



GATHERING COCOANUTS IN THE PHILIPPINES



EXTRACTING SAP FROM THE COCOANUT PALM

## Cutting the Cocoanut Cake

### The Growth of the Tree and the Preparation of Its Products

By May Tevis

WHEN a commercial enterprise pays big dividends the process of dividing the shares is known in common parlance as "cutting a melon." If the commercial importance of the cocoanut trade continues to expand as it has done during the last few years, cocoanut groves will undoubtedly become so valuable that the sharing of profits from them may come to be known as "cutting the cocoanut cake." One of the greatest industrial geniuses of modern times, the famous multi-millionaire soap boiler, Sir William Lever, now Lord Leverhulme, of Port Sunlight fame, declared in the foreword of a book published shortly prior to the war, "I know of no field of tropical agriculture that is so promising at the present moment as cocoanut planting and *I do not think in the whole world there is a promise of so lucrative an investment of time and money as in this industry.*"

The very title of the book in which these enthusiastic words are found, "Cocoanuts: The Consols of the East," (1913) indicates his belief that such property is as valuable a security as British Government Bonds. Such an investment, in fact, might be said to be even better than government bonds since its value steadily increases for a number of years. The reader, who has thought of the cocoanut chiefly as an agreeable ingredient of cakes and confections will be curious to know the basis of so sweeping a statement—a statement which is agreed with moreover by various other authorities upon the subject. The answer is to be found in the enormous and steadily increasing value of cocoanut products.

#### PRODUCTS OF THE COCOANUT TREE: *COCOS NUCIFERA*

The chief of these products are copra, coir, cocoanut butter and today. But these are not all, since it has been computed

that the cocoanut yields no less than 84 different products of value.

The cocoanut tree may be regarded, indeed, as one of man's most valuable servitors, so that there is little wonder that some native tribes worship it as a symbol of divinity. This magic tree furnishes its happy owner with not only food, drink, and wine, but with oil, vinegar, light, timber for the making of houses and furniture, and fiber for the making of textiles, cordage and fish nets.

Before describing the preparation of the four chief commercial products we may cast a glance at some of the minor products. The nut itself is largely used by confectioners, restaurateurs, vegetarian specialists and others, not only in the popular desiccated form, but in numerous other ways.

The copra residue, after the oil has been expressed, yields a splendid food cake for cattle, sheep and poultry, being exceptionally rich in oil, albuminoids and digestible carbohydrates.

The shell serves many ornamental and domestic purposes, being used in the making of drinking bowls, beads, dagger handles, hookahs, ladles, water dippers, combs, fish hooks, spoons, rubber tapping cups, gourds, linoleum and other articles too numerous to mention. It also makes a superior charcoal, used in filling gas masks.

The dust of coir fiber is worked up to make felt for use under carpets.

The stem is utilized for furniture, fancy articles, sailing boats, rafters, laths, etc. Hollowed-out stems are used as channels, gutters, etc., and are largely employed in building operations among the natives. The wood is also susceptible of

a high polish and, under the name of porcupine wood, is imported into this country for use in cabinet making.

The bark yields a strong, cohesive gum.

The husk makes valuable manure, rich in potash and phosphoric acid.

The leaves furnish excellent roofing material, mats, baskets, brooms, fodder for cattle, and manure. When burnt they produce an ash so rich in potash that it proves a good substitute for soap.

The nut, when young, supplies a delicious cooling drink and an attractive dessert. It is also an ingredient for curry.

The green husk makes a toothsome preserve.

The young leaves are used for making a piquant pickle.

The early shoots of the seedling form a delicious vegetable.

*Copra*.—Copra is the trade-name given to the kernel of the cocoanut after it has been dried, when it is quite white, possesses a pleasant smell, and breaks with a sharp, brittle fracture. The ideal article has been described as "that which yields a clear, white oil, free from fatty acid, pleasant and smooth to the taste, and having no pungent and acrid smell. The producers on the Malabar Coast, who have been established there for many years, have by dint of much devotion and energy succeeded in putting on the market an almost perfect product, even when prepared in bulk, almost wholly free from deleterious substances, which therefore rightly commands the keenest competition and the highest prices."

