



# **Chontaduro**

## ***Bactris gasipaes* (Kunth)**

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## Introduction

*Bactris gasipaes* or more commonly known as peach palm or pejobaye, a tropical spiked palm in the palm family Aracacea, one of only a handful couple of palatable palms in its variety of around 50 species. A quickly developing, erect palm, it achieves a develop stature of up to 20 m (60 feet) in 8-12 years, getting to be hard to climb since a significant part of the storage compartment is ringed with sharp spines. A solitary palm can develop different stems creating numerous groups of 50-300 drupe natural products, each bunch weighing around 25 pounds (11 kg). The individual ovoid-funnel shaped molded organic products have a red or yellow external layer (exocarp) and orange internal tissue (mesocarp) and are variable in measure, developing to around 400 g (0.9 pounds) with a little hard seed (endocarp).

*Bactris gasipaes* develops particularly along waterways 1800 m (6000 feet) in rise on the edges of generally sticky woodlands in its local starting point: Amazonian Columbia, Ecuador, Peru and Brazil. The most essential palm for Pre-Columbians, it was brought into Costa Rica before 2300 BC, where it naturalized. It is developed in Central and South America, and furthermore in Southern Florida, parts of the Caribbean and the Philippines. It's monetary significance is expanding, particularly as palmetto (palm heart); the lower quality types work for, flour and oils, and are progressively being sent out around the world more and more. A example of this is perfectly seen in Cali, Colombia where this plant makes part of the lower classes economy in which small cultivators of the plant sell it all over the city as snacks. A young colombian entrepreneur even started his own peach palm chip company, which is a great healthy snack.

Indigenous individuals utilized all aspects of this tree: the seeds were cooked and eaten like chestnuts, the organic product bubbled for human utilization and sustained to animals; the natural product was additionally aged into mixed beverages. The palm's solid, adaptable wood functioned admirably to build and making lances, bows and bolts; its sharp external stem was in some cases hung around chicken houses to stop predators, or despined strips were molded into beds. The dietary palm heart was expended; sap removed from the storage compartment to age

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into a strong drink; youthful blooms eaten, leaves woven into containers and utilized for covering rooftops, and roots ground for restorative purposes.

## Chapter 2: Ecology

### 2.1 Distributional Context

#### 2.1.1 Affinities

The Chontaduro, Peach Palm, or Pejibaye *Bactris gasipaes* is part of the *Areceaceae* *Palmae* family. This tropical palm is one of the 50 edible palm species in its genus (Campbell, 2013). Peach palm is a multi-purpose palm tree providing edible fruits and palm heart which is in its core. It could be considered the most important domesticated palm species of the Neotropics.

Cultivated populations can be divided on the basis of phenotypic and genetic diversity into (a) two western populations (i. Central America, Colombian inter-Andean valleys and Pacific lowlands in Colombia and Ecuador; ii. inter- Andean valleys in Venezuela) and (b) two eastern populations (i. upper Amazon and ii. eastern Amazon) (Mora-Urp'í et al. 1997; Rodrigues et al. 2004; Hernández-Ugalde et al. 2008).

In general, landraces from the western group have harder stems, more abundant and stronger spines, larger leaves and more solid rooting in their juvenile phase (Mora-Urp'í et al. 1997). The wild form can be further subdivided into three types based on taxonomic differences: type I of the southern Amazon; type II of northeast Colombia and northwest Venezuela; and type III of the Tropical Andes, southwest Amazon and Central America (Henderson 2000; Clement et al. 2009). Cultivated peach palm for fruit production is managed traditionally for subsistence production. Farmers typically sow it at low plant density (3-20 plants/ ha) in their gardens and swidden agroforestry systems (Clement 1989; Potters 1997) but in modern agriculture it is planted at 400-500 plants/ha for fruit and 3000 to 20 000 plants for heart-of-palm. Peach palm is perennial for both fruit and heart-of-palm production. Cutting the main stem and offshoots for heart- of-palm does not kill the plant, but instead allows preformed buds to develop into new offshoots.

