

# The breaking & winnowing of cocoa beans

*Notes from a small-scale study conducted in Vietnam*

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**F**ound growing in Central America over five thousand years ago, cocoa beans have been primarily used as main raw material for chocolate and other confectionery products in the world.

In fact, more than 90 percent of the worldwide cocoa beans produced are used for chocolate production. It is one of the major crops of several countries with a total crop of 4739 metric tonnes annually.

According to the UN Food and Agriculture Organization (FAO), cocoa is most commonly grown in Côte d'Ivoire, with the country supplying as much as 30 percent of the world's total cocoa. The demand for cocoa in countries is continually increasing, with global production not yet able to keep up.

With global demand largely driven by the strong performance of the global chocolate industry, the top cocoa producing countries are expected to further strengthen their position, creating even more business opportunities for their local cocoa suppliers.

In Vietnam, according to the report of the Department of Crop Production, Ministry of Agriculture and Rural Development in 2015, the area for growing cocoa is around 22,300 ha, with the two largest growing areas found in the Mekong River Delta and the Central Highlands.

However, the harvested area is about 11,055 hectares, accounting for 50 percent of the total planted area, which is responsible for the output of dried cocoa beans in Vietnam of about 4000 tonnes annually.

The product yielded from the processing of cocoa beans is called nibs. Most nibs are ground, using various methods, into a thick, creamy paste, known as chocolate liquid or cocoa paste.

This liquid is then further processed into chocolate by mixing in (more) cocoa butter and sugar (and sometimes vanilla and lecithin as an emulsifier), and then refined, conched and tempered.

Alternatively, it can be separated into cocoa powder and cocoa butter using a hydraulic press or the Broma process, a process that produces around 50 percent cocoa butter and 50 percent cocoa powder.

### Breaking & winnowing

In the chocolate or cocoa powder manufacturing process, the roasted cocoa beans have to pass through the breaking and winnowing steps in order to obtain the nibs. The quality of chocolate or cocoa powder depends strongly on the amount of shell that is not separated and still mixed in with the nibs.

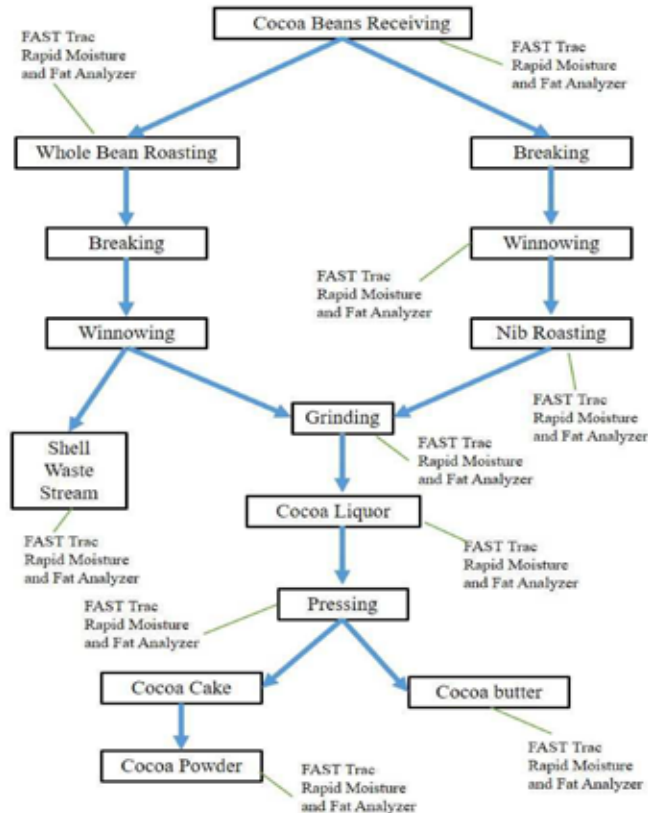
Most of the cocoa bean breaking machines are based on the principle of grinding. This leads to some disadvantages as the shells might be not separated from the cocoa kernel after the shattering.

This can in turn result in low efficiency of the cleaning process, with the nibs also crushed so much that they fall out with the shell in the winnowing step as they have a similar density to the shell fragments.

As a result, the ratio of nib loss during the cleaning process can be as high as 11.3 percent. Therefore, the shattering and cleaning process can strongly affect the economic efficiency of cocoa production.

In order to address this issue, new methods for cocoa breaking and winnowing have been developed and studied in order to increase the cleanness level of the grinding process and to reduce the rate of nib loss.

This article investigates the effectiveness of a breaker, used in combination with the pneumatic winnower, when seeking to increase the cleanness of the final product and reduce the rate of nib loss.



## Ensuring maximum yields

Throughout the world, the range of cocoa processing machines have become much more reliable and comprehensive over previous decades, allowing them to meet the challenge of large industrial scale production.

However, most of the plants in Vietnam are still on a relatively small scale as the annual yield of cocoa produced in Vietnam is also small. This has led to the cocoa processing factories not being equipped with the modern machines found in some plants elsewhere in the world.

In more recent times, most of the cocoa plants in Vietnam have been using the grinding method for the separation of the nibs and shell, whilst the winnower includes a screen raking system for separating the shell fragments.

Furthermore, the nibs are the main material in the production of cocoa powder, chocolate and butter, with the breaking and winnowing steps playing a vital role in the quality of the final product produced.

When the nibs are still mixed with the shell in the shattering and cleaning step, the quality of powder and liquor using for producing chocolate decreases a lot and as a result, the economic efficiency may also be negatively influenced.

As shown in Figure 1, the process of producing cocoa nibs from cocoa beans can be broken down into two main methods for breaking and winnowing. The first one sees the beans roasted before going to the breaker and winnower to produce the nibs.

The other one is the bean can be broken and winnowed first to make the nibs before they move to roast step. In this study, the first method has been selected in which the cocoa beans were roasted before going to the breaking than to the

winnowing step, with the cleanness of the winnowing step defined as the ratio between of mass of nibs and the total mass of mixing of nibs and shell after winnowing counted by percentage.

The nib losses ratio during the breaking and winnowing step is defined as the ratio of the maximum mass of nibs and the mass of nibs received after winnowing step. In order to calculate this, a 10kg of roasted cocoa was is put into the breaker and winnower, with the final mass of the nibs then measured once the process was complete.

## Developing a suitable cocoa breaking and winnowing stage

This study found that breaking and winnowing are two steps in cocoa bean processing that if conducted properly, will lead to an increase in the economic efficiency of the process and the quality of nibs produced.

If the producer's aim is to develop a suitable cocoa breaking and winnowing stage in the processing system with a high level cleanness and low nibs rate loss, then the technique used by this study would help them to achieve these aims.

This technique, which saw the cocoa beans broken by a centrifugal type mechanism in combination with a pneumatic cleaning system, enabled a processing system with breaking and winnowing capacity of approximately 80 kg/hour.

The experimental results indicate that the efficiency of the cleaning process also rises to more than 99 percent and the ratio of nibs loss reduces to just 1.6 percent, leading a worthwhile increase in the economic efficiency of the cocoa processing process.