The process of drying the cocoanut is effected by one of four methods, which are: (1) In the sun; (2) in kilns; (3) in hot air chambers; (4) in rotary hot air appliances. The nuts are first husked and split open with a cutlass, and the milk is then poured out. The broken cocoanut is then divided into several pieces, from each of which the white kernel is extracted with a sharp knife, the pieces being spread out in trays, and, if the first process be adopted, exposed to the sun for a period of five to ten days, according to circumstances. In the old days the natives simply broke their cocoanuts in two and laid the halves on the ground on barbecues, or on drying racks and hurdles, with the kernel exposed to the

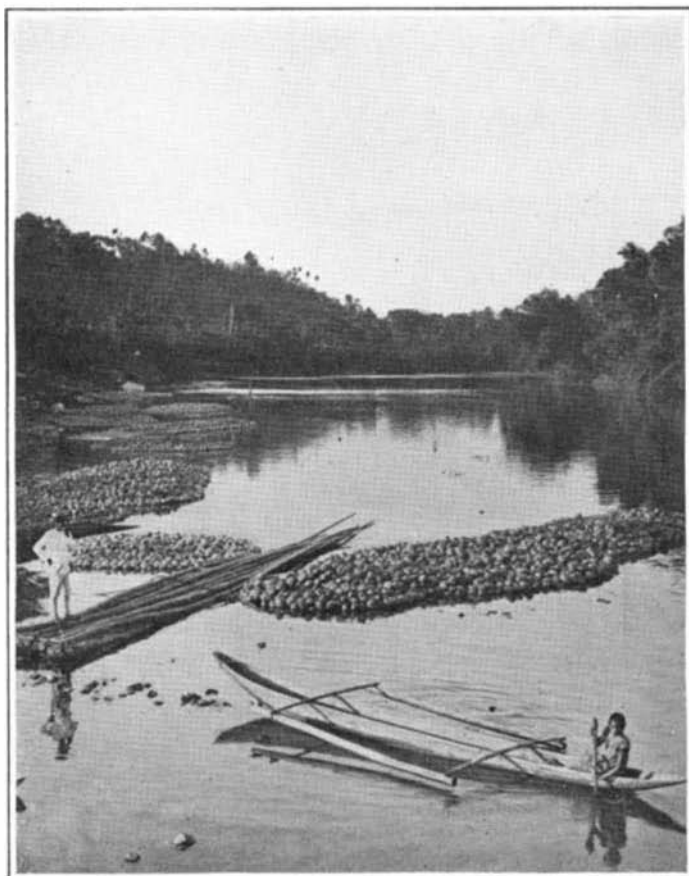
sun. But trays are now in general use, and these are frequently attached to shelter houses, into which they can be transferred at night, or when rain threatens.

Although sun-drying produces a good-looking copra, it usually leaves behind it from 6 to 20 per cent of moisture, which influences the development of mould, a defect that seriously diminishes the market price of the product. This mould is ascribed by some authorities to the fact that fermentation can take place during the slow process of sun-drying. Experiments conducted by experts have established the fact that to obtain a copra free from any tendency to develop mould the moisture retained must not exceed 5 per cent. The impossibility of being able to depend upon a continuance of brilliant sunshine throughout the entire period of preparation renders sun-drying an uncertain, expensive, time-wasting process as compared with more scientific and up-to-date methods.