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Table 1. Names given to *Bactris gasipaes* in various countries in South America

Costa Rica	Trinidad	Panama	Colombia	Venezuela	Bolivia	Peru	Surinam	French Guiana	Brazil
Pejivale	Peachnut, Pewanha	Piva	Cachipay, Chichagai, Chonta, Choritadura, Chenga, Jijirre, Pipire, Pirijao, Tenga	Bobi, Cachipay, Melocoton, Pachigaro, Pariguayo, Pixabay	Comer, Chonta, Tempe	Chonta Ruru, Pijuayo, Sara-Pijuayo, Pisho-Guayo	Amana	Parepon	Popunha

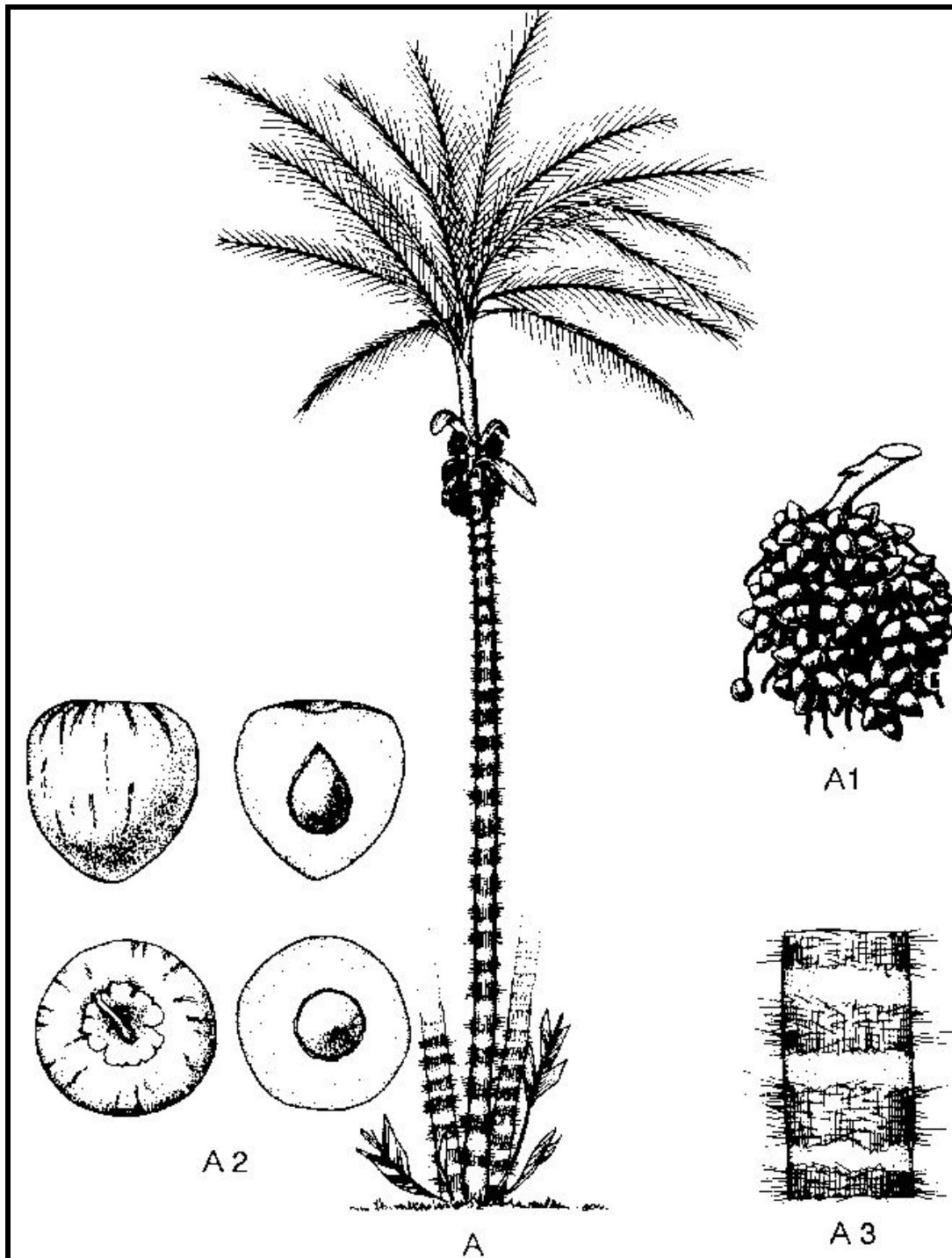


Figure 1. Main characteristics of a peach palm; A1 the huge branch of fruits that a palm produce that can have from 50-300 individual fruits. A2 the triangular fruit with a starchy outside and a hard black seed in the middle. A3 the characteristics spines on the palms stem to avoid animals from climbing to its top.(FAO 1989)





