Cacao
(Theobroma cacao Linnaeus)
FOREWORD

Cacao is one of the fruit trees that has a big potent in both local and international markets. Its scientific name *Theobroma cacao* L. which means “food for the Gods” in Greek. It is one of the 22 species of Theobroma. The species is very popular worldwide primarily because it is being used as raw material for chocolate production. It is also being utilized in the preparation of cosmetic and pharmaceutical products.

Cacao is an exotic species but it thrives well in the country because it is an equatorial crop. It can be observed that all cacao producing regions are situated within 20 degrees north and south of the equator referred to as “Cocoa Belt”.

Some experts believe that the success of the National Greening Program (NGP) can be achieved through agroforest hence, in the implementation of the NGP, it aims to plant an equal number of forest trees and multi-purpose trees such as fruit trees and plantation crops. Cacao is among the perennial crops that can be used for intercropping, similar to coconut, coffee, abaca, pili, nangka, cashew, tamarind and other fruit trees. Thus, there must be sustainable production of cacao in the country.

The information provided in this brochure will be of great help to interested farmers, farm investors, and other enthusiasts in supporting the plantation and production of cacao in the country.

HENRY A. ADORNADO, Ph.
Acting Director, ERDB
## SPECIES

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**Cacao**

(*Theobroma cacao* Linnaeus)

Compiled by

MARITA W. BRIZ
Common Names: Cacao, cocoa, chocolate tree, chocolate nut, food of the gods

Local Names: Kakaw (Tagalog); Cacao plant (English)

Scientific Name: Theobroma cacao Linnaeus or Theobroma cacao L.

The generic name *Theobroma* was derived from the Greek, θεός (theos), meaning “god,” and βρῶμα (broma), meaning “food.” *Theobroma* means “food of the gods.” While the specific name cacao is derived from the Nahuatl (Aztec language) word xocolatl, from xococ (bitter) and atl (water).

The species scientific name *Theobroma cacao* was named by the Swedish botanist Carl Linnaeus in 1753.

Scientific Classification:
- **Kingdom**: Plantae - Plants
- **Subkingdom**: Tracheobionta - Vascular plants
- **Superdivision**: Spermatophyta – Seed plants
- **Division**: Magnoliophyta – Flowering plants
- **Class**: Magnoliopsida – Dicotyledons
- **Subclass**: Dilleniidae
- **Order**: Malvales
- **Family**: Sterculiaceae - Cacao family
- **Genus**: Theobroma L. - Theobroma
- **Species**: Theobroma cacao L. - Cacao

(Source: National Plant Database. 2004)
Description

The Cacao tree is a shade tolerant, moisture loving, understory rainforest tree. It is a small evergreen tree about 4 to 9 m high tall. The leaves are simple light to dark green, petiolate, lanceolate in shape and smooth on both sides measuring around 4-8 inches long. The flowers are very small, clustered, whitish with reddish tint and have no scent. The fruits are pods measuring around 5-10 inches long and 2-3 inches in diameter with hard shells that are smooth or rigged, elongated or rounded which may be red, yellow, orange or brownish-yellow to purple. The fruits grow on the trunk or on the branches of the tree. The seeds are large, round, white or pale purple. Around 20 to 50 seeds also called “cocoa beans” are enclosed within each fruit. Each seed is coated with a cream sweet-sour, juicy delicious pulp. It has a smooth and brownish bark and has white and light wood.

Accordingly, there are 20 known varieties of cacao and hundreds of hybrids. However, for chocolate making, there are only 4 types/varieties of cacao trees that are being cultivated.

a. Forastero (“foreign”)

This is a commercial variety. It has green pods which turn yellow when ripe. It is melon-shaped with round end having smooth, inconspicuous ridges or furrow. It has flat and purple beans when it is fresh with harsh flavor and bitter taste. It is commonly grown variety which is resistant to pests and diseases. It also grows faster and produces higher yield compared to other varieties. This is mainly cultivated in Africa and also in Central and South America. It constitutes about 80% of cacao production worldwide.

b. Criollo (“of the new world”)

This variety is considered the best in terms of flavor and aroma. It is less bitter and more aromatic compared to other beans. It is the most prized, rare, and produces the highest quality chocolate. However, it is low yielding and susceptible to many diseases. It has red or yellow pods, thin wall which is pointed or warty on the surface. It has large and plump beans with white or pale purple cotyledons. Criollo is usually found in northern South America and Central America. It has three (3) recognized varieties: the Venezuela, Nicaragua and Trinidad.

c. Trinitario (“from Trinidad”)

It is a cross breed of Forastero and Criollo cacao in Trinidad around 1730. It is hardy and has good quality fruits. This variety is mostly grown in Central and South America and Asia. It has the aroma of Criollo while its productivity and resistance to pest and diseases characteristics are from Forastero. Chocolate production, from this variety is also considered as high quality.

d. Nacional (also known as “Arriba Nacional Cacao”)

This variety is mainly cultivated in South America west of the Andes. It has an excellent aroma, however it is difficult to grow and prone to diseases. It is also a form of criollo.

