

## THE VEGETABLE FIBERS OF THE PHILIPPINE ISLANDS.

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THERE is probably no country of equal size in the world having a greater variety or wealth of vegetable fibers than the Philippine Islands. These fibers are of every class and of every description. They are obtained from the bast of the largest forest trees and from the slender stems of twining ferns. Their uses range from the manufacture of the most delicate and beautiful of textile fabrics to the construction of cables, furniture and houses. As an article of commerce, the one fiber, manila hemp, exceeds in value the combined values of all other products of the islands. As a factor in the domestic economy of the Filipino people, the fibrous plants of field and forest furnish, with the exception of food, nearly all the necessities of life.

*The Relative Importance of the Fiber Industry.*

The relative position that the vegetable fibers hold among the various agricultural products of the Philippine Islands is a subject that is neither clearly nor generally understood. The development of the various branches of the fiber industry will, in no inconsiderable degree, determine the future industrial condition of the islands. Until very recently there has been practically no machinery, no modern methods of cultivation, no introduction of improved species and varieties of plants; and yet, even under these unfavorable conditions, the production of fiber has grown to be the leading industry of the islands. To-day the vegetable fibers and fiber products form the most important source of wealth of the archipelago. A brief investigation of several of the more important of the fiber-producing plants should be sufficient to give some little idea of the vegetable fiber in the Philippines as a commercial product. Such an investigation, however, must leave entirely out of consideration the greater part of the four or five hundred so-called 'local' fibers, the use of which plays an interesting and important part in the every-day life of the Filipino. To fully appreciate the extensive use of these local fibers, one must go into the fields and villages and homes of the native people.

But two fibers are now exported from the Philippine Islands, manila hemp and maguey. The latter has been, up to the present time, of comparatively little importance; the annual exports of maguey fiber amounting to something more than one thousand tons. Manila hemp, however, is not only the leading article of export, but it con-

stitutes more than two thirds of the total value of all exported products. Its position is indicated by the following table.

EXPORTS FROM THE PHILIPPINE ISLANDS FOR THE YEAR 1903.

Article.	Value.	Per cent. of Total Exports.
Manila hemp .....	\$21,701,575	66
Copra .....	4,473,029	14
Sugar .....	3,955,568	12
Tobacco .....	1,882,012	5
All other .....	1,109,596	3
	\$33,121,780	100

The production of manila hemp is a well-established and very profitable industry, the development of which requires only an improvement in methods of cultivation and the introduction of fiber-extracting machinery. Maguey is a comparatively new product, and its value is not as yet well known throughout the islands. Cotton and kapok (tree cotton) are widely distributed and have a general local use. Coir (cocoanut fiber) is produced in enormous quantities, but is not utilized, because of the lack of fiber-extracting machinery. Jute grows in several of the provinces, but is not produced in quantities sufficient for export. These six vegetable fibers, which are among the most important commercial fibers of the world, are all Philippine products, and can be economically and profitably produced throughout the archipelago.

*Classification of Fibers.*

Vegetable fibers may be classified either according to their structure or to their uses. The former classification includes the 'bast fibers,' obtained from the inner bark of dicotyledonous plants; the 'structural fibers,' obtained from the stalks, leaf stems and leaves of monocotyledonous plants; the 'surface fibers,' or hair-like growths surrounding the seeds of certain plants, and the 'woody fibers,' consisting of the whole or a part of the stems, roots or wood of various plants.

Any economic classification is unsatisfactory for the reason that the same fiber frequently has several entirely different uses. Thus, for example, manila hemp, primarily a cordage fiber, is extensively used in the Philippines for textile purposes; while cotton, a textile fiber, is also used for cordage. Considering only their more important uses, we have the following general economic divisions, together with one or more of the leading Philippine fibers of each division.

Cordage fibers.	Plaiting and Thatch Material.
Abacá.	Nipa.
Maguey.	Burri.
Textile Fibers.	Tie Material.
Cotton.	The Rattans.
Piña.	Malobago.
Stuffing and Filling Material.	Abacá (Manila Hemp), <i>Musa textilis</i> .
Kapok (tree cotton).	

The fiber produced by the plant *Musa textilis* is known throughout the civilized world as manila, or manila hemp. In the Philippine Islands the name abacá (pronounced ab-a-kár) is applied to both plant and fiber. This fiber is distinctly a Philippine product, for the abacá plant, though introduced into India, Borneo and other countries, has never been successfully cultivated other than in the Philippine Islands. Manila hemp was first exported from the Philippines a century or more ago. In 1820 samples of the fiber were brought to Salem, Massachusetts by John White, a lieutenant in the United States navy, and from 1824 to 1827 it began to be used quite extensively in Salem and Boston. The growth of the industry is indicated by the increase in exports of fiber, from 41 tons in 1818 to 137,752 tons in 1903.