Figure 2. Mature fruit bunches of cultivated peach palm accessions with different country origin; Costa Rica, Trinidad, Panamá, Colombia, Venezuela, and Bolivia. Conserved in the peach palm genebank collection of the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE)

in Costa Rica (Photos courtesy Xavier Scheldeman and Jesus Salcedo)

### 2.1.2 Origin

Peach palm was commonly cultivated and used in tropical Latin America during pre-Columbian times in the 15 century; chronicles have recorded more than 300 different indigenous names for the fruit since the European invasion (Patiño 2000). Peach palm can be subdivided into the cultivated variety, *B. gasipaes* Kunth var. *gasipaes*, and the wild form *B. gasipaes* Kunth var. *chichagui* (H. Karsten) (Henderson 2000). Phylogenetic studies of chloroplast and nuclear DNA polymorphism in species from the *Bactris* clade have confirmed a close relationship between cultivated and wild peach palm accessions (Couvreur et al. 2007).

### 2.1.3 Present distribution

Peach palm is a predominantly an outcrossing species, though self-fertilization has also been observed (Mora-Urpí et al. 1997). Pollination is carried out mainly by insects, particularly small curculionid beetles over distances between 100 and 500 m; wind and gravity can also function as pollen vectors (Mora-Urpí et al. 1997; Clement et al. 2009). Since peach palm is a long-lived perennial and a predominantly outcrossing species, one can expect its populations and landraces to contain high levels of genetic diversity (Hamrick and Godt 1996; Mora-Urpí et al. 1997). In addition, extensive human dispersal up to a distance of 600 km has further stimulated gene flow and low differentiation (Cole et al. 2007).

## 2.2 Environmental Factors in Distribution

### 2.2.1 Elevation and Climate

The widespread cultivation of peach palm in the Americas reflect its capacity to adapt to a wide range of ecological conditions in the tropics and subtropics. It is usually grown on deep, well-drained soils in areas below 800 m elevation, with an annual precipitation of between 2,000–5,000 mm and an annual mean temperature above 24 °C (Mora-Urpí et al. 1997). Peach palm is occasionally found at higher altitudes of up to 1,800 m , as is the case in Colombia's Cauca region, in the Valle del Cauca (El Tambo).

### 2.2.2 Geology & soils

It delivers generally well on low richness soils, exceptionally dissolved laterites with half aluminum-immersed corrosive soils following the cut and-consume of essential or auxiliary woodland, however generation diminishes in the long haul without extra supplement inputs. It doesn't endure waterlogged soils. It can withstand generally short dry seasons (3-4 months) if soils are not too much sandy, but rather dry seasons fundamentally lessen development and yield. Cooperative relationship with vesicular-arbuscular mycorrhizae enhance development (Janos 1977; Ruíz 1993), particularly on aluminum-soaked soils, and are frequently basic for ordinary improvement (Clement and Habte 1995). Wild people are for the most part scattered and moderately confined, or happen at low thickness in little fixes. Broad normal stands of wild peach palm have not been accounted for. Peach palm becomes quickly under ideal conditions (Postma and Verheij 1994). Seedlings grow gradually under woodland shade conditions and develop plants require full daylight for ideal generation of blooms, products of the soil. A photoperiod impact which is the plants response to the measure of sunlight has not been seen on the blooming.





Figure 4. Normally the peach palms grow 2-3 meters apart due to need of direct sunlight for greatest production.

## 2.3 Vegetation Component

### 2.3.1 Interactions & Effects

It creates moderately well on low-fruitfulness soils, profoundly dissolved laterites with half aluminum-soaked corrosive soils following the optional woodland, yet generation diminishes in the long haul without extra supplement inputs. It doesn't endure waterlogged soils. It can withstand moderately short dry seasons (3-4 months) if soils are not unnecessarily sandy, but rather dry seasons essentially decrease development and yield. (Janos 1977; Ruíz 1993), particularly on aluminum-soaked soils, that are frequently basic for ordinary advancement (Clement and Habte 1995). Wild peach palm (subsp. *speciosa*) happens in bothered regular biological systems, basically along waterway quaint little inns essential woods gaps,(subsp. *utilis*).