Uses

Cacao is primarily grown for chocolate production. The beans are commonly processed into chocolate drink, cake powder, butter, chocolate paste, chocolate bars, candies and
confectioneries. It is used as flavoring for pastries and ice cream. It is also being utilized as raw material for cosmetics and pharmaceutical products.

The pulpy flesh of cacao is also edible. It is used as digestive enzyme tincture as it contains enzymes protease, invertase, raffinase and oxydase. Cacao seeds contain around 2% of alkaloid theobromine, known as central nervous system stimulant. Theobromine is being used as diuretic. It helps dilate the blood vessels thus lowers blood pressure. Dry cacao seeds may also contain around 12-18% cocoa polyphenols or cocoa flavonoids. The polyphenols in cacao are mostly epicatechin and catechin but there are also other catechins and quercetin. The flavonoids in cocoa have potent antioxidant which can scavenge free radicals that can inhibit the oxidation of Low-density lipoprotein. They also have anti-inflammatory effect.

Nutritional value

The Nutritional composition of Cacao per 100 g cocoa powder:

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount (g)</th>
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<tbody>
<tr>
<td>Carbohydrate</td>
<td>16.5</td>
</tr>
<tr>
<td>Protein</td>
<td>21.5</td>
</tr>
<tr>
<td>Fat</td>
<td>11</td>
</tr>
<tr>
<td>Dietary fiber</td>
<td>34</td>
</tr>
<tr>
<td>Polyphenols</td>
<td>7-18</td>
</tr>
<tr>
<td>Theobromine</td>
<td>2.5</td>
</tr>
<tr>
<td>Caffeine</td>
<td>0.1</td>
</tr>
<tr>
<td>Pottasium</td>
<td>2.0</td>
</tr>
<tr>
<td>Calcium</td>
<td>150 mg</td>
</tr>
<tr>
<td>Magnesium</td>
<td>550 mg</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>700 mg</td>
</tr>
</tbody>
</table>

SOURCE: http://www.montosogardens.com/theobroma_cacao.htm

Origin and Distribution

Theobroma cacao L. is native to the American tropical rainforest. The tree originated in clumps along riverbanks in the Amazon basin situated on the eastern equatorial slopes of the Andes. It can be found in the tropics in a band between 10 to 20° north and south of the equator, termed as the “Cocoa belt”. It has been widely distributed throughout the humid tropics. The major area of commercial production is in Côte d'Ivoire, Ghana, Indonesia, Nigeria, Brazil and Cameroon. It is also cultivated throughout the Philippines.

Site Requirements

The species can adapt to a humid tropical climate. It grows well in fertile, well drained soils. It is suited in clay loam soil of good structure and rich in organic matter. It grows best under light shade but can also thrive in full sunlight but with ample amount of soil moisture. In its natural habitat, it is usually found under a forest understory tree at altitudes up to 900m above sea level, though it thrives best in areas with an elevation of 600 m asl with a mean annual rainfall of around 100 to 200 cm. However, the ideal pH is 6.0 to 7.0. It requires a temperature of around 22 to 32°C and a relative humidity of 80%.

Propagation

Seed Technology

The species is commonly propagated by seeds. Seeds can easily germinate as soon as the fruit ripens, but can loss their viability once they dry out. Germination occurs around 5 to 10 days. The seed
should be placed in a bamboo basket for a day to soften the mucilage embedded on the seed coat. The mucilage should be removed by rolling the seeds in dry soil or in ash or it can also be rubbed with sawdust and wash with water. Then, the cleaned seeds should be spread on wet sack under shade to keep moist. When the radicle breaks through the seed coat, it can now be planted in polyethylene bags or in seed bed. Sow seeds horizontally with the raceme pointing downward. The newly planted seeds will then be placed in a nursery. Watering should be done regularly. Transplanting will be done 6 to 8 months after sowing or when the seedlings have 4 to 6 pairs of leaves.

Establishment of Shade Crops

Newly planted cocoa trees require 75% shade during their first year and 50% shade in their second year. After that, the pod bearing cocoa trees only need around 25% density of direct sunlight for the rest of its life span.

