

# Creating a Low-Cost Dryer for Javanese Cardamom (*Amomum compactum*) to Empower Farmers Group in Burno Village, Senduro District, Lumajang Regency

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## Abstract

The conventional approach to dry cardamom using sunlight is ineffective to be conducted in village that has high rain intensity and low ambient temperature. In the dry season, cardamom needs to be dried for 4-5 effective days, meanwhile, when it's the rainy season, it would take 14-16 days. The weather and the high prices of dryer machines in Burno Village, Senduro District, Lumajang Province, Indonesia, force the cardamom farmers to sell their cardamom in the form of wet cardamom, although it would reduce 80% of their revenues. This program aims to create a low-cost cardamom dryer to empower farmer groups in Burno Village to make their own dryer from used goods. Collaborating with the Tanirejo farmer group, this program managed to create a prototype of a dryer machine for cardamom which will reduce the drying time by 86% from 2,090 minutes to 277 minutes. By implementing this low-cost dryer, farmers can dry their cardamom efficiently, increase their revenue, and improve their overall economic stability.

**Keywords:** Community empowerment; Farmers group; Javanese cardamom; Low-cost dryer

## 1. INTRODUCTION

Kuliah Kerja Nyata - Pengabdian pada Masyarakat (KKN-PPM), the student service learning program, at Universitas Gadjah Mada (UGM) is a mandatory learning program for every undergraduate student in UGM. This program serves as one of the three pillars of higher education or *Tri Dharma Perguruan Tinggi*. KKN-PPM UGM 2023 is spread across 31 provinces in Indonesia, one of them is assigned to Burno Village, Senduro District, East Java Province, Indonesia.

Located at the foot of the mountain Semeru with an altitude of 900 metres above sea level, Burno Village holds great potential for Javanese Cardamom (*Amomum compactum*) cultivation. This potential makes 22.86% of people in Burno Village choose to be a farmer (Pemerintah Daerah Lumajang, 2018). According to Burno Village Official Government website, Javanese Cardamom is one of the most favourable crops that are cultivated in this village, alongside coffee and local bananas.

Javanese Cardamom or White Cardamom grow in fertile soil with an altitude of 200–1,000 m above sea level with an annual rainfall of 1,500–4,000 mm and a temperature range from 10–35°C (Harits et al., 2018; Rini et al., 2022). According to Central National Statistics Agency (BPS) (2019), this plant is one of Indonesia's biggest export commodities and is mainly exported to Central and South Asia. Part of this plant that has high economic value is its seed which is used as spices. To be

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exported, this seed must be dried to certain water content to make it last longer to be stored (Suhartini et al., 2019).

Fresh cardamom has a range of water content between 70–80% (wet basis) and must be dried until reaching at least 12% moisture content (Triwahyudi et al., 2015). The conventional way to dry cardamom is by using sunlight. Farmers in Burno Village are facing problems to dry this cardamom seed due to low ambient temperature and high rain intensity. According to the Meteorological, Climatological, and Geophysical Agency East Java Region (2021), Burno Village has high rain intensity in the range of 2,001–2,500 mm/year with ambient temperature between 18–27°C.

Cardamom farmers in Burno Villages depend too much on this conventional way, despite the condition of their village not being optimum to utilize sunshine to dry it. Based on an interview with local farmers in Burno Village, it takes about 4–5 effective days to dry cardamom in the dry season and about 14–16 days in the rainy season.

Drying cardamom is a crucial process for farmers to get more revenue. A one kilogram of dry cardamom would be priced between IDR60,000–IDR80,000, meanwhile, the wet cardamom would be priced only IDR10,000–IDR15,000 in the local market. Due to high rain intensity and short sunshine duration, cardamom farmers in Burno Village often sell their cardamom in the form of wet cardamom which cut more than 80% of their revenue. Due to the low margin profit and fluctuating prices for the farmers to sell their cardamom, they face problems to buy a dryer machine to dry their cardamom in the rainy season. Hence, a low-cost dryer machine is needed for the farmers to dry their cardamom. This dryer machine needs to meet 2 main standards, that's are: low-cost to make and easy to operate for the farmers.

