



# The Utilization of a Briquette Making Machine to Process Gambier Leaf and Twig Waste as Fuel for Gambier Sap Processing so as to Reduce Gambier Sap Production Costs in Toman Village, Babat Toman Sub District, Musi Banyuasin District, South Sumatera Province

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**Abstract.** Gambier leaf and twig waste is a problem at the location of the gambier sap-making process, because there is quite a lot of waste and there is no adequate disposal site, meanwhile it is disposed of at the Gambier plantation as organic fertilizer, disposed of at the location of the gambier sap-making process and if there is an empty land location, in terms of leaves and twigs can be used as fuel for processing gambier sap. With the dissemination of the Utilization of Briquette Making Machines to treat Gambier Leaf and Twig Waste as Gambier Sap Processing Fuel, this problem will be resolved properly, because all waste will be made into briquettes so that there is no waste from the Gambier latex manufacturing process that is not utilized. Utilization of this briquette making machine will ultimately reduce the production cost of processing gambier sap by 50% and the income of gambier farmers, cooperatives and will improve the welfare of gambier farmers. Then the environment where the gambier sap is processed is clean and the garden land is the same way and the negative impact of smelly twigs and leaves can be eliminated.

**Keywords:** Gambier · Briquettes · Waste

## 1 Introduction

### 1.1 Background

Gambier is estimated to have been known to the people of the archipelago around 2,500 years ago because it became a mixture in the betel nut tradition. In addition, it is used as a dye, tannery animal skins, as well as drugs such as stomach pain, burns, or headaches. Gambier is one of the important agricultural commodities, because it has a fairly high economic value. Gambier is traded in the form of dried sap which is extracted from the crushed leaves and twigs of the gambier plant which has been processed and

molded into sticks. Gambier can be used as raw material in the pharmaceutical industry, cosmetic industry, batik industry, paint industry, leather tanning industry, biopesticides, growth hormones, pigments, and as a mixture of food additives [1].

Because of its usefulness, since hundreds of years ago gambier is one of Indonesia's potential commodities and has promising foreign and domestic market opportunities. For the export market, the world demand for gambier is quite large and is expected to continue to increase because the main consumer is India, which has the largest number in the world. Indians have a habit of consuming gambier by eating it directly in the form of biscuits along with tea drinks and used for traditional ceremonies with a fairly high frequency. In addition, the demand for gambier from leading universities in America is also quite large.

Along with the development of types of industrial goods that require raw materials from gambier, the need for gambier in industry will also increase. The main market for Indonesian gambier is exports. Indonesia is the most important supplier of the world's gambier needs, which controls 80% of the world's gambier market share. In addition to India as the main export destination, Indonesia's gambier export destination countries are Bangladesh, Japan, Malaysia, Pakistan, Singapore and several other countries. According to Central Bureau of Statistics [2] Indonesia's gambier exports in 2009 reached around 18,298 tons with a value of US\$38.04 million. The large volume of Indonesian gambier exports to India reached 91.15% of the total export volume of Indonesian gambier. In addition, Singapore is also the largest importer of gambier from Indonesia. Singapore's highest import volume ever reached 92.1% of Indonesia's gambier production. Thus, the prospect of gambier exports to foreign countries is wide open. In Indonesia, West Sumatra is currently the largest producer of gambier plants in addition to several provinces that are also gambier producers, such as the provinces of Aceh, Riau, West Kalimantan and South Sumatera.

Harvested area, production, and productivity of gambier by province on the island of Sumatra in 2014 can be seen in Table 1.