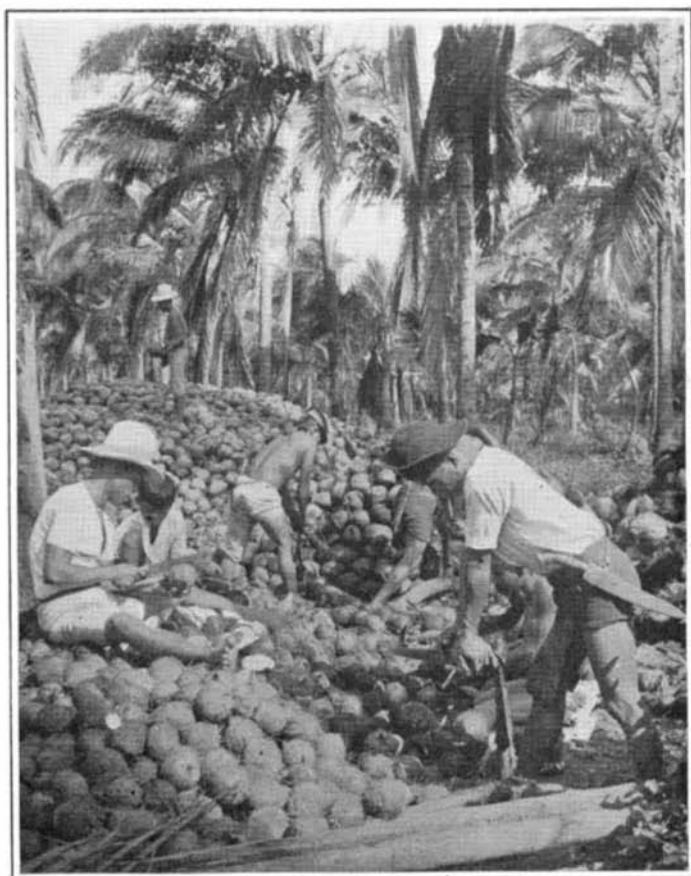
Generally speaking, in the Dutch East Indies the nut is gathered green and immediately cut into quarters by the natives by means of a sharp knife. Then it is exposed to the sun, on the beach or some other place, and it dries naturally, while retaining its white color. When dried the copra is placed in gunny bags for shipment. The work of drying, collecting and baling has long been almost entirely in the hands of the Japanese, who have demonstrated their superiority in this work.

At the drying stage women and children are employed to turn the copra and keep it well exposed to the sun. Living being cheap, consisting as it does mainly of fish and rice, the wages paid to these workers are extremely low.

*Cocoanut Oil or Butter*.—While copra can be used as a food and is so used by the natives, its great industrial value to the world is as a source of oil. For many years there has been a steady shrinkage throughout the world in the production of animal fats, whereas there has been a steady increase in population. This decrease in the available percentage of animal fats per capita was very marked even in the first 14 years of the present century. The Great War enormously increased this shortage of fats in three ways—the decrease



RAFTS OF COCOANUTS ON A PHILIPPINE RIVER



STRIPPING OFF THE HUSKS OF THE COCOANUTS

in production of oil bearing fruits and seeds, the increased consumption required in the feeding of armies since fats are an invaluable source of heat and nourishment for the human body, and finally, the enormous waste of fats involved in the manufacture of glycerine, the source of nitro-glycerine and other high explosives. At the present time the world is suffering from a fat famine, to which the present price of table butter bears melancholy witness even in the United States; but in the last few years coconut oil has come to be used upon a colossal scale in the manufacture of nut butter and other cooking fats, of soap, candles, cosmetics, glycerine, etc., as well as for lubricating and illuminating purposes. It is sometimes used also as a substitute for cod liver oil, being far more palatable than the latter, while likewise highly nutritious.