## Chapter 3: Biology

### 3.1 Life Cycle and Phenology

### 3.2 Life Cycle

Peach palm generally begins flowering between 3-5 years, and may produce annual fruit crops for 50-70 years(Overbeek 1990).The palm can produce 1 year a very high production rate and then the next 1-2 years a decrease in production(J.M . Perez ,1997) This depends directly to the climate altering the plants system.



Figure 5. Young *Bactris gasipaes*

### 3.3 Phenology

#### 3.3.1 Flowering and Fruiting

In the Amazon basin flowering season is from October-December and the harvesting season is from January-April. Fruits mature in 3-4 months but not all are ready at the same(J.M . Perez 1997).



Figure 6. Green coloration shows ripening fruit ready in about 1-2 months(Popovkin 2008)

#### 3.3.2 Year to Year variation in flowering and fruiting

More often than not there are two harvests amid the time of a year, a bigger product and a littler yield which are around a half year apart(Mora-Urpi 1984). The littler yield more often than not originates from plants that created close to nothing or nothing in the past crop;this edit cycle changes every year relying upon particular aspects.The distinctive viewpoints are, for example, Rainfall patterns,soils, and landrace.There are varieties in blossoming and fruiting phenology,due



to genotypic and nutritious states of the plant. As the Inflorescences develop on the stem, not all the natural product branches can be collected at the time (J.M. Perez 1997).



Figure 7. Peach Palm Inflorescences (Popovkin 2008)

### 3.4 Reproductive Biology

#### 3.4.1 Pollen

Peach palm individuals in nature are usually scattered apart, so the pollen gene flow is rather limited and local to the area. The dispersal of the pollen in this area is done by small

mammals, insects, and wind due to this the breeding populations are normally small and genetically isolated from others which creates a wide spectrum of variation (Miranda and Clement 1990). Thanks to that there is a big quantity to collect and conserve for investigation.

### 3.5 Sexuality

*Bactris gasipaes* is dominantly allogamous, which implies that it cross-composts with different plants this is because of the plant having separate pistillate and staminate blossoms and protogynous advancement. Self-preparation may happen, in any case, and permit some disengaged plants in the wild to replicate. Selfing is managed by a hereditary contrariness mechanism (Mora-Urpi and Solis 1980), this makes an impressive variety in self-richness in plants. 0-88% self-ripeness among plants, in view of seed set after on controlled gathering in Manaus, Brazil (Clement and Arkcoll 1984). Due to the conceptive science and different components, peach palm might be organized hereditarily into different subpopulations in the wild (Clement 1988-1989).

#### 3.5.1 Anthesis & 3.5.2 Fruit Development and Seed Set

The internal temperature ascents of the unopened inflorescences rises step by step and , late toward the evening of the 1 day, causes an opening of the peduncular bract and uncovered the responsive female flowers (Schroeder 1978). Female anthesis starts right then and there, unfertilized blossoms stay responsive for over 24 hours.

On the 2 day male anthesis begins and that is the point at which the seed set starts, male blossoms release their dust in 15-30 minutes, showering inflorescences and going by creepy crawlies, at that point the bloom abscise. Dust from the 2 day may likewise fall on unfertilized marks of shame inside similar inflorescences or might be blown to neighbors inflorescences with open blooms on the 3 day (Mora-Urpi 1982).





Figure 8. Bee with pollen attached ready to propagate it

### 3.6 Pollination and Potential Pollinators

Insects are the main pollen vectors, but pollen dispersal also occurs via wind and gravity (Mora-Urpí 1982). Fruits and seeds are naturally dispersed within short distances, principally by birds and rodents and occasionally by water. The pollination cycle lasts 3 days (Mora-Urpí and Solís 1980).

### 3.7 Ecophysiology

Peach palm is most productive in deep, fertile, and well drained soils (Figure 9, below) at low to medium altitudes (0-800 m) abundant rainfall is preferred (2000-5000 mm/year) and temperatures above 24 degrees Celsius. This plant will not do well and most possible produce none or very little if in waterlogged soils, or if the soil is very sandy and there is a 3-4 month dry season. For stable production nutrient inputs must be done do not affect plants organism (Clement and Urpi 1995).