The common banana, *Musa sapientum*, the plantain, *M. paradisiaca*, and abacá, *M. textilis*, are closely related species of the same genus. The banana plant produces a fiber similar in appearance to manila hemp, but lacking in strength; while the fruit of abacá resembles the banana, except that it is filled with large black seeds and has no economic value. The abacá plant is a large tree-like herb fifteen to twenty-five feet high, a single rootstock bearing from twelve to twenty stalks. These stalks, from which the fiber is obtained, are formed of a series of thick, fleshy, overlapping sheaths, each sheath being the petiole of a leaf.

At the time of flowering, which occurs when the plant is from two and a half to three years old, the stalk is cut close to the ground and the leaves are removed. The native laborer, sitting on the ground, inserts under the bark or fibrous covering of one of the outer leaf sheaths a small piece of bone called the 'locnit,' and with it tears off a long ribbon-like strip of fibrous material. Each successive layer is similarly treated down to the central stem of the trunk. The fiber ribbons are collected in the field and are taken to a small bamboo hut where the fiber extracting apparatus has been set up. This crude machine, the 'pañguijan,' consisting of a large knife fastened upon a block of wood and operated by means of a bamboo spring and foot lever, is the only method that has ever been discovered for extracting manila hemp. The work of hemp-stripping is very exhausting, the average result of a day's work being about twenty-five pounds of fiber. The record of the numerous attempts and failures to perfect an abacá-cleaning machine forms one of the most interesting chapters in the industrial history of the islands. The introduction of such a machine will be of almost incalculable benefit and will revolutionize the entire hemp industry.

The only treatment of hemp, after the completion of the stripping process, is a few hours' drying in the sun. The fiber is then made up into rough bales and packed over the mountains, or shipped in native boats down the rivers, to the nearest seaport. From here it is taken

in a small coastwise steamer to the baling presses and warehouses of Manila and Cebu.

*Maguey, Agave sp.*

Several different species of the genus *Agave*, including *A. Americana*, *A. vivipara* and *A. rigida*, are found in the Philippine Islands. Both the plant and fiber are known throughout the archipelago as 'maguey'; while the fiber, in the commercial world, bears the name 'Manila aloe.'

This plant was probably first brought to the Philippines from



FIG. 1. STRIPPING ABACÁ.

Mexico or Central America; but when, or by whom, there are no records to determine. It is now grown on all of the larger islands, and as a fiber producing plant is next in importance to abacá. Maguey fiber is used locally in many of the provinces both as a cordage and as a textile material. It is produced in sufficient quantities for export only in the provinces of Ilocos and Union of northern Luzon. In this district rice and corn are cultivated in the more fertile fields, the stony hillsides and other so-called 'waste land' being utilized for maguey. For several reasons maguey seems destined to become an important Philippine product. It is not seriously injured by the long dry season, it can be successfully grown on 'light,' dry soils, and its cultivation requires comparatively little labor and but few draught animals, all of which characteristics make it eminently suited to conditions found in many parts of the islands.

The maguey plant consists of a short thick stem which bears an

aloe-like cluster of from twenty to forty fleshy leaves. These leaves are light green in color, bear sharp lateral teeth and a terminal spine, and are from three to five feet long. The leaf is composed of pulpy material interspersed with the vascular bundles which furnish the fiber. When the plant matures, which requires from seven to fifteen years, a central stalk, or 'pole,' grows to a height of fifteen to twenty feet. This stalk first bears flowers and afterward a large number of small bulbs. The growth of the 'pole' is followed by the death of the plant.

The process of fiber extraction consists in separating the fibrovascular bundles from the pulpy portion of the leaf. Where machines are used for this work, the leaf is run under the surface of rapidly revolving wheels or rollers which scrape the pulp from the fiber. In the Philippines the fiber is extracted by the process known as 'retting.' The mature leaves are harvested and tied in bunches. These bunches are then placed in the streams and rivers, where they are allowed to remain under water for eight or ten days. This 'retting,' or rotting, results in the disintegration of the substances which surround the filaments. After the leaves have been sufficiently retted they are removed from the water, dried in the sun, and are then shaken and beaten to remove all extraneous material that may still adhere to the fiber. This retting process is slow, expensive, and gives an inferior quality of fiber. Improved fiber-extracting machinery has recently been imported into the Philippine Islands and the general use of such machinery should give a decided stimulus to the maguery industry.

