

Using Cocoa Pod Husks to Improve Crop Yields and Soil Quality



Using the two processes described in this guide, cocoa farmers can reduce their reliance on expensive chemical fertilizers and fungicides, and ultimately:

- Increase crop yields.
- Prevent black pod disease on cocoa pods.
- Improve the overall quality of soil.
- Save money.
- Save time.

Preventing black pod disease and promoting nutrient-rich soil is an expensive burden for smallholder farmers.

Depleted soil and agricultural diseases are some of the main causes of low crop production for smallholder farms. For cocoa trees, which are mainly grown by smallholders, black pod disease limits production. Black pod disease is caused by a fungus called *Phytophthora*. This destructive disease spreads swiftly among the cocoa pods turning their healthy, bright yellow color to black and destroying the crop. Many farmers turn to chemical fungicides and must constantly remove diseased pods, which requires time and money. The cost of ensuring cocoa pods free of diseases can represent as much as 50 percent of sales. This places a heavy financial burden on small-scale farmers who depend on agriculture to make a living and provide for their families.

Compost and biochar made from cocoa pod husks offer two affordable solutions.

While many consider the husks of cocoa pods to be waste, farmers can reuse these readily available materials. Recent research has demonstrated that compost made from cocoa pod husks (both healthy and diseased) is effective at both improving soil quality and inhibiting black pod disease in cocoa. This research also showed that biochar produced with cocoa pod husks can help rebuild overused soil by boosting nutrients and improving the soil's physical characteristics, which supports crop growth. This guide includes proven instructions for making compost (see Section 1, page 2) and biochar (see Section 2, page 6) from cocoa pod husks, drawing results from a lab-based research study and a field-tested training conducted by Njukeng Jetro Nkengafac, Ph.D., at the Institute of Agricultural Research for Development (IRAD), Cameroon.

Agriculture extension workers, non-governmental organizations, and farming associations that provide training and resources for farmers can use this information to support local farmers in adopting these effective and sustainable practices.

SECTION I

HOW TO MAKE COMPOST FROM COCOA POD HUSK

Cocoa pod husks along with other plant and animal remains naturally decompose—breaking down from a solid into a much simpler substance rich in nutrients—to produce this type of compost. Microorganisms (tiny living creatures in the soil) are responsible for breaking down the plant and animal remains. These beneficial microorganisms need air, water, and warmth to live and break down the cocoa husks. Over time, the remains of the cocoa pod husks turn into a dark brown, crumbly mixture that looks and smells like soil. The resulting cocoa pod husk compost mixture can serve as both a natural protectant against black pod disease and as an organic fertilizer that is rich in nutrients. Cocoa pod husk compost has several other benefits that promote healthy crop yields.

Benefits of Cocoa Pod Husk Compost

- Promotes nutrient-rich soil and increases water-holding capacity.
- Prevents disease-causing bacteria, viruses, or other microorganisms (such as the one that causes black pod disease).
- Supports healthy crop growth.
- Encourages good root spread.
- Helps reduce weeds.
- Reduces pollution and other negative environmental impacts associated with chemical fertilizers and fungicides.
- Improves soil for future crops.

Cocoa pod husk compost can do two important things:

1. Help prevent black pod disease on cocoa farms, and in turn reduce reliance on chemical fungicides.
2. Improve the overall quality of the soil, and in turn reduce the need for chemical fertilizers.

THE PROCESS

Materials

- Cutlass or shredder
- Field thermometer or stick
- Watering can
- Fork or spade
- Banana leaves or plastic sheets
- Space for the compost heap (approximately 2.5 meters long by 2 meters wide)
- Space to mix the compost ingredients (approximately 2.5 meters long by 2 meters wide)
The higher the volume of compost ingredients, the more space one requires.

Compost Ingredients

- Cocoa pod husk
- Animal and/or poultry manure
- Grasses (green manure)*

**The use of green manures such as Tithonia (Mexican sunflower), Gliricidia, Leucaena, Sesbania, Crotalaria, and Lantana leaves increase the compost's nutrient content.*



1 Pick a location for the compost: Choose a site near the area where you will be using the compost to make moving it easier. The area should be flat and cleared.

Select a location that is protected from wind, rain, sun, and water runoff to ensure that the compost pile does not get either too dry or too wet.

2 Prepare the composting ingredients by cutting the cocoa pod husk and grasses into smaller pieces.

3 Prepare two sites by placing banana stems or logs of wood down to mark one section for the compost heap and a second separate section for mixing.

4 Individually measure the cocoa pod husk, grass, and manure. Using two parts of cocoa pod husks for every one part of grass and one part of manure, thoroughly mix the components until they are well blended.