Gambier is one of Indonesia's leading export commodities because 80% of the world's gambier products come from Indonesia. Toman Village is one of the villages located in Babat Toman Sub-District, MUBA Regency, South Sumatera Province, as the

**Table 1.** Harvested area, production, and productivity of gambier

No.	Province	Harvest Area (Ha)	Production (Tons)	Productivity (Tons/ha)
1.	West Sumatra	19,598	13,790	0.70
2.	Riau	4.256	4.230	0.99
3.	North Sumatra	1.552	1,887	1.21
4.	South Sumatera	480	270	0.56
5.	Riau islands	191	356	1.86
6.	Aceh	31	26	0.64
7.	Sumatra Region	26,131	20,485	5.79

center of gambier or called “gambo” by local people in South Sumatera. The existence of the gambier garden in Toman Village is estimated to have been going on for hundreds of years, before the Dutch government. In fact, the production of gambier sap became the mainstay of the Babat Toman community before the presence of rubber plantations developed by the Dutch. Then those who still survive become gambier farmers in Babat Toman, mostly in Toman Village, and a small part in Toman Village. Thankfully, when the price of rubber fell and never improved, there were a number of Toman Village residents who made gambier as a crop between their rubber plantations.

Ginde was the first to develop a gambier garden in Babat Toman, which came from the upper reaches of the Musi River. It is recorded that 19 gambier farmers are members of the Ginde Farmers Group. The gambier farmers who join represent one family, because planting and managing the gambier sap must be done by more than one person. Each farmer has an average of 1–1.5 ha of gambier gardens. Meanwhile, the area of gambier gardens in Babat Toman sub-district is currently around 35 ha. Gambier plants, said Syamsul, can be harvested when they are three months old from planting. But the harvest is only once a week. If he is over one year old, it can be done 20 times a month. “If it is well cared for, for example there are no plants, including grass around the gambier plants, they can reach tens of years. It could be 25 years,” he explained.

The process of making gambier sap takes 3–4 days. From harvesting to drying. In one month, harvesting can be done 20 times on gambier plants that are over one year old. Harvesting is done from 05.30–09.00 am WIB. For an area of one hectare, the harvest can reach 200 kg. The harvested leaves and old twigs. The leaves and twigs of the harvested gambier are taken to the processing ward, then boiled for one hour. Then grind for about half an hour. Pressed to extract the starch for about an hour. This starch is left on overnight. In the morning, the gambier essence is put into a sack, then pressed. The result is water and solid sap. “This water is used as fabric dye,” said Syamsul in the gambier processing ward behind his house. This solid sap is then boiled for 15 min, and then put into a container measuring 1 × 1 m with a height of 10 cm. After letting it sit all day or after it hardens, just cut it. Gambier pieces are then dried in the sun. “In the dry season, one day may be enough to dry in the sun, but in the rainy season like now it can take 2–3 days,” said Syamsul.

In order to increase the income of gambier farmers, the Muba Regency Government [3] plans to produce catechins from gambier. Currently in the process of study, both management and marketing. Catechins are a class of secondary metabolites that are naturally produced by plants and are included in the flavonoid group. This compound has antioxidant activity due to its phenol group. The structure has two phenol groups [ring-A and -B] and one dihydropyran group [ring-C]. Because they have more than one phenol group, catechin compounds are often called polyphenolic compounds. Based on a study, he claims, the catechin content in gambier is higher by about 73.3%, compared to tea leaves around 30–40% [4]. “We are very happy and willing, if our gambier products will be processed to produce catechins by the government. Moreover, the price is in the range of IDR 300–500 thousand per kilogram. “Gambier farmers are also ready to change the tradition in processing gambier so that it produces lots of catechins, such as leaves, don’t crush them, don’t take long to boil,” he continued. Actually, we wanted to produce the catechins ourselves, but the machines were expensive so we couldn’t

do it. It is estimated that up to Rp. 700 million. “That’s just the engine. We are happy if there is support from the private sector to facilitate, of course involving the Muba Government,” said Sahuri. “Gambier farmers are also ready to change the tradition in processing gambier so that it produces a lot of catechins, such as not crushing the leaves, not boiling for long,” he continued. Actually, we wanted to produce the catechins ourselves, but the machines were expensive so we couldn’t do it. It is estimated that up to Rp. 700 million [5]. “That’s just the engine. We are happy if there is support from the private sector to facilitate, of course involving the Muba Government,” said Sa-huri. “Gambier farmers are also ready to change the tradition in processing gambier so that it produces a lot of catechins, such as not crushing the leaves, not boiling for long,” he continued. Actually, we wanted to produce the catechins ourselves, but the machines were expensive so we couldn’t do it. It is estimated that up to Rp. 700 million. “That’s just the engine. We are happy if there is support from the private sector to facilitate, of course involving the Muba Government,” said Sahuri.