*Cotton, Gossypium sp.*

Cotton has been grown in the Philippine Islands for hundreds of years. In 1601 three hundred pieces of 'Ilocos cloth' were sent from Manila to the Moluccas, and throughout the earliest Spanish records of the islands we find frequent references to cotton and cotton-growing. At one time the production of this fiber occupied a position of considerable importance and domestic cotton was an article of inter-island trade, but the importation of cheap cotton goods was followed by a decline of the local industry and it has never regained its former position. The Spanish authorities endeavored to foster the industry by means of ordinances and government regulations, but without any appreciable results. To-day we find small 'patches' of cotton scattered throughout the islands from northern Luzon to southern Mindanao. Occasional shipments of a few bales each are received every year in Manila, principally from the province of Ilocos. In many different towns and villages small quantities of cotton are collected, cleaned by hand and woven into a coarse cloth. There is nothing in the archipelago at the present time, however, worthy of being called a cotton-growing industry.

There is every reason why the cultivation of this plant should be

encouraged, as cotton and cotton goods form one of the largest items of imports into the islands. Experiments that have been made during the past year, to say nothing of earlier efforts in the same direction, have demonstrated that a satisfactory yield of good cotton can be obtained in the Philippines. Insect enemies will have to be overcome and methods of cultivation regulated to suit an early or late rainy season, but, in general, soil and climate conditions are favorable. A great deal of interest is now being shown in regard to this subject by Filipino planters. Large quantities of seed have been distributed in the provinces, and the next year promises to show at least a begin-

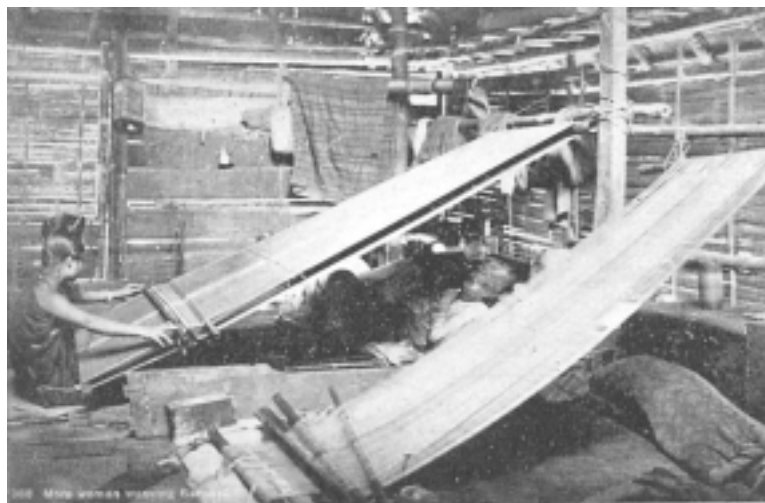


FIG. 2. MORRO WOMAN WEAVING SARONG.

ning towards the establishment of a Philippine cotton-growing industry.

*Piña (Pineapple), Ananas sativa.*

Pineapple fiber, or piña, is of peculiar interest as furnishing the material for the beautiful and justly celebrated piña cloth. This fiber is obtained from the leaves of the same plant that produces the well-known fruit. The pineapple plant is grown quite extensively in the Philippine Islands both for its fruit and for its fiber, but when utilized as a fiber plant the undeveloped fruit is usually cut shortly after the time of flowering.

Pineapple fiber is one of the finest and strongest of all of the vegetable fibers. It is the former quality that prevents its more extensive use, as the extreme delicacy of piña makes its extraction from the leaf an extremely slow and difficult operation. A very simple and primitive method is used in the Philippines for the extraction of this

fiber. A single freshly cut leaf is placed upon a smooth board and is then scraped with an old plate or piece of earthenware. This scraping removes the pulpy material and lays bare a layer of fiber which is deftly lifted with the finger or a small spatula. After the fiber has been thus extracted it is washed in running water and dried in the sun. Frequently the washing and drying are repeated several times before the required degree of softness and fineness is obtained. It is estimated that twenty-one thousand leaves are required to produce fifty pounds of fiber. When it is considered that each separate leaf must be slowly and laboriously scraped, the small production and high price of piña fabrics are not surprising. Before piña can become a product of any considerable commercial importance, a machine must be perfected for the extraction of the fiber.

*Kapok (Tree Cotton), Ceiba pentandra.*

The white cotton tree with its tall straight trunk, its almost horizontal branches, and large odd-looking seed pods is well known to any one who has traveled through the Philippine provinces. This tree is found in nearly all parts of the tropical world. In Java there are extensive kapok plantations, but in other countries we usually find the cotton tree growing along the roadsides, scattered through the forests; or, as in India, planted about the old Buddhist temples. There are no kapok plantations in the Philippines, but the cotton tree grows in nearly all of the provinces and the fiber is very generally used for local purposes.

