmers bringing some gaharu seedlings

Condition of Gaharu Tree after 4 Years Transplanting

As soon as received gaharu seedlings, farmers transplanted to their home garden under the existing trees. Gaharu seedlings need shadow in the early growing. Farmers have prepared planting holes containing mixed compost and soil. After 2 months (Figure 2), generally seedling grew well. Gaharu that planted without addition of compost, showed abnormal symptoms as characterized by yellowish plant leaves and small growing. After 8 months, most of gaharu plants grow well and some others showing abnormal symptoms and dead. Some 5% of gaharu seedlings were dead due to some reasons such as drought, pest and disease. The height of plants ranged from 70-120 cm with stem diameter of 1-3 cm.

In July 2007, after more than 2 years transplanting, the height ranged from 150-300 cm with stem diameter of 4-7 cm. The growth speed of plants depend on soil fertility and maintenance of farmers. Gaharu planted in planting hole containing compost with good cultivation usually grow well. Seeing good performance of gaharu trees, some farmers such as Mr. Oman, grow more additional gaharu plants in his home garden. Now more than 100 gaharu trees growing in Mr. Oman home garden.

Figure 2. Gaharu trees after 8 months (lefts) and 4 years transplanting (right)

In 2009, about 80% of planted *Aquilaria sp* grow very well in their performance. The average of plant diameter reaches 7.4 cm with plant height of 7.3 m. After four years transplanting, some gaharu plants have infected naturally by fungi (Figure 3). It can be detected by cutting then burning the gaharu wood. Usually the first infection is around the branches. If wood burning and relese specific gaharu resin aroma, it mean that the process of accumulation of gaharu resin is going on. The beginning of gaharu trees infected by fungi were not similar.

Some trees very early but the other did not infected until teen aged depend on environment. Not all of planted gaharu trees producing gaharu resin, therefore, before harvesting shoul be checked the existing of gaharu resin.

Figure 3. Preparation for making fungi infection (left) and gaharu tree has contained gaharu resin (right)

CONCLUSIONS

1. Acid sulfate soil are characterized by strongly acid to toxic level, most mineral elements to be leached out. In this condition, most crops tend to die immediately and only adapted plants can survive.
2. Gaharu is non timber forest plant can be cultivated at acid sulfate soil at home garden. Gaharu plant endures with low pH and nutrients, and temporary submerge. Gaharu has very high economical plant after infected naturally or artificially by special fungi resulting gaharu resin.
3. Cultivation of gaharu plant in farmer home garden, in the long run has opportunity to obtain much money due to high economical value. However, the chance will become reality when farmers maintain their gaharu trees and success in fungi inoculation.

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