Technology that is disseminated to the society is in the form of a technology package for making briquettes made from waste leaves and gambier twigs which are used as fuel for the process of making gambier sap in the farmer group in Toman Village and Ginde Sugi Cooperative, Babat Toman Sub-District, MUBA Regency.

## **1.2 Formulation of the Problem**

Referring to the rationale on the background above, there are several problems that can be formulated, namely: First, how to use the waste from the process of making gambier sap into briquettes, secondly, what are the social, economic and environmental impacts of using gambier sap into briquettes.

## **1.3 Benefits and Purpose**

Based on the problems described above, the following are some of the expected objectives of the research; First, calculate the cost savings of gambier sap production by using waste briquettes from the process of making gambier sap, which so far have only been disposed of and disturb the environment. The two uses of the results of this study are to enrich the treasures of knowledge and can be used as consideration for the government or gambier farmers in maximizing profits and utilizing waste.

## **2 Methods**

The approach in this study uses the PRA (Participation Rural Appraisal) approach, with a descriptive study. This approach and type of study is used in order to obtain an overview and solution to the behavior or habits of gambier farmers in producing gambier sap in more depth so that there is no more waste left and all can be utilized.

## **2.1 Related Parties**

This activity involved academics from universities, management of the Ginde Sugi cooperative, the local government, and the Ginde Farmers' group producing gambier sap. Academics who are members of an activity team who act as team leaders, as well as implementing dissemination activities for the use of briquette-making technology. Participating farmers and cooperative administrators are targets who have been trained in the application of bonding technology from gambier leaf and twig waste. The local government acts as a party that helps smooth the partnership process between Ginde Sugi and the Gambier Ginde Farmer Group. Maintaining the Integrity of the Specifications.

## **2.2 Methods and Stages of Application of Technology**

The unit of observation is something that is used as a source to obtain data in order to describe or explain the implementation of dissemination of activities to gambier farmers. The unit of observation in this activity is the parties related to policy, by collecting information from key informants such as: gambier farmers, cooperative management, and local governments from the village to the district as well as related parties such as academics and community leaders. The sample collection method is to find out the income and expenses of gambier farmers by using the Snowball Sampling method by following the channel carried out by the farmers. The snowball sampling method is a method for identifying, selecting, and taking samples in a continuous network or chain of relationships [6].

## **2.3 Data Collection Supporting Activities**

Both qualitative and quantitative research methods were used in the study [7]. Mixing methods is a form of triangulation in research seen as mitigating the weaknesses found in single methods. Triangulation methods can be done by using different data collection techniques from the same data source, or by using the same data collection techniques from different data sources. The triangulation technique combines several data collection techniques such as; First, in-depth interviews which are data collection techniques with questions and answers to informants carried out to obtain the widest possible description and information related to the issues studied. The second stage, namely, participatory observation, is a data collection technique in which researchers are involved in the daily activities of data sources. Further Stainback in Sugiono [8], states that in participatory observation, the researcher observes what the people being researched do, listens to what the people being researched say and participates in the activities of the people being studied. The third stage is a document study to obtain an objective and complete picture of the facts in the field, so a document study needs to be carried out. Literature review. Document study was conducted to complement the results of interviews and observations in qualitative research. Document study is collecting data from various literatures related to this dissemination activity. Documents can be in the form of written and unwritten documents. Written documents can be in the form of life histories, regulations, policies, written works, while documents in unwritten form can be in the form of pictures and photos. In addition to using the above techniques,

