

## Inventory of superior cocoa (*Theobroma cacao* L.) clones in Gedong Tataan sub-district Pesawaran

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**Abstract.** Pesawaran Regency is one of the largest cocoa-producing regions in Indonesia, ranking 5th, therefore cocoa plants are very strategic in this region. According to [1] Pesawaran Regency has a cocoa area of 27,411 ha with a total production in 2021 reaching 30 thousand tons, with an average production per hectare of approximately 1 ton of dry cocoa beans. This is considered still relatively low when compared to its potential. One of the cocoa-producing areas, namely the Gedong Tataan sub-district, is one of the largest areas for cocoa plants but its production is still relatively low at less than 1 ton/ha. Some of the problems in the Gedong Tataan sub-district include old plants, pests and unknown clones. The first step in a good cocoa cultivation business is to prepare clear planting material [2]. A clear cocoa clone will determine the sustainability of the cocoa business in the long term and benefit both production and increasing community income. The research was conducted using a survey method. Samples of respondents and cocoa plantations were determined purposively from cocoa plantation areas in Gedong Tataan sub-district, Pesawaran district, namely Sungai Rare and Wiyono villages. Observation variables in this study include identification of clone types (description) and climatic conditions. The obtained clone observation data were analyzed descriptively according to the morphological characteristics of each clone. Based on the data obtained, 5 types of superior clones were obtained including MCC 01, MCC 01, Sulawesi 01, Sulawesi 02 and BB. Based on the 5 clones, all of them had their own advantages and disadvantages, but in the Gedong Tataan sub-district the most commonly found was the MCC 02 clone with high production potential.

### 1. Introduction

Pesawaran Regency is one of the regencies located in Lampung Province. This district was inaugurated on November 2, 2007 based on Law Number 33 of 2007 concerning the Establishment of the Pesawaran Regency. Initially this district was part of South Lampung Regency. This area is rich in natural resources for agriculture, plantations and forestry. The population of Pesawaran district in 2020 is 477,165 people [3]. One of the great potentials of Pesawaran Regency lies in its plantation sector, in this case the cocoa plant. This area has a long history of cocoa plantations. Apart from the aspect of land suitability and climate, cocoa is also a major commodity in helping people meet their daily economic needs. Pesawaran Regency is one of the largest cocoa-producing regions in Indonesia, ranking 5th, therefore cocoa plants are very strategic in this region.

According to [1] Pesawaran Regency has a cocoa area of 27,411 ha with a total production in 2021 reaching 30 thousand tons, with an average production per hectare of approximately 1 ton of dry cocoa beans. This is considered to be quite low considering the potential for cocoa production, which is up to 2 tons per hectare of dry beans. There are many aspects that lead to low cocoa production in Pesawaran Regency. One of the largest cocoa-producing areas is the Gedong Tataan sub-district, which is mostly located in 2 villages, namely Sungai Rare Village and Wiyono.

Several things that cause low cocoa production in general in Gedong Tata, namely the plants are old, attacked by CPB pests and attacked by cocoa pod rot [4]. This is also similar to what has been experienced by cocoa plants in Pesawaran Regency, including unclear clones, plants that are too old, attacked by pests and diseases, which ultimately make farmers desperate to cultivate cocoa again.

Based on some of the important things above to support the development of cocoa plants to be successful, the first step in a good cocoa cultivation business is to prepare clear planting materials [2]. A clear cocoa clone will determine the sustainability of the cocoa business in the long term and benefit both production and increasing community income. Departement of Plantation [1] also added that the clone that will be developed soon is the MCC 02 clone. However, there are still many superior clones that must be inventoried, both superior clones originating from outside the region and superior local clones commonly developed by the community. This needs to be done in order to maintain sustainability so that later it can be developed and can be in captivity by the community or the Plantation Office of Pesawaran Regency for the provision or procurement of superior seeds for the people of Pesawaran Regency.