In former times coconut oil was extracted by very primitive native methods from the copra. Oil extraction is now, however, a factory rather than a plantation process. It involves two essential phases: First, the maceration of the copra, and second, the separation of the oil. The maceration is very perfect, consisting of grating or scraping and then of very thorough grinding. The oil is extracted by means of large and powerful hydraulic presses. In some cases there is first a cold pressure to produce oil of the best quantity, and afterward a pressure after treatment with hot water or steam; or the pulp may be squeezed both times after a preliminary heating to facilitate the removal of the oil. Oil expressed cold is as a rule of better quality, and oil destined for use as food is usually secured in this manner. After the oil is expressed it is permitted to separate by standing. The upper layers, usually cold enough to be solid in consistency, are then removed, and the residue is again treated to secure the remaining oil of poorer quality. The best mills in Europe sometimes succeed in extracting more than 70 per cent of oil from the copra used. This demands not merely very complete extraction but also that the copra used should have contained very little water. With most of the copra marketed it is impossible by the most perfect treatment to secure more than 65 to 67 per cent of oil.

Where the oil is required in a colorless condition, as for toilet and perfumery purposes, the Malabar system is to plunge the kernel into boiling water for a few minutes; it is then grated, subjected to pressure, and the pulp thus obtained re-boiled until the oil rises to the surface.

Some Malabar experts pride themselves on their ability to produce oil so white that it is almost impossible to distinguish it from water when the two are placed in phials side by side. In the ordinary temperature of tropical countries the oil maintains a liquid form, but in lower temperatures, such as those common in this country and in Europe, it assumes a white butter-like solidity. Under conditions of extreme cold it can be separated into two distinct constituent elements, the more liquid of which is known as olein and the more cold as cocosin, or cocostearin, which is a somewhat complex constituent containing fatty acids. When the oil is fresh the flavor and odor are agreeable, and in that condition it is largely used in the East for food purposes and cooking. But there it rapidly becomes rancid, and when in that state is used for illuminating, soap-making, and other industrial purposes. Throughout the East kerosene is slowly superseding coconut oil as an illuminant, especially since mineral oil was discovered in Burmah and other Eastern regions.

The advantages claimed for nut butter prepared from coconut butter are its highly nutritious quality and the number of calories furnished the body, its freedom from pathogenic germs, the readiness of its digestion and the completeness of its assimilation by the body, besides, of course, the fact that it is much cheaper than cow's butter.

**Oil Cake.**—After the oil has been expressed from the copra, there is a residue which forms a valuable cattle food, or if not required for that purpose, makes an efficient fertilizer. In the East this residue is known as poonac, and the cake made

from it possesses four valuable qualities, which are: First, the milk produced by poonac-fed cattle is of a better quality; secondly, the quantity is usually increased; thirdly, the resultant cream is firmer; and fourthly, the butter proportion is larger, and the color and flavor are improved.

**Coir.**—Coir is the commercial name of the fiber prepared from the husk of the coconut. The word is Malay or Indian in origin, but has been adopted into European languages. In countries where coconut culture is very old, the use of this fiber likewise dates further back than our knowledge reaches. In Polynesia and extending as far west as the Marianne and Caroline Islands, this is the main material used for cordage. It was in use as far west as Ceylon before the discovery of this part of the world by Europeans. In these parts of the world it served not merely for rope, and for string to make fish nets, or to tie the parts of houses together, but to calk boats, and in various other ways. For calking boats it is better than most other durable fibers because it will swell more when put into water, and will therefore make a tighter plug.

The chief peculiarity of coir rope is its elasticity. The coconut fiber will stretch fully 25 per cent without breaking. The amount which ropes made of it will stretch depends upon the method of manufacture, but in all cases they will stretch more than ropes made of any other of the commercial fibers. This makes coir rope especially desirable where it is subject to jerks. As used for fish nets, and in other ways which demand exposure to water, coir has the advantage that it is more durable than most other fibers; that is, it is less subject to decay.

The breaking strength of coir is 39 kg. when fresh and 24 kg. after having been immersed in water for 116 days, a length of time which causes the entire decay of both English and Indian hemp and of the American agave. The individual cells of coir are shorter than any other of the most important commercial fibers, including those of the ramie, of hemp, of flax, of abaca, of the American agave and of jute. Thus, the average length of the ramie fiber is 150 mm. whereas that of the coir is only 0.7 mm.

