

Cacao Production

A report by Cedric Ricci

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Jiwa Damai Permaculture gardens, Bali

Jiwa Damai is located in a tropical forest with many cacao trees. However the cacao production has decreased in the past years due to a black pod infection. The following article is meant as a support for those who wish to learn about cacao, the black pod disease and methods how to deal with it. This article contains a short overview to the history and the ecology of the cacao, a summary of the cacao plantation in Jiwa Damai and a description of the black pod disease.

History

The scientific name of the cacao tree is *Theobroma cacao*. *Theobroma* means in latin « food of gods ». In fact the cacao was cultivated in South America a long time before the Spanish conquest. Mayas and Aztecs were the first to cultivate it and they enjoyed so much the taste of cacao seeds that they thought it was a gift from god.

The seeds were sent to the court as exchange for money and were also used to produce a sour drink called « xocoalt » the ancestor of our actual chocolate.

In 1519, the Spanish landed on the Mexican coast and started to conquer the country. Cortez met the Aztec emperor, Moctezuma, who offered him a cup of « xocoalt ». First the conquistadores didn't like it but religious people from Oaxaca added sugar cane and vanilla and created chocolate.

In 1524, Cortez sent the first load of cacao to the Roman emperor who allowed the Spanish to keep the monopoly of this trade. The cacao revolution started in Europe.

In 1615, the keen interest in Cacao spread all over Europe through France. Spanish, French, British, Portuguese and Dutch started to cultivate it in their own colonies. At that time the cacao was only

consumed as a drink. The first chocolate to crunch was created in 1674 in London.

In the XXth century the cacao production increased from 115 000 tones in 1900 to 2 600 000 tones per year in our days.

The Cacao Tree

The cacao tree is cultivated from 0 to 700m altitude in a tropical climate with steady rains all year round. It's a sciophilous plant (shade lover) which grows in deep and fertile soil.

It starts to produce fruit after 3 years, the flowers appear as bunch on the tronc of the tree and on main stems. The cacao tree grows thousands of small white flowers (1cm in diameter) per year but only 1% of them will turn into fruit..

The tree begins producing fruit after 3 years and is considered adult after 6 years and can produce from 20 to 80 fruits per year for 40 years . However it is easily prone to disease when it reaches 20 years.

There are three main types of cacao trees :

Criollo from central America and Mexico, produces a thin elongated fruit, the Forastero is a round fruit. They are green and orange when ripe, the seeds are big and brown . They represents only 1% of the world production because it is really fragile and sensitive to disease.

Forastero from Amazonia, has purple seeds and green fruits, yellow when ripe. It represents 80% of the world's production

Trinitario is an hybrid from the first two types and was first grown in Trinidad. The fruit are red and orange when ripe. It combines the special flavour of Criollo and the resistance of Forastero. It represent almost 20% of the world cacao production.

Cacao Trees at Jiwa Damai

At Jiwa Damai we inherited 27 cacao trees with age unknown. According to the story of the place and the size of the trees we determined the age of the trees between 15 to 20 years old.

They produce from 20 to 40 fruits but are all infected by the Phytophthora spp fungus which carries the Black Pod disease. The purpose now is to rehabilitate the cacao plantation, curing the old trees and/or planting new ones.

To rehabilitate the cacao plantation we need to know more about the disease and how to establish healthy plants.

The Black Pod Fungi

IS A NAME FOR A COMBINATION OF FUNGI EFFECTING PRIMARELY THE CACAO TREES. THE TREES CAN BE AFFECTED BY ONE OR MORE OF THE FUNGI MENTIONED BELOW. ITS GENERAL NAME IS BLACK POD

The black pod is caused by the Phytophthora spp, a fungus species identified in 1917 by Butler and it spreads really fast.

Seven fungi were identified as the cause for the black pod :

Phytophthora palmivora located in tropical and sub-tropical areas. It is found in nearly every tropical country.

Phytophthora megakarya was identified in the Ivory Coast. It is found only in West- and Central Africa.

Phytophthora capsici can be found in tropical and sub-tropical areas. It affects plants sensitive to mildew and the cacao plant.

Phytophthora citrophthora is located in tropical and sub-tropical area. It affects the citrus. It has also been detected in black pod cases in Brazil and Indonesia.

The following fungi cause Black pod but are described as insignificant.