## 2.4 Data Processing Method

The method used in this study is a survey method, one of which is to see the income and expenses of gambier farmers. The calculation formula used is as follows: Farming income is the difference between revenue and production costs. The formula for production costs, income and farm income is written in the following equation:

$$BT = BTp + BV$$

Description:

BT: Total cost/Production cost (Rp/lg/year)

BTp: Total fixed cost (Rp/lg/year)

BV: Total variable cost (Rp/lg/year)

$$Pn = Hy \times Y$$

Description:

Pn: Total revenue from farming (Rp/lg/year)

Hy: Selling price (Rp/year)

Y: Real production produced (kg/lg/yr)

$$Pd = Pn - BT$$

Description:

Pd: Farming income (Rp/lg/year)

Pn: Total farm income (Rp/lg/year)

BT: Total cost (Rp/lg/year)

## 3 Results and Discussion

### 3.1 How to Make Briquettes

Prepare the tools and materials needed in making briquettes. In this study, the manufacture of briquettes with agricultural tools and machines, such as modifying the leaf and twig crusher briquette machine which has a production capacity of 100–150 kg/h with steel plate material, then with a mixer, along with modifications to the briquette printer (Fig. 1).

### 3.2 Economic Impact

Briquettes made from processed gambier leaf and twig waste can certainly have a positive impact on the people of Toman Village. The data collection technique was carried out using a triangulation technique, which used the results of the data by conducting direct interviews with farmers processing gambier sap in Toman Village and obtained from related journals regarding research on the use of gambier sap.

Can save variable costs incurred by farmers by 50%. Because the wood to burn gambier sap has certain characteristics. If the size of the wood is too small, the wood



**Fig. 1.** Briquette making machine.

**Table 2.** Income of Gambier processing farmers per month

	Production	Price (Rp)	Amount (Rp)
<b>Reception</b>			
Gambier sap	62.4 kg	45,000	5,616,000.00
Gamabo (by-product)	48 (gallons)	35,000	168,000.00
Amount of Receipt			7,296,000.00
<b>Production cost</b>			
Fixed cost			608.866.40
Variable Cost			620,798.40
<b>B. Production Quantity</b>			1,229,664.80
Income			6,066.335.20
% variable cost (Use of wood as fuel)			50%

will burn easily, and if the wood is made from rubber trunks, the wood will run out quickly and produce a fire that is too hot. A fire that is too big makes a little gambier sap. Good wood is fun wood and leban wood. The wood is obtained by buying and gambier farmers have to pay 50% of the total cost. The following is data regarding the total expenditure of gambier farmers, namely expenditures for tools and materials in the gambier processing process.

From Table 2 it can be seen that the expenditure of farmers in buying wood as fuel for the process of making gambier sap is Rp. 620,798.4 or 50.4% of the total cost. So the cost that can be saved is IDR 620,798.4 per month.

### 3.3 Social Impact

The social impact after the existence of a machine for processing gambier leaf waste into briquettes (fuel substitute for wood) is that farmers want to continue to run the business

of using gambier trees as their ancestors did. In terms of society, Toman Village is famous for producing gambier which has high catechin quality. The ancestors used to prepare gambier sap to be used as a snack (Nyirih) as evidenced by the teeth of the residents in Toman Village, they have never had problems with their teeth. Farmers will continue to preserve traditional medicines from gambier trees because waste treatment equipment can save costs incurred by farmers.

### 3.4 Environmental Impact

There are no more piles or waste of leaves and gambier twigs left over from processed gambier sap. Initially, there were many piles in front of the gambier processed production house which were left on the ground.

## 4 Conclusion

Utilization of leaves and twigs left over from processing gambier sap can save the cost of producing gambier sap, especially for purchasing wood as fuel and the environment where the gambier sap is processed is clean and there are no more leaves and twigs scattered around the prepared text file.

## 5 Suggestions

It is hoped that the government will pay special attention to the gambier artisan farmer groups by providing training so that gambier processing becomes more hygienic and utilizes all waste so that it has economic value and can help market the processed gambier sap so that the market is wider.

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