The strands which are extracted from the husks of the coconut and which are referred to in common speech as the fibers are 30 cm. more or less in length, depending of course on the size of the nut from which they are taken. The diameter is about 0.3 mm. In cross section, they are roundish or somewhat heart-shaped, the concavity or groove along one side being the place where the vessels were located. The strands are harsh and more or less dark in color according to the nuts from which they were secured and the method by which the fiber was extracted. The fiber is strongly lignified, and to this is due its color and harshness, and its relative brittleness as compared with pure cellulose fibers.

From what has been said as to the qualities of the coir, it follows that for ropes it is to be recommended where elasticity or resistance to decay are especially desired; but for general use it is an inferior cordage material because the brittleness of the strand makes it wear out more rapidly than many other kinds of rope, and because it is weaker than the best rope material. As a textile fiber it is of very little general value because of its coarseness, harshness, brittleness and color. The color can be removed, at least in very large part by chemical bleaching, but this treatment leaves it too weak for practical use. On the other hand, the qualities of harshness and stiffness and dark color all make it an especially good material for doormats and hallmats and for various kinds of brushes. It is for these uses that the coir has its chief market value. This combination of stiffness and elasticity also gives it a certain value as a stuffing fiber, and the poorer qualities of coir are marketed, under the name of mattress fiber, for such use.

It is also made to combine with wool in the manufacture of carpets and rugs of great durability and richness of effect, and to make brushes and brooms for household and stable purposes, matting for sheepfolds, pheasantries and

poultry yards; string for nurserymen and others for tying up trees and various garden purposes; nosebags for horses, mats and bags for seed crushers, oil presses, and candle manufacture. The refuse of the husks is used by horticulturists for many purposes.

A vast commerce is also conducted in the manufacture of coir cables, which are not only strong, elastic and buoyant, but are improved and strengthened by immersion in sea water, although fresh water is said to rot them. These cables are somewhat rough to handle, and not quite so neat looking as those made of hemp, but their greater elasticity renders them superior for many purposes.

**Toddy.**—In the East Indies palm sap used as a beverage is known as toddy. In the case of the cocoanut the sap is obtained from the unopened flower cluster. This is gradually bent downward so that when cut the sap will drip freely from the cut end. The tip of the cluster is then removed with a sharp knife, enough being cut off to include the ends of the younger branches of the panicle. The toddy collector carries a vessel usually of bamboo into which he pours the sap which has flowed from each cluster, leaving in its old place the vessel into which the sap has dropped. Each time the tree is visited another thin slice is removed from the cut surface and the thinner the slice the longer the toddy will continue to flow. If a slice is removed three times a day instead of only at morning and at night, a greater flow can be obtained for the 24 hours. The toddy is used either as a fresh beverage, or for the production of liquor, as well as for making sugar and vinegar, and as a source of yeast.

**Arrack.**—The strong liquor distilled from the sap of the cocoanut and other palms is known as arrack.

**Sugar.**—Cocoanut toddy has long been used as a source of sugar through out the Far East. The business, however, is everywhere a purely local one. The sugar content of the sap as it flows from the tree is high enough for the sap to be figured as a cheap source of cane sugar, but the fermentation is so rapid that the sugar which can be made from it is decidedly high-priced. For the manufacture of sugar, it is necessary to inhibit the fermentation of the sap as completely as possible. The commonest way of doing this in Malaya and Ceylon is to put into the vessels which collect the sap a little of some finely powdered bark which is rich in tannin. The sugar which is produced in this way is called "jaggery." From good sap, 1/12 the weight of jaggery can be produced.