## 2. METHOD

This program was held in Burno Village, Senduro District, Lumajang Regency, East Java, Indonesia in July–August 2023. The making of the dryer was carried out in collaboration with the Tanirejo farmer group, the biggest farmer group in the village, which have more than 40 active members. The process of making this dryer is divided into 3 phases, which were a literature study for creating dryer design, the process of creating a dryer prototype, and workshop on creating and operating a javanese cardamom dryer as presented in Figure 1.



**Figure 1.** Workshop on creating and operating a javanese cardamom dryer: (a) Cutting and cleaning the combustion; (b) Chamber installing the blow torch and fan; (c) First trial of cardamom dryer

It started in June 2023, when the team discussed with the leader of the farmer's group to investigate the problem that the farmer groups are currently facing at the time. The farmer group tell about their problem to dry their cardamom seed due to the high rain intensity in the village. further,

the team gathered data to create the design of the dryer and consulted it with the farmer's group representative. The final design is executed on a prototype scale which is made from used goods, like oil tanks and cement sieves to reduce the production cost. **Figure 1** shows the final prototype design of the dryer. After the dryer prototype is finished, it will be presented in a workshop with the Tanirejo farmer group.

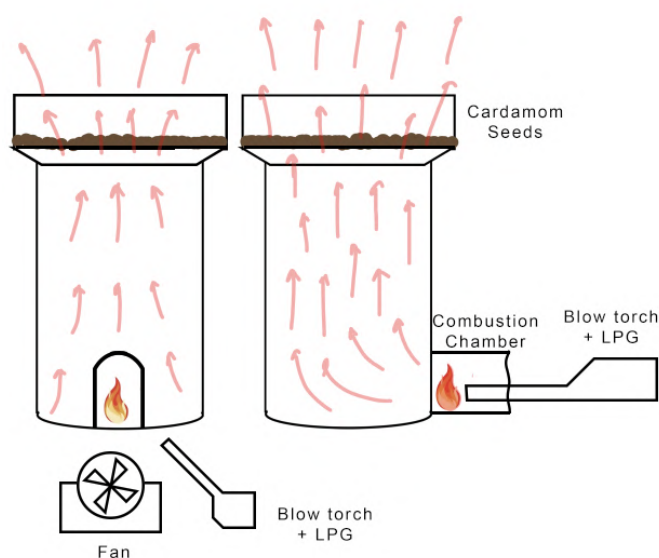
### 3. RESULT AND DISCUSSION

#### 3.1. Characterization of Javanese Cardamom

Fresh Javanese Cardamom (*Amomum compactum*) is collected from a local farm 1 day before it will be dried. This cardamom has a range of humidity between 70–80% (wet basis) and must be dried until reaching at least 12% humidity level to make it able to be stored safely (Triwahyudi et al., 2015). The cardamom size that is used in this program is unsorted and has a range of size between 4–8mm.

#### 3.2. Creating dryer prototype

The goal of making this activity is to make it low-cost and easy to make so cardamom farmers able to make and operate it by themselves. This dryer is made from 4 main compounds, used oil tanks as a combustion chamber, sieves as the container for cardamom, blow torch as heat sources, and fan to push hot air through the cardamom seeds (**Figure 2**). This design is categorized as hot air convective dryer, where the heat sources come from the hot air that blows through the cardamom seed. In this design, water evaporates from each side of the seeds (Mishra et al., 2021).



**Figure 2.** Final design of cardamom dryer

**Table 1.** Budget plan to make dryer prototype

Equipment	Prices	Unit	Sources	Total
Used Oil Tank	IDR100,000.00	1	Local Market	IDR100,000.00
Blow torch	IDR125,000.00	1	Online Shop	IDR125,000.00
Fan	IDR75,000.00	1	Local Market	IDR75,000.00
LPG	IDR25,000.00	1	Local Market	IDR25,000.00
Total				IDR325,000.00

The process of making this dryer prototype starts with making 2 holes in the side and top of the used oil tanks. After that, a blow torch is inserted in the hole and the gas is ignited. Fresh cardamom