Phytophthora heveae affects mostly the hevea tree, Brazil nuts, avocado, mango and guava tree. It has been detected on cacao trees in Malaysia but its effects are insignificant.

Phytophthora katsurae affects mainly the coconut tree. It has been detected on cacao trees at the Ivory Coast.

Phytophthora megasperma is located in temperate and sub-tropical areas. It is found in Venezuela.

Description of Disease

Symptoms

All above named fungi affect the cacao fruit the same way.

Two days after the infection of the tree, small translucent spots on the fruit appear which turn quickly brown and then dark. At first these spots are small and translucent, then the color changes quickly into brown and dark.

14 days later, the fruit is completely covered, the external and internal tissue turns black and the seeds dry out and form a mummified fruit. A strong poisonous smell is emitted from the fruit.

After 14 days spores appear as a white/yellow layer which grow thicker as the disease intensifies.

The fungus also affects the trunk, stems, suckers (branches which don't provide fruit) and flowers. The infection causes necrosis (small cavities excreting red fluid) around the trunk and a fast death of the tree (those symptoms can also be caused by other diseases)

NB : The only way to know which variety of fungus attacks the tree is through laboratory analysis.

Propagation

The mummified fruit are the main source of infection for *Phytophthora palmivora*. The fungus can attack at any time, from the young tree to the adult tree, the disease can appear on the stem, flower, fruit or trunk.

One fruit can produce 4 millions structures which produce spores.

The spores are dispersed by rain (hydrochory), wind (allochory), insects (entomochory) or animals (zoochory) and infect the soil or travel through the air to other cacao trees. This fungus needs water to spread from the infected source. Humid conditions promote fast spreading of the disease. *Phytophthora palmivora* can survive 10 months in an infected fruit after it fell from the tree (it depends on the soil cover).

The main source of *Phytophthora megakarya* is through the soil. When rain is falling, the drops hit the ground and spray spores to the

plants around. Once in the leaves the fungus can survive in necrosis. It can survive in an infected waste at least for 18 months.

NB : humans can also spread the disease through contaminated harvest, unclean tools, shoes or clothes.

Reducing the parasite

There are three main strategies to deal with the fungus ; through farming methods, using chemicals, and the biological approach.

Since Jiwa Damai is an organic garden we will not discuss here the chemicals used, which damage the environment and are dangerous for human health.

Farming Methods

Using proper farming methods to grow cacao tree will not eliminate the disease but will reduce considerably the increase of the disease. The purpose is to create an unfavourable environment for the fungus.

This entails : using resistant plant varieties which are resistant to the parasite. This seems to be the best , to plant those varieties seems to be the best approach, however it might be quite costly.

Identify a healthy trees in an infected plantation to select seeds for new planting. Make sure to use only seeds from a healthy tree.

To reduce humidity and increase the air flow. Trees have to be well space from each other (maximum 1320 trees/ha).

Remove weeds, especially during rainy season.

To reduce insect attack, thin out the forest cover but avoid creating holes in the forest cover in order to not expose the soil to bug infestation (Miridae)

To reduce the propagation of the parasite, a good mulching can reduce germs resulting from splashing water.

Intensify field inspection during the rainy season, after 2-3 days raining look for the spot on the fruit and remove them before they turn brown.

Remove the infected trees with precaution.

Make a sanitary harvest, remove all the infected fruit and harvest the ripe healthy fruits.

To have strong and healthy trees, spread a generous amount of compost around the trees to restore the nutrients in the soil.

Cut the suckers and the parasitic plant which is using the trees energy thus allowing the tree and fruit to grow strong.

Biological Approach

The use of fungus, bacteria and others micro-organism is still experimental and those products might be hard to find as they are not produced in commercial quantities. However, some tests have been done with the fungus *Trichoderma* spp. It has been shown in laboratory tests that this antagonist can take the place of *Phytophthora* spp and has no negative effect on the cacao trees.

In Jiwa Damai we try to use those natural methods to rehabilitate our cacao plantation. However as the cacao tree reaches a certain age, they are really sensitive to disease and it is more and more difficult to remove it.

Our trees are already old, and we began a cacao tree nursery ; we planted 30 cacao seeds two months ago and 27 plants have grown out of the seeds. Half of them will be kept in the nursery for 3 more months while the other half will be planted next month as an experiment.

The follow up article will be on how to create a cacao nursery and the growing process.

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