#### THE GROWTH OF THE TREE.

As our pictures show, the cocoanut is a tall, handsome, and picturesque palm. While it is found in many parts of the tropics where it is able to obtain enough water, it yields the best results between the latitude 70°N and 12°S, which are outside the hurricane zone. Authorities differ as to whether its original home is in the islands of the Pacific Ocean or whether it is, like all other species of the genus to which it belongs, a native of tropical America. The nut thrives best where the mean temperature is from 75° to 85°F. and the mean annual rainfall is not below fifty inches. It derives special benefit by growing on the sea shore, as the palms require constant and adequate moisture, and soil that does not become sour and waterlogged, for their highest development. Mountainous districts are not favorable to the cocoanut, nor are localities with a torrid and dry temperature. Most experts agree that the best and most prolific estates are located near the sea, upon fairly level land, where rivers and torrents have brought down deposits of rich, friable loam. "The nearer the coast the better the nut" is the general dictum, although trees grow with fair success up to an altitude of 2,000 feet provided that the temperature requirements are fulfilled. But the cocoanut palm does not flourish on steep slopes nor in positions that are overshadowed and sheltered, and it cannot tolerate the presence of stagnant water in the neighborhood of its roots. Ample sunlight, a sufficiency of moisture and large quantities of salt in the soil constitute

its essential requirements, and that is why it prospers on sea beaches or in places near the sea.

Obviously, soils vary according to region and location, but the best is an alluvial loam. Given this advantage the trees reach a state of great luxuriance. Light, deep, sandy loams overlying coral or some other porous substratum are also suitable, but the plant depends to a considerable extent on the fertility of the soil and requires a liberal supply of humus—i.e., decayed vegetable matter. Cocoanuts do not prosper on pure sand alone, unless it be repeatedly fortified by quantities of manure and humus. Heavy clay soils and all those with an impermeable substratum which are likely to hold stagnant water, as well as all shallow soils, should be carefully avoided.

When the trees come into bearing the ripe nuts are usually gathered every two months by means of a knife attached to a pole. When the trees have reached a height of more than fifty feet however "cocoanut collectors" are employed. These pickers climb the trees until they reach the top where they are so near to the fruit that they can readily tell which is ripe and which is not. At the same time they are able to search for and destroy the beetles which attack the cocoanut tree. Very high trees can be climbed only when the weather is fairly dry since in the wet weather the trunks are too slippery. The coir substance, which clings to the stem must on no account be interfered with, since it assists in retaining the moisture around the bud.

It is better to let the nuts remain unhusked for two or three weeks after gathering, since this always insures a larger yield. It is estimated that 40 nuts per year can be counted on from each tree, though some give a much larger yield. The first transport of the cocoanut from the estate is frequently accomplished by binding them together into a sort of raft and floating them down canals to the sea.

#### COMMERCIAL IMPORTANCE OF COCOANUT PRODUCTS.

Not only has the shortage of fats become menacing to health and life in America thus ensuring, as we have said, a wide market in the Occident for cocoanut oil, but it is expected that a constantly expanding market for this product will be found among the 600,000,000 of the population in China. In "All About Cocoanuts," the interesting volume by Belfort and Hoyer a somewhat curious reason for this is given, to the effect that at the outbreak of the Russo-Japanese war oil producers in Europe and America made a sudden raid upon soya bean oil as a substitute for more expensive edible oils. This forced the Chinese to buy cocoanut oil as a substitute. But although soya oil receded in price the Chinese consumer has meantime become accustomed to the cocoanut oil and even prefers it.