Permanent shade crops that are ideal to intercrop with cacao trees should have a thin canopy, tall trunk and those that do not defoliate seasonally. Some of the trees that are suitable as cacao intercrop are coconut, cashew, durian, longan, mango and mangosteen. Both cacao and shade trees should be planted with a spacing of 6 x 3 m.

Pollination

Unlike many flowers in the world which are pollinated by bees (Hymenoptera) or butterflies and moth (Lepidoptera), cacao flowers are pollinated by tiny flies called Forcipomyia midges belonging to Diptera. Cacao trees bear fruit and have flowers at the same time. Gnat-like insects and bats pollinate the white flowers early in the morning. If the flowers are not pollinated, they die within 24 hours. Only 3 out of 1,000 flowers in a cultivated tree progress from pollination to fruit; it takes from five to eight months for a bud to produce ripe fruit.
Cacao clones may be self-incompatible. In this case, cross pollination to set fruits is needed. Hand pollination is also necessary if pollinating insects are absent. It should be done early in the morning, using two different trees for cross pollination. Fruit development takes 120-150 days from pollination to maturity.

**Plantation Establishment**

Site preparation should be done before planting.

**Planting**

Prior to transplanting, the holes should be filled with top soil mixed with 14-14-14 fertilizer at a rate of 250g per hole. The hole should be big enough to accommodate the ball of the seedlings. The regular size of the hole is 30 cm wide x 30 cm long and 30 cm deep. After planting, cover the root of the seedlings lightly with soil. Planting should be done during early morning or late afternoon at the onset of the rainy season.

**Weeding and mulching**

Weeding is done within the radius of the lateral branches of the species. Mulch around the base of the tree lessens the frequency of weeding. Cut weeds and other farm residues can be utilized as mulch.

**Pruning**

Pruning is done to increase the production of cacao and to reduce and eliminate pest and diseases infestation. Pruning should be done regularly. However, the best time to conduct heavy pruning is after the high production cycle, approximately one month before the rainy season. Fertilizer application is recommended after pruning.

**Harvesting**

The species usually bear fruit on its 4th to 5th year after transplanting. The pods can be harvested 170 days after fruit setting. Ripe pods can be harvested every 3-4 weeks.

**Pest and Disease Management**

In the Philippines, the most common pest is the Black pod. Other pests include Cacao pod borer, vascular streak dieback, *Helopetes* and cacao stem borer.

1. **Black Pod Rot** (caused by *Phytophthora palmivora*)
   - Harvest frequently to avoid pathogen sporulation;
   - Harvest, destroy and bury all the infested, dead and mummified pods;
   - Prune the cacao trees and shade trees to reduce humidity;
   - Provide good drainage system so that the spores cannot spread in puddles of water;
   - Trees that have died due to tree canker should be cut down and destroyed;
   - Scrape off the bark from the infected area and put paint or soap on it.

2. **Cacao Pod Borer** (*Conopormorpha cramerella*)
   - Regular harvesting or weekly harvesting of all ripe pods should be carried out to break the lifecycle of the pest;
   - Sanitation can be done by burying all empty cacao pod husks, and by removing all other diseased
pods, black pods, and pods eaten by animals from the trees;
• Pruning can also be done to increase the sunlight, which eliminate the pest;
• Bagging or sleeving of the young pods using newspaper and stapler or plastic bag could also be done;
• Apply fertilizer to increase the general health of the tree as well as to increase cacao production.

3. Vascular Streak Dieback (caused by Oncobasidium theobromae)
• Sanitation pruning is done by cutting off the infected branches at 30 cm below the infected area, then burn the infested cuttings;
• Nurseries should have polyethylene roofing to protect the seedlings from spores;
• Shade on the cacao trees should be reduced to lower humidity;

4. Plant Vascular Streak Dieback (VSD) tolerant varieties

5. Helopeltis (a sap-sucking bud)

Helopeltis prefers open canopies and sunlight. But still pruning is necessary to cacao trees for better visibility of the disease so as to apply control methods. General sanitation of farm or plantation is needed as well as regular harvesting.

6. Stem Borer (Zeuzera)
• Cut off infested branches at 40 cm below the lowest larvae hole;
• After the pruning of infested tree, big branches, especially those with stem borer holes, should be burned;
• The hole can be also covered or plugged with mud or wood to prevent the larva to hatch;
• Poke the larvae out with a piece of wire;
• Spray some soap solution in the exit hole so the larva will emerge from the hole due to unpleasant soap fume then kill the Stem Borer.
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http://en.wikipedia.org/wiki/Theobroma_cacao# Taxonomy_and_nomenclature


http://www.montosogardens.com/theobroma_cacao.html


www.xocoatl.org/tree.htm Cached
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