## 2. Methods

This research was conducted in the Gedong Tataan sub-district, Pesawaran district in July-October 2022. The tools and materials used in this study were stationery, cameras, and several respondents consisting of farmers and assistants in the Gedong Tataan sub-district. The research was conducted using a survey method. The sample of respondents and cocoa plantations was determined purposively from the cocoa plantation area in Pesawaran in the Gedong Tataan District which was divided into 2 villages, Sungai Rare and Wiyono. The stages of research implementation include: site survey, determining respondents, site review, identification and documentation. The variables observed included: type of clone, observation of clone morphology (leaves, flowers, fruit, production potential and pest resistance) and climatic conditions. The analysis in this study was carried out descriptively, both qualitatively and quantitatively.

## 3. Results and Discussion

### 3.1 Situation of area

Gedong Tataan District is one of the largest cocoa-producing sub-districts in Pesawaran Regency. Gedong Tataan District, Pesawaran Regency has an area of 16,520 ha, with 19 villages in it. Gedong Tataan also has a smallholder plantation with an area of 450 ha which is dominated by cocoa. As an area that has cocoa land as a source of agriculture to survive. Meanwhile, farmers who do not have land to cultivate cocoa use state-owned forests to continue farming cocoa [3].

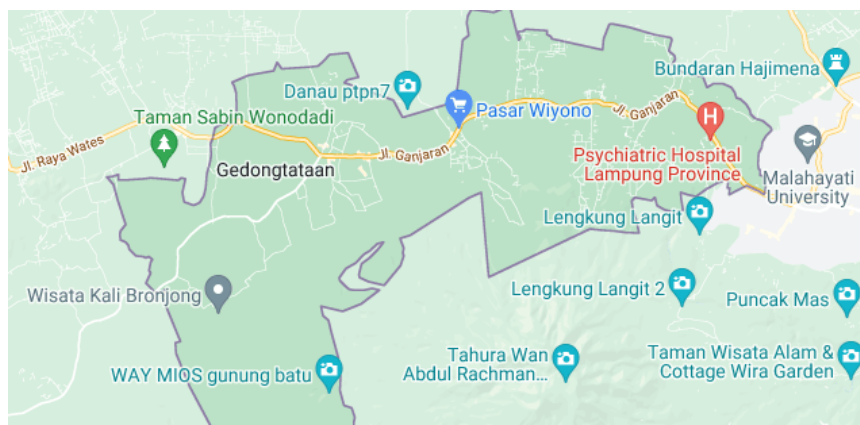


Figure 1. Gedong Tataan District Map

Gedong tataan sub-district has a lot of potential in the field of cocoa plantations because most of the people are cocoa farmers. However, the current situation of cocoa in Gedong Tataan District is not well maintained, causing low production. This situation is suspected to be due to several factors including old plants, attacks of pests and plant diseases and unclear clones. This results in

complex problems so that many farmers switch to other commodities. Even though the Gedong sub-district is geographically very suitable if cocoa is developed because the climatic conditions are very suitable. Plant development is not only influenced by plant factors but is also influenced by external factors so that plants can grow and develop optimally [4].

### 3.2 Clones

A clone is a planting material that is produced or propagated vegetatively [5]. Superior cocoa plant material plays a very important role in cocoa farming in the community. The productivity and quality of cocoa yields is largely determined by the quality of the planting material. One of the efforts to increase the productivity and quality of cocoa can be done by side grafting clonalization technique [6]. Currently, there are many cocoa clones scattered in the community with various characteristics. Based on the observations that have been carried out, there are several superior clones scattered in the Gedong Tataan sub-district. These clones include MCC 01, MCC 02, Sulawesi 01, Sulawesi 02 and BB (Buntu batu). These clones constituted the majority of clones developed in the Gedong Tataan sub-district, especially in Sungai Rare and Wiyono villages.