The following figures represent the imports of cocoanut oil and copra for the fiscal years of August, 1913, to July, 1914, as compared with 1918-1919:

#### Cocoanut oil:

August, 1913, to July, 1914.....	74,067,372
August, 1918, to July, 1919.....	345,737,913

#### Copra imports:

August, 1913, to July, 1914.....	100,853,374
August, 1918, to July, 1919.....	296,599,419

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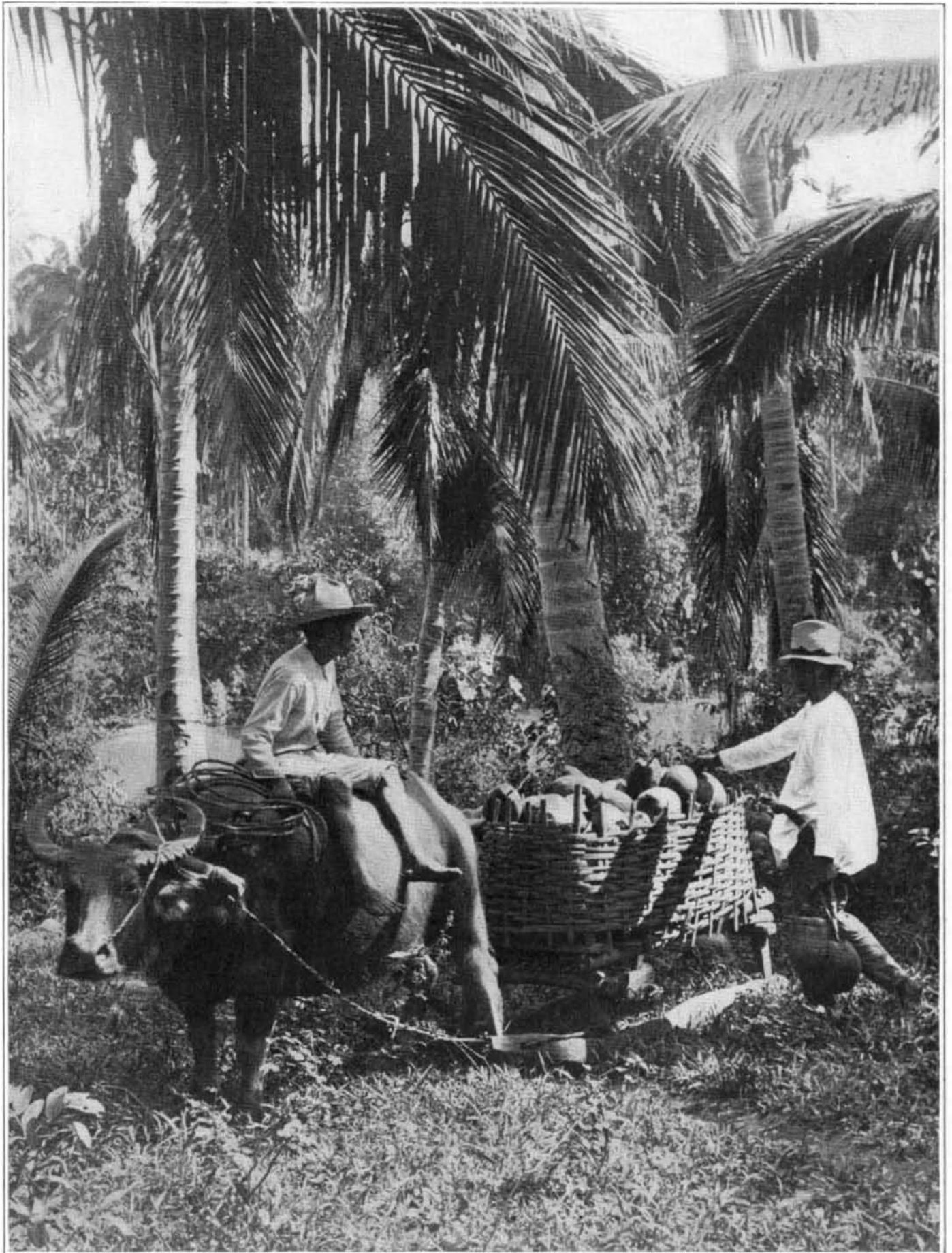
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CUTTING THE COCOANUT CAKE—PHILIPPINE NATIVES HAULING COCOANUTS TO THE MILLS. (SEE PAGE 404)