Kapok is the floss obtained from the seeds of the cotton tree and, in a structural classification, is one of the 'surface fibers.' The fiber is too short a staple, and also too brittle and elastic, to be spun, but these very properties make it the most valuable of all the vegetable fibers as a stuffing and filling material. Its harshness and elasticity prevent its becoming matted when used for cushions, pillows and mattresses. For bandages and surgical dressings it is cooler and more elastic than cotton.

Not only does the cotton tree produce a valuable fiber, but it has, also, a number of other economic uses. The tree itself, with its horizontal branches, is used for living telegraph poles and as a shade tree on coffee plantations. The wood, which is light and soft, is utilized for tanning leather and for making toys. The sap and tender leaves have a medicinal value. The bark yields a reddish fiber from which cordage and paper are made. The roots, when powdered and mixed with the sap, is a cure for dysentery. The fruit has some value as a food product. The seed yields an excellent oil and the seed cake is used both for cattle-feeding and as a fertilizer.

In Java the production of kapok is rapidly becoming a leading industry, and this fiber is getting to be more generally known and more

fully appreciated throughout the civilized world. The more extensive cultivation of the cotton tree in the Philippine Islands is greatly to be desired, as the development of this industry will add another valuable commercial fiber to the list of our exported products.

*Nipa, Nipa fruticans.*

One of the most widely known of all Philippine objects is the nipa house, or 'shack.' The material used for the construction of this house is the fibrous leaf of the nipa palm. This palm grows along the shores and in the deltas of rivers. Its leaf, consisting of a long



FIG. 3. THE BURRI PALM.

midrib bearing a large number of slender leaflets, is similar in structure and appearance to the leaf of the cocoanut. When the plant is fully grown the leaves are cut and the leaflets stripped from the stem. These leaflets are bent over a piece of bamboo, sewed together with fine strips of rattan, and thus made into small mats or shingles. The nipa mats are laid on the sides and roofs of houses in the same manner as shingles, and are fastened down with strips of bamboo. A house built of this material can be constructed in a few days and, under ordinary conditions, will last from five to seven years. It is cheap, cool and in every way suited to the climatic conditions of the country.

The nipa palm has several other uses. Its fruit is edible and the



flower stem yields an alcoholic beverage known as tuba or nipa wine. Hats, mats, rain coats, sails and various other articles are woven from the leaves.

*Burri, Corypha umbraculifera.*

Another member of the Palmaceæ that has a great variety of uses in the Philippines is the burri, or talipot palm. This palm grows in abundance in nearly all parts of the archipelago. It is a large ornamental tree crowned with gigantic fan-like leaves. These leaves, like those of the nipa, are composed of numerous slender leaflets. In the burri, however, all of the leaflets radiate from the end of the long stem. Preparatory to use, the leaves are gathered and dried, often for several weeks. They are then split into narrow strips and in this form are woven into hats, mats, bags, baskets, fans and other similar articles.

*Local Fiber Plants.*

More than four hundred Philippine plants have been reported, the fibers of which have some local economic use. It is difficult to select from among this number the few that may be considered of first importance. The rattans (*Calamus sp.*) which are found throughout the forest regions of the islands are of great value and are used for many different purposes. Malobago, or balibago (*Hibiscus tiliaceus*), is a valuable bast fiber obtained from a tree growing near the seacoasts. Pandan (*Pandanus sp.*), the plant known in the United States as 'screw pine,' yields a fibrous leaf from which are made hats, mats and sugar-sacks. Idioc, or cabonegro (*Caryota urens*), is a coarse black fiber well known in the commercial world and used in the Philippines for making a coarse resistant cordage. Anabo (*Abroma alata*) is a strong fine bast fiber produced in all parts of the archipelago and largely used as a cordage material.

*The Development of the Fiber Industry.*

The methods now employed in the production of the leading Philippine fibers are slow, wasteful and a century behind all ideas of modern agricultural development. Certain definite lines of improvement such as the more careful selection of plant varieties, a more thorough system of cultivation, and the extraction of fiber by means of machinery are urgently needed. A development of the fiber industry along these lines, that shall result in carefully managed abacá, maguey and cotton plantations, and in the introduction and general use of fiber-extracting machines, will be a long step towards the fulfillment of the first and greatest need of the Philippine Islands, the establishment of the country on the solid basis of material prosperity.