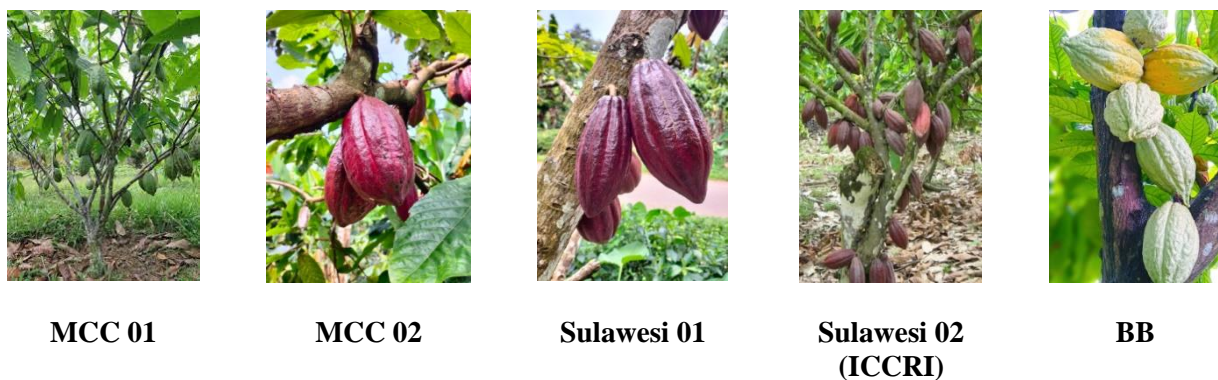


Figure 2. Superior clones at Gedong Tataan

Some of these clones are clones that are often encountered and are superior clones commonly used in various regions in Indonesia. Some of the above clones are also resistant to several types of plant pest organisms (OPT) such as Cocoa Pod Borer (CPB), Cocoa Pod Rot (CPR) and VSD. However, of the 5 superior clones, the majority or the type of clone that is the most widely cultivated is the MCC 02 clone. The MCC 02 clone is certainly a superior one because it is believed to be able to withstand 3 types of pests that often attack cocoa plants in general [7].

### 3.3 Morphological Character

Based on observations that have been carried out, several morphological characteristics of clones are found in the Gedong Tataan sub-district including leaves, flowers, fruit, production potential and resistance to pests. The leaf characteristics (Table 1) showed that MCC 01 and MCC 02 clones had the same leaf characteristics, while Sulawesi 01, Sulawesi 02 and BB clones had the same leaf characteristics. Although some clones have differences in leaf characteristics, basically the function, location and use are the same. Similar to the nature of its branching, cocoa leaves are also dimorphic. In orthotropic shoots, the petiole is 7.5-10 cm long, while in plagiotropic shoots the leaf stalk is only about 2.5 cm. The petiole is cylindrical in shape and finely scaly, depending on the type. One of the special properties of cocoa leaves is the presence of two joints (articulations) located at the base and tip of the leaf stalk. With this joint, the leaves are reported to be able to make movements to adjust to the direction of the sun's rays [5].

Table 1. Leaf morphology characteristics

No	Clones	Morphological Character (Leaf)	
		Leaf Shape	Leaf Texture
1	MCC 01	Lengthy	A bit rough
2	MCC 02	Lengthy	A bit rough
3	Sulawesi 1	Lengthy	Smooth
4	Sulawesi 2	Lengthy	Smooth
5	BB	Lengthy	Smooth

#### 4.

Cocoa superior clones are widely used as parents to produce hybrids and as a source of shoots [8]. Not to mention the 5 clones located in the Gedong Tataan sub-district that have been identified, of course in the future it is hoped that the clones that have produced will continue to be preserved for better results. The next morphological characters are flowers (table 2) and fruit (table 3), each clone has different characteristics, the flower stalk color of MCC 01, Sulawesi 01, Sulawesi 02 clones has the same red color, while MCC 02 and BB have the same color whitish green. Meanwhile, the sepals of MCC 01 are whitish yellow, MCC 02 and BB are whitish green, Sulawesi 01 is whitish red and Sulawesi 02 is white. While the form of staminodes are all the same, namely blooming.