Figure 9. Well drained, crumbly, dark soil ideal for peach palm

## 4.0 Propagation and Management

### 4.1 Propagation

Pejibaye might be engendered by seed or suckers. Organic product nature of pejibaye proliferated by seed differs generally. Unrivalled plants must be spread by suckers. Pejibaye seeds take 60 to 90 days to develop. Preceding planting altogether wash the seed and dunk it into a fungicide to anticipate seed-decaying parasites. Somewhat cover the seed in an all around depleted media, cover the holder with a plastic sack to expand the relative mugginess, and place the compartment in a warm however shaded area. Well-developed seedlings will be prepared for planting out-of-entryways following a half year. Seedlings develop quickly, and following 21 to 27 months or progressively the storage compartment starts to frame. Under positive climatic and social conditions the palm has 15 to 25 takes off. Seedling trees may start to manage natural product following 3 to 4 years. (Crane, Jonathan H. 2006)

### 4.2 Management

For this plant it is important to take in consideration all the aspects already mentioned in this article, to successfully plant and grow Peach Palm best. Aspects to take in account go from; Tending, Pest and disease control, up to Ecophysiology.

### 4.3 Tending

Proper planting is super important for successfully growing a strong, productive tree. The first step is to choose a healthy nursery tree, which is going to be the startup. Make sure the area of planting is even and has proper soil. Pejibaye palm trees need about 4-6 inches (10.2-15.2 cm) of water per month for normal growth and production. Inspect the tree for insect pests and diseases and inspect the trunk of the tree for wounds and constrictions. Watering it regularly is key, and when leaves are brown they should be cut down.

#### 4.4 Fruiting

The eatable natural product hangs in bunches of 50 to 300 foods grown from the ground weight 25 lbs (11.4 kg). There might be up to 5 groups of natural product on a plant at any given moment. The time from blooming to natural product collect is around 8 to 9 months. The organic product is a drupe and is yellow to orange to red or caramel, turning purplish when completely ready. The natural product might be oval or cycle, 1 to 2 creeps in breadth, with a 3-pointed calyx at the stem end. The peel is thin. The mash might be yellow to light-orange, sweet, dry and coarse, organic product more often than not contain just 1 dark seed shut in a thin endocarp. Some natural product are seedless. (Crane, Jonathan H. 2006) There is by all accounts a misconception on the impacts of creepy crawly impregnated plastic packs in controlling the irritation weevils. A few creators prescribe a control of the weevils by covering the natural product packs with blue translucent plastic sacks without bug sprays.



Figure 10. Peach Palm fruit clusters

## 4.5 Flowering

The inflorescence appear from leaf axils, is enclosed in a spathe, and is composed of racemes 20-31 cm long. The racemes possess yellow male and female flowers; terminal flowers are all male. Flowers are mostly insect pollinated, and cross pollination among plants improves fruit set.(Crane, Jonathan H. 2006)

The peach-palm is a plant with male and female flowers mixed on the rachillae. It is also protogynous, since the female flowers are fertile as from the opening of the spathe and continue to be receptive for 24 hours. Anthesis of the male flowers occurs on the second day of the cycle.(Bermejo, Hernandez J.e. and Leon, J. 1994)

## 4.6 Pest and disease control

The trunk of pejibaye is susceptible to attack by *Phytophthora* algae. Leaves may be attacked by *Pestalotiopsis* sp., *Mycosphaerella* sp. and *Colletotrichum* sp. Fruit diseases are caused by *Monilia* sp. and *Ceratocystis* species. Insect pests include the sugar cane weevil (*Metamasius hemipterus*) and mites.(Crane, Jonathan H. 2006)

## 5. Marketing and Economy

### 5.1 Major Distributors

Due to environmental conditions and location, South America has the prime environment for the cultivation of peach palm. This creates a huge economic augment for the intern economy of the country, and even neighbour countries. Being the main producers, they have a huge demand for the fruit and the palm heart in countries with no correct conditions to grow their own. Some of these being; USA, Europe, and Asia.

### 5.2 Processing

Preparing of peach palm organic products isn't a major activity, agriculturists have had issues with deals since they have not formalized the procedure and products. Even however it hasn't generally achieved the market handled peach palm items are impressive potential for national and worldwide markets in which they are planted (Leakey 1999; Godoy et al. 2007). To understand the genuine potential the sustenance must be perceived by the business as evident requested items (Leakey 1999). Some confirmation recommends that red and less slick composes are ideal for jams and different uses and afterward more harmed or and stained ones are ideal for flour (Godoy et al. 2007). In Cali, Colombia, peach palm has accomplished to have an extraordinary nearness in markets, women in the roads have retires loaded with organic products prepared to be blended with salt and nectar for people on foot to purchase. Handled organic products are either vacuum pressed or canned as it is finished with the hearts. In Popayán, Colombia peach palm chips are sold in little bundles which for some is a long privately-run company. In spite of the fact that simply starting to enter standard markets, similar to each other item the chips have a probability to be a potential achievement.