Knowing the relative amount of each ingredient is an important step. Using the ratio of two parts cocoa pod husks to one part of grass and one part of manure ensures that the compost has the right balance of nutrients.

5 Transfer the mix from the mixing area to the compost area in batches. Layer the mixture and then sprinkle wood ash on top. Continuing layering the mixture and wood ash until the desired height (about 1.5 meters) is reached. The number of layers depends on the heap size.

6 Cover the heap with banana leaves or plastic sheets to reduce heat and moisture loss, and to protect from over-wetting by rain.

7 Check the temperature of the compost heap after one week. To do so, insert a stick into the middle of the heap. Wait 5 minutes, then remove the stick and touch the part of the stick that was inside the heap to feel whether it is hot. If the temperature is warm, the breakdown process has started.

If the stick feels cool when you touch it, this means the temperature is not building up and that the heap is too dry. Try sprinkling water lightly on the heap to moisten. Be careful not to soak the heap. Turn the heap and recheck the temperature in one week or before the next turning (see next steps).

If you have a field thermometer, you can also use that instead of a stick to check the temperature of the compost. Once the breakdown process has started, the temperature should range between 50 to 65 degrees Celsius.

Re-check the temperature of the compost heap on a weekly basis to make sure the materials are breaking down. The temperature will increase and then decrease as the process continues.



8 Turn the compost 14 days after creating the compost heap. Turning should be done in such a way that the mixture's edges are rotated into the center of the heap. The compost heap should be turned every 14 days especially during the first eight weeks.

Why should you “turn” the compost? Turning enables every part of the compost heap to get enough air, moisture, and warmth to break down evenly. It also reduces the buildup of tight layers within the mixture that can block air and water flow. Most importantly, turning the compost helps ensure that the compost reaches the right temperature to destroy any bacteria, virus, or other microorganism that can cause disease.



9 The compost should be ready after 10 to 12 weeks. You can tell the composting process is complete when turning the mixture no longer produces an increase in heat in the pile. “Ready” compost looks and smells like soil. The temperature of mature (finished) compost is slightly warm.

10 Apply the compost as a ring around the base of the cocoa tree every year. The ring should extend to the end of the tree's canopy. Once the mixture has been applied, cover with soil to prevent direct exposure to sunlight and prevent the compost from losing nutrients or being washed away by rain.

Compost should be applied once a year at the beginning of the rainy season. The amount of compost to be applied greatly depends on the crop and the soil nutrient status.



11 Store compost. Compost should be spread on the ground to air-dry before it is stored. Once dried, compost can be used or stored in bags. It's important to keep the compost in a dry place and to prevent it from mixing with other materials that could contaminate and compromise effectiveness.

SECTION 2

HOW TO MAKE BIOCHAR FROM COCOA POD HUSK

Biochar is a type of charcoal that can be used to naturally enhance soil. It is produced by burning cocoa pod husks and limiting the exposure to air during the burning process. Biochar's benefits come from its unique chemical attributes and the way they interact with the soil. The charred product helps to rebuild soil by boosting nutrients and improving the soil's physical characteristics, which supports crop growth.

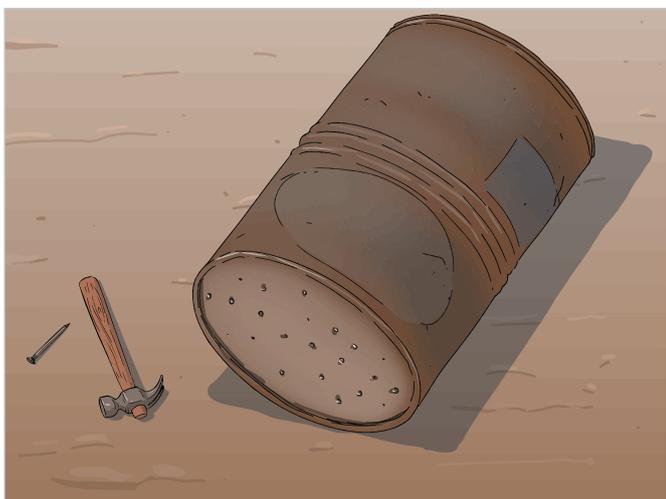
Benefits of Cocoa Pod Husk Biochar

- Improves the quality and productivity of the soil.
- Improves crop growth and yield.
- Helps soil to hold more water.
- Helps retain fertilizers (for example, compost).

