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THE STORY OF THE BANANA



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A YOUNG BANANA PLANTATION IN COSTA RICA.

The banana has a prodigal method of propagation, for before the parent stalk and fruit have matured new plants spring up. These are offshoots that grow from the root of the original plant, and each in turn becomes a parent stalk with its fruit. Constant productivity is thus brought about by the new young shoots taking the place of those that have borne, for each plant yields but one stem or bunch of bananas, after which it is cut down and becomes waste material.

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THE STORY OF THE BANANA

Compiled and edited by PHILIP K. REYNOLDS,
Assistant to the President of the United Fruit Co.

EARLY HISTORY.

PROBABLY few of the millions who enjoy the banana as a daily article of food ever stop to consider its origin or growth or the long and rapid present-day journey of this remarkable fruit from the tropical plantation to the consumer's table.

While the commerce in bananas is of comparatively recent growth, the plant has been cultivated and used from the earliest historical times. The bas-reliefs of the monuments of Assyria and Egypt show that the fruit was known and used in those lands in ancient times. When Alexander the Great invaded India he found large tracts of land in the lower valley of the Indus devoted to the cultivation of the fruit.

The original home of the banana is believed to be India, at the foot of the Himalayas, where it has been cultivated since remotest antiquity. Its origin in the New World is as doubtful as the origin of the American Indian. Indigenous to Asia and Africa, where more than 60 distinct species of the genus are known, it is said to have been brought first to America from Spain early in the sixteenth century and planted in the Dominican Republic,¹ whence its spread was rapid throughout the surrounding islands and the mainland. This has never been authentically established, however, and some authorities include the banana among the articles that formed the base of the food supply of the Incas and the Aztecs before the arrival of the Spaniards. Certain it is that throughout the whole of tropical America there is a strong tradition that at least two species of the banana were cultivated long before the coming of the Europeans. Furthermore, it is singular that in all the languages indigenous to the regions where the banana appears the plant has a special name, not proceeding from the conquerors, as was the case with the names of many other plants, animals, and various articles introduced into America after its discovery.

¹ The modern name of the eastern part of Hispaniola.

The first known importations of bananas into the United States were in the late sixties, when small quantities were brought to New Orleans by schooners from the Bay Islands off the coast of Spanish Honduras, and shipments on a very small scale were made by steamer to New York from Colon (within the present Panama Canal Zone). In 1870 a few bunches were brought into Boston from Jamaica by schooner. In the years immediately following further small quantities were brought by schooners from Jamaica and Cuba into Bos-



FLOWER BUD A FEW DAYS AFTER EMERGING AT TOP OF TRUNK
AND BEFORE ANY BRACTS HAVE FALLEN.

ton, New York, Philadelphia, and Baltimore. In 1872 the first steamer shipment (250 bunches) was made from Colon to New Orleans, which resulted in flooding that market. About 1879 bananas were first shipped from Costa Rica to New York by steamer. The fruit, even at this time, was looked upon as a curiosity, no one dreaming of its later becoming an important factor in the food supply of the United States. In the eighties, schooners generally gave way to steamers for carrying bananas, but it was not until the formation of the United Fruit Co. in 1899 that the banana industry really assumed large proportions.

Bananas were first imported commercially in small quantities into England from Madeira in 1878 and from the Canary Islands in 1882, but were regarded as exotic rarities. In 1901 banana shipments by steamer from Jamaica to Great Britain were started by Elders & Fyffes (Ltd.). Although refrigerator ships were used the venture was not successful until the following year, when the United Fruit Co. began to supply that company with bananas from Jamaica and Costa Rica specially selected for the British market.

The history of the banana trade is one of the romances of business. From small beginnings, hardly more than a generation ago, it has developed into an industry of great size and economic importance. Moreover, it is unique in its economic aspects since it involves a highly specialized system of production in widely separated tropical localities, the maintenance of adequate, expensive, and carefully controlled means of rail and water transportation, and highly organized distributing agencies in the countries to which the fruit is sent.

PRINCIPAL SPECIES.