### 5.3 Products

Heart-of-palm is developing into an important commercial crop, especially for the gourmet market. Fresh, dried and canned hearts-of-palm are being marketed for preparation of salads, soups, roasted chips and fillings. It is a good source of dietary fibre, and a moderate source of magnesium and iron. Commercially produced flour, prepared from fruit mesocarp, was recently introduced into the Costa Rican market for use in infant formula, baked goods, soups and other products. Canned fruits are being marketed in Costa Rica: these include whole or half fruits, either peeled or unpeeled, with or without the seed. (Jorge Mora- Urpi, John C. Weber, & Charles R. Clement, 1997)



Figure 11. Pejibaye flour is a great option to bake a different flavour pasta or cake.



Figure 12. It's said that peach palm has aphrodisiac characteristics, its one of the main ingredients in sexual aphrodisiac drinks.



Figure 13. Pickled fruit lets consumer chose their use in the kitchen, from eating alone to using in salads or as decoration.





Figure 14. Peach palm has an incredible flavor, creams and pastes are made for a wide variety of different recipes to give an extra touch of flavor.



Figure 15. Fried peach palm slices are a great snack somewhat similar to plantain chips. Figure 16. Hearts of palms are the inner trunk

## 5.4 Nutritional Value

Some devour peach palm in extraordinary amounts as a wellspring of vitality, despite the fact that it isn't that high in proteins and minerals (Leterme et al. 2005). The measure of oil and starch in each peach palm shifts depending of its particular area and species. Potassium, Selenium and chromium are the primary minerals it has, a kilogram of the natural product can have 16– 49 g of lysine, 8– 13 g of methionine, 19 g of cysteine, 27– 39 g of threonine and 4.5– 7 g of tryptophan (Leterme et al. 2005). The dryness in each natural product was unmistakably connected with its surface and the measure of protein and fat it has (Giraldo et al. 2009; Rodriguez et al. 2009). As opposed to that the measure of oil was altered to the dullness in the fruit (Leterme et al. 2005; Giraldo et al. 2009).

## 5.5 Animal Feed

An expected 40– 50 % of peach palm generation never achieves the market and is either bolstered to cultivate creatures or squandered (Clement et al. 2004). With low fiber and high starch content peach palm natural products are considered to hold extensive potential as a vivacious element of creature bolster, particularly as a substitute for maize (Clement 1990). Bland natural product assortments with low oil content are typically favored for creature nourishment (Leakey 1999). Caloric esteems acquired as evident metabolizable vitality (TME) show that peach palm has higher vitality content than maize and furthermore that it is pointless to isolate the seeds from the organic products in creature encourages (Zumbado and Murillo 1984), which speak to another alternative for increasing the value of second-quality natural products. Benavides (1994) found a blend of 60 % peach palm and 40 % coral bean (*Erythrina berteroana*) to be best to ensile. Coral bean foliage offered a protein-rich option, and the silage was high in absorbability. Another favorable position of ensiled peach palm natural products is that the compost of domesticated animals to which it is sustained can undoubtedly be returned as manure to the plants, along these lines shutting the supplement cycle in the creation framework (Clay and Clement 1993).

Peach palm organic products can be additionally handled with a focus on poultry, pigs, and angle and into multi-nourishing squares for dairy animals, goats, and sheep (Argüello 1999). In certain damp tropical districts, where grains don't yield well without significant measures of sources of info, prove recommends that creating creature nourish in light of peach palm could be less expensive than bringing in maize (Clay and Clement 1993). Information from the Brazilian Cerrados proposes that peach palm organic products could meet all or part of the caloric necessities of poultry, on a standard with millet or sorghum. The organic products are assessed to give 3,500 kcal kg<sup>-1</sup> of metabolizable vitality (Teixeira et al. 1996).

## 5.6 Other uses

Like other palms, the seed is rich in saturated fatty acids, and could be used to manufacture cosmetics and soap. Its wood is very useful all over the region for carpenters to make different types of furniture and other handicrafts (Clement 2006). Peach palm wood is very fibrous and hard which is great for some constructions (Patiño 1989).

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