Table 2. Flower morphological characteristics

No	Clones	Morphological Character (Flower)		
		Stem color	Sepal color	Staminode
1	MCC 01	Red	Yellowish white	Rise
2	MCC 02	Whitish green	Whitish green	Rise
3	Sulawesi 1	Red	whitish red	Rise
4	Sulawesi 2	Red	White	Rise
5	BB	Whitish green	Whitish green	Rise

Meanwhile, the fruit morphology characteristics of MCC 01 and MCC 02 clones are oval in shape, while Sulawesi 01, Sulawesi 02 and BB are pointed. In the fruit color parameters, MCC 01 and BB clones have a green color, while MCC 02, Sulawesi 01 and Sulawesi 02 have a purple color. Meanwhile, the texture of the fruit was coarse in MCC 01, Sulawesi 2 and BB, while the texture was fine in the clones MCC 02 and Sulawesi 01. Of course, this was mainly influenced by the genetics of each of these clones. However, it is also possible that environmental factors such as climate and soil can influence the morphology of plants [9]. This is also similar to the opinion [10] which states that climatic factors always affect the growth and development of plants in a place.

Table 3. Fruits morphological characteristics

No	Clones	Morphological Character (Fruits)			
		Fruit shape	Fruits color	Rind	Fruit groove
1	MCC 01	Oval	Green	Rough	√
2	MCC 02	Oval	Purple	Smooth	√
3	Sulawesi 1	pointed	Purple	Smooth	√
4	Sulawesi 2	Pointed	Purple	Rough	√
5	BB	Pointed	Green	Rough	√

Based on observations in terms of plant productivity (Table 4), each clone was a superior clone with high production potential. However, in reality, crop productivity based on conversion results shows that production is still relatively low. The highest production of the 5 cocoa clones was found in the MCC 02 clone, which was 1500 kg with a real potential of up to 300 kg/ha. While others are low, this is related to the condition of cocoa in the field which is still a lot of problems. Field constraints

such as old plants, pest attacks and poor cultivation techniques can of course be minimized with mentoring activities for better cocoa cultivation [11].

Table 4. Yield Potention

No	Klon	Yield Potention			Reality
		Yield Potention (kg)	Number of trees/ha	Dry seed weight (g)	Production (kg/ha)
1	MCC 01	3000-3600	1100	1,75	1000
2	MCC 02	3000-3160	1100	1,61	1500
3	Sulawesi 1	1800-2500	1100	1,1	800
4	Sulawesi 2	1800-2750	1100	1,27	800
5	BB	3000-2800	1100	0,7	500

As for the resistance to pests and diseases, it shows several advantages of each clone. Table 5 shows that MCC 02 clones have the strongest resistance to CPR, VSD and CPB, MCC 01 clones are resistant to CPR and VSD while Sulawesi 1 and 2 clones are only resistant to VSD and CPR, respectively. For BB clones, the data that has been collected is vulnerable to OPT attacks. However, this cannot be separated from the good field conditions or not. Clones that are resistant without good garden sanitation will not guarantee that the plants will be attacked by pests. So the effective and efficient way is to prevent attacks by regularly sanitizing the garden [12].

Tabel 5. Resistant to pests and diseases

No	Klon	Resistant to pests and diseases		
		Cocoa Pod Rot (CPR)	VSD	Cocoa Pod Borer (CPB)
1	MCC 01	√	√	
2	MCC 02	√	√	√
3	Sulawesi 1		√	
4	Sulawesi 2	√		
5	BB			

## 5. Conclusions

Based on the results and discussion, it can be concluded that in the Gedong Tataan sub-district through the Sungai Rare and Wiyono villages, 5 superior clones were obtained, namely MCC 01, MCC 02, Sulawesi 1, Sulawesi 2 and BB. Each of the 5 clones had advantages and disadvantages, but the most widely cultivated and the best clone was MCC 02.

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