The banana belongs to the family *Musa* and is one of the most important and interesting of all food products. Grown on an equal acreage, it will support a larger number of persons than wheat. There are many species of the plant, but the most important commercially are: First, *Musa sapientum*—Fruit of knowledge—deriving its name from the belief that the ancient sages of India reposed in the shade of the banana tree and refreshed themselves with the fruit thereof—formerly thought to be a distinct family, but now known to be a species which is found growing in the West Indies and on the American mainland from the Tropic of Cancer to the Tropic of Capricorn; second, *Musa cavendishii* (Chinese or dwarf variety), found in the Canary Islands, on the African mainland, in portions of Asia, and in the islands of the Pacific and Indian Oceans; and third, *Musa paradisiaca*—Fruit of paradise—deriving its name from the legend that the banana tree grew and flourished in the Garden of Eden and was the tree of the source of good and evil. This last variety is known as the plantain, which is found throughout all the regions named and which is eaten only when cooked.

There are a number of varieties of the *Musa sapientum*, the most common being known as Gros Michel (“Great Michael”), which is the principal banana of commerce, and grows to the best advantage in low alluvial plains. In the ripening process, the skin of the Gros Michel assumes a beautiful yellow color. It is this particular variety which is dealt with throughout this booklet. Another variety of the *Musa sapientum* is the “claret” or “red” banana (deriving its name from the color of its skin), which is found in Central America and the West Indies. This banana is also known as Baracoa, Red

Jamaica, and Red Spanish. In comparison with the Gros Michel, the bunch is smaller while the fruit itself is shorter but larger in diameter, giving it a somewhat stubby appearance. Although the red banana has a pleasant flavor, there is a very limited demand for it.

There are also many varieties of the banana and plantain which have not been definitely assigned to one botanical species, as there appear to be all gradations between *Musa sapientum*, *Musa paradisiaca*, and other species. Thus we have the red banana mentioned above; the apple banana and the lady's finger, both highly prized in tropical countries, but little known elsewhere; the apple plantain, India plantain, maiden plantain; golden banana; Congo banana, and many other varieties.

There are in addition so-called ornamental bananas belonging to the genus *Musa*, some of which have fruits resembling the common banana, but which are not edible, and these species, such as *Musa ensete* and *Musa coccinia*, are valued only as ornamentals. The Manila hemp, *Musa textilis*, is in the same group, having small fruits somewhat like the ordinary banana filled with seeds, but valued only for the fiber in the stalk.

Search is constantly being made for some variety of banana that will be superior to the Gros Michel in flavor, shipping and keeping qualities, and in abundance of production, but so far nothing has been found to excel the Gros Michel, and this variety still stands preeminent as the one best suited to the requirements of the American and European markets.

The banana plant is a rapidly growing herbaceous perennial which contains in the aggregate about 85 per cent water. It is probably the largest terrestrial plant not having a woody stem above ground. The real trunk or main stem of the plant is underground, and is a thick, fleshy rootstock, known as a rhizome, on which large buds or "eyes" are developed, somewhat as the eyes develop on the potato. From the buds on this short, solid rhizome, or bulb root, the leaves grow upward, the first ones tightly rolled and sharply pointed. Growth takes place rapidly, new leaves pushing up through the center while the stalk increases in height until it is several yards above the ground. What seems to be the trunk of the young tree is in reality only a compact mass of leaf sheaths, spirally arranged and overlapping. As the plant develops in size, the older leaf sheaths are pushed outward by the young growing leaves within, and a smooth, shiny, strong pseudostem, or trunk, is formed. At the upper end of the "trunk" the leaves cease to clasp the stem and each one develops a true petiole or leaf stem. These petioles quickly develop into immense, bright green leaves, or fronds, and spread out or rise almost vertically, giving a very graceful, palmlike aspect to the

whole plant. The number of leaves so appearing varies from eight to twenty or more, according to the vigor of the plant and the soil conditions. These leaves are often of great size, attaining a length of from 8 to 12 feet and a width of 2 feet or even more.

The trees vary much in size, those growing in the rich river bottoms along the Atlantic coast of Central America sometimes reaching a height of 40 feet, with a diameter of 18 to 24 inches. It is interesting to note, in comparison, that the average height of the banana tree in Jamaica is from 18 to 25 feet, and in Cuba from 12 to 18 feet, showing the effect of climatic conditions as we recede from the humid warmth of the torrid zone.