THE BIOCHAR PROCESS

Materials

- Cocoa pod husk
- Metal drum with lid
- Long shovel with a wooden handle
- Watering can



1 Dry the cocoa pod husk. *Cocoa pod husks should be dried so that they can burn easily.*

2 Make small holes at the bottom of the metal drum. *This will allow in a small amount of air during the burning. A nail can be used to make the small holes.*

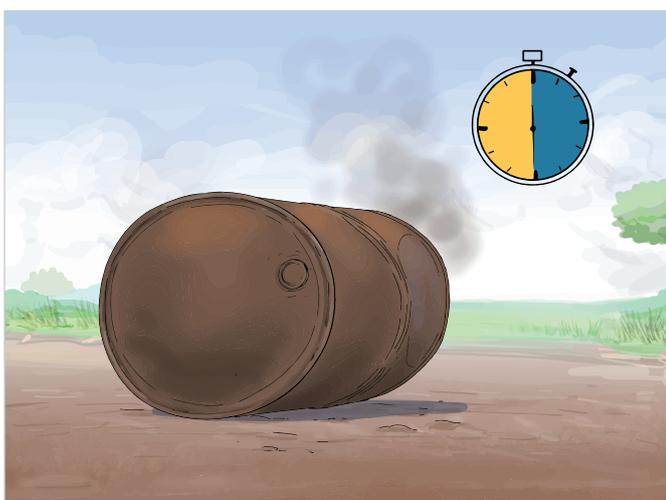
3 Fill the metal drum with the cocoa pod husk. *They can be whole or in small pieces.*



4 Light the cocoa pod husk on fire. *Lighter fluid can be used in small amounts. The drum can be either upright or on its side, depending on the size of the drum and the convenience for the user.*

Warning: *Use caution with the heat and fire so as not to burn yourself.*

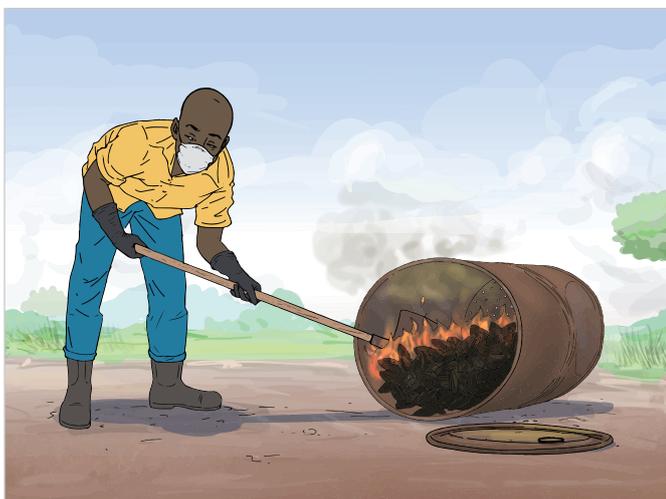
Take care to reduce risks of wild fires; remove all dry debris from around the area of biochar preparation.



5 Cover the drum with its lid, *once the fire starts producing flames.*

6 Carefully open the drum after 30 minutes to determine if most of the mixture is burnt.

You can tell the mixture burning as it will start to turn black like coal.



7 **Carefully turn the mixture** using a long shovel (preferably with a wooden handle or another material that does not conduct heat) to ensure even burning.

Warning: Do NOT use a shovel with a metal or plastic handle.



8 **Pour water over the mixture to put out the fire**, once the mixture is fully burnt. The mixture will have a black appearance that resembles coal.

9 **Spread out the biochar to dry.** Pour out the biochar in a dry place and spread the mixture evenly until it is dry.



10 **Apply the biochar in the field like any other manure/fertilizer.**

Biochar should ideally be used right away. If not, the biochar should be spread out to dry before storage (see Step #9). If it is stored wet, fungal growth will occur and will result in contamination of the biochar. Biochar can be stored in a burlap bag.

Warning: Before applying biochar, take care to cover and protect one's nose, mouth, and eyes. Be sure to wear gloves during the application process. Do not eat during the application, and wash your hands and equipment thoroughly afterward.

Application recommendations and precautions: Like any other fertilizer, environmental consequences will arise from over application or poorly timed application. Therefore, avoid applying biochar when it is raining to avoid runoff. Also avoid applying biochar under windy conditions.

Biochar does not naturally decompose like compost; the material stays in the soil. Therefore, frequent application is not necessary.

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- Oumar Doungous, Emile Minyaka, Essoua Alex Morel Longue, and Njukeng Jetro Nkengafac, "Potentials of Cocoa Pod Husk-Based Compost on Phytophthora Pod Rot Disease Suppression, Soil Fertility, and Theobroma Cacao L. Growth," *Environmental Science and Pollution Research* 25, no. 25 (2018): 25327-35.
- Martha Eneke Munongo, George Elambo Nkeng, and Jetro Nkengafac Njukeng, "Production and Characterization of Compost Manure and Biochar from Cocoa Pod Husks," *International Journal of Advanced Scientific Research and Management* 2, no. 2 (2017): 26-1.

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