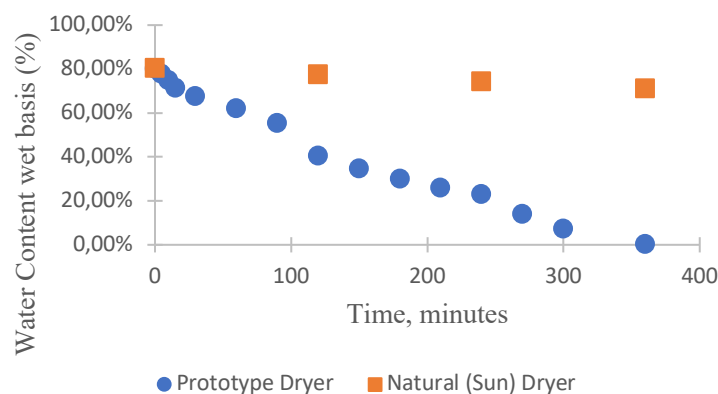
seed is placed on the sieve tray above the combustion chamber and the fan is turned on to push hot air through the cardamom seed. The total capacity of this prototype is 15kg of wet cardamom seeds. All of the prototype-making process is carried out by empowering members of the Tanirejo farmer group. The total cost of making this dryer is IDR325,000. Detailed cost for making this dryer showed in **Table 1**.

### 3.3. Cardamom drying process

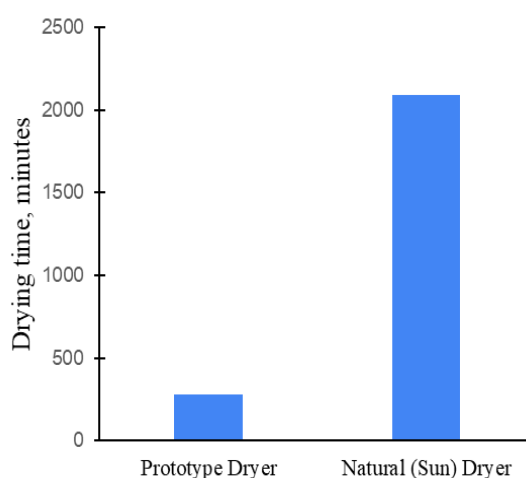
Cardamom is dried with the prototype dryer at a constant temperature of  $54^{\circ}\text{C} \pm 5^{\circ}\text{C}$ . This temperature is set because it is the optimum temperature for drying cardamom and resulting in the highest essential oil content (Dash, 2021; Wang, 2021). As much as 2.5kg of cardamom was put in the dryer and weighed every 15 minutes with a digital scale to know the drying rate and the moisture content of the cardamom. At the same time, in comparison, as much as 2.5kg of cardamom is being dried under the sun under uncontrolled air temperature and humidity to know how long it takes to dry cardamom without a dryer. The sun-dried cardamom is dried for 8 hours/day, starting from 8.00 to 16.00 and is weighed every 2 hours.

### 3.4. Drying result

After being dried for 4 hours, the cardamom in the prototype dryer showed 0% moisture content, meanwhile the cardamom dried with the sun still has 70.74% moisture content (wet basis). Based on **Figure 3**, the desired moisture content of 12% will be reached within only 278 minutes. Compared to natural sun dryers which need 2,090 minutes or 4 effective days.



**Figure 3.** Moisture content comparison between two methods of drying cardamom



**Figure 4.** Drying time comparison between two methods of drying cardamom

This cardamom dryer is able to reduce the drying process from 4 effective days to 4 hours 30 minutes (**Figure 4**). This dryer also helps farmers to dry their cardamom in the rainy season when the

air humidity is high and the short sunshine duration makes the sun drying process will be reaching 10–14 effective days. According to the farmer group, there are no significant differences between dried cardamom seeds that dried with the dryer prototype and that dried with the sun.

### 3.5. Workshop with farmer group

The cardamom dryer is presented in a workshop with 36 participants from the Tanierjo farmer group (Figure 5). This workshop explains how to create and operate this cardamom dryer. The workshop activities concluded with the transfer of the cardamom dryer prototype and its operational guidebook. Figure 6 shows the result of cardamom after being dried for 120 minutes.



Figure 5. Workshop on cardamom dryer making and operational



Figure 6. The result of cardamom after being dried for 120 minutes

## 4. CONCLUSION

The focus of this community services program is to create low-cost cardamom dryers that can empower farmer groups to solve their problem to dry their cardamom seed to enhance the revenue. This dryer is made to reduce drying time by 86% from 4 effective days to 4 hours 30 minutes without

significant differences in the quality of the cardamom seeds. This means the farmer groups can sell their cardamom faster, with higher prices, and more sustainable because they don't need to rely on the weather. This program does not only provides technology to the people but also empowers them to create and improve their own technology.

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