As many buds or eyes are developed from a single rootstock, there eventually arises a little colony of plants from the same underground mother root, but in the course of time each plant develops a bulb of its own.

As the individual plant approaches maturity, it produces a flower bud which later becomes a bunch of bananas. The stem which is to bear the fruit pushes up from the rhizome through the center of the leaf sheaths, until at the end of the ninth or tenth month after planting, the flower bud emerges at the top of the trunk, looking not unlike a huge ear of corn enveloped in its husks or bracts. As this flower bud increases in size, it bends over and downwards; the covering (or bracts) then drops off, disclosing the young bananas, quite small and pointing outward, but bending upward as they become larger. The terminal flower bud on the cluster is sterile and produces no fruit.¹

THE FRUIT.

Each plant developed to maturity from the rootstock bears but a single bunch of bananas, which is made up of so-called "hands" or clusters. These hands grow separately in spirals, each containing from 10 to 25 individual bananas or "fingers." Commercially, bananas are classed as ranging from nine to six hands, any bunch having less than six hands not being readily marketable. The standard commercial sized bunch has nine hands, all bunches with nine or more hands being classed as "nine hand" fruit. A nine hand bunch varies in weight according to the variety of the fruit and the soil and climatic conditions under which it is grown, the average weight ranging from 50 to 75 pounds. Occasionally a bunch of bananas is produced which has as many as 22 hands with more than

¹ The inflorescence is a terminal spike with floral leaves placed spirally, and sometimes magnificently colored; in the axils of each of these, several flowers are situated in two transverse rows (accessory buds); the lowest flowers are pistillate, the upper ones staminate, so that the fruit is found only in the lower region of the inflorescence, the remaining portion persisting as a naked axis after the bracts and flowers have fallen off; the inflorescence terminates in an ovoid bud, formed by the flowers which have not opened.

300 individual bananas, weighing approximately 150 pounds, but this is extremely rare.²

The heaviest and the best developed fruit comes from Panama and the lightest fruit from Cuba, the difference being explained by the differences in the agricultural conditions, which, as we have seen above, similarly affect the size of the tree itself.

One will readily appreciate the necessity for infinite care in handling a bunch of bananas when he pauses to consider that this fruit, which is cut from the tree in a green state, is, until fully ripe, practically a living organism drawing sustenance from its stalk, with sap flowing and tissues changing; that it generates heat within itself in the ripening process; that a few degrees of temperature above or below normal may stimulate too rapid ripening on the one hand, or produce checked vitality and chill on the other; and that from the plantation to the ripening room it is shipped "loose," *i. e.*, without box, crate, or wrapping of any kind.³

WHERE GROWN.

Bananas are now cultivated in most tropical countries, where they constitute one of the principal foods. They can be grown in subtropical zones, but to produce the fruit to the best advantage a tropical climate and considerable rainfall are necessary. In addition to the immense production of bananas in Central and South America, the West Indies, and Mexico, they are grown (in some localities for export but chiefly for local consumption) in the tropical sections of Africa, Asia, and Australia where the rainfall is abundant; also in the Canary Islands, Hawaiian Islands, Philippine Islands, Malay Archipelago, Fiji Islands, and the various islands of the Pacific within the

² *Commercial banana terms.*—"Variety" indicates the country where produced and exported. For example: "Limons" are grown in the vicinity of Port Limon, Costa Rica. "Changuinolas" are grown in the Changuinola district of Panama, etc.

Bananas are divided into classes based on the number of hands to each stem.

(a) "Nines" are bunches of bananas containing nine or more fully developed hands.

(b) "Eights" are bunches of bananas containing eight fully developed hands.

(c) "Sevens" are bunches of bananas containing seven fully developed hands.

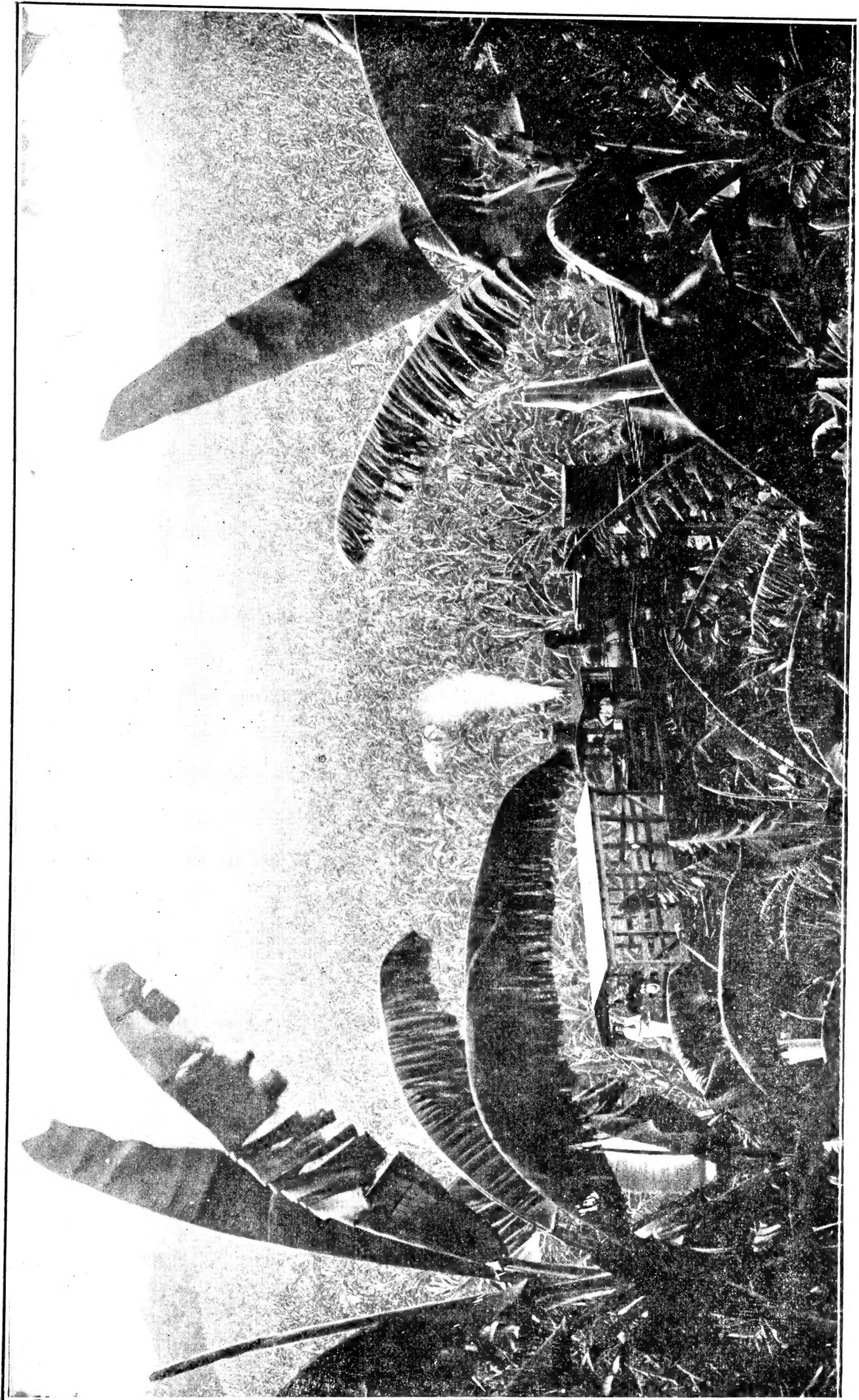
(d) "Sixes" are bunches of bananas containing six fully developed hands.

"Stems" is a general term applied to bananas regardless of class and has exactly the same meaning as "bunches of bananas."

"Grade" refers distinctly to the fullness of the fruit when cut and is expressed as follows: Three-quarter, full three-quarter, and full. Thin fruit, the fingers of which are not sufficiently filled out, is the exact opposite of full fruit.

³ Canary and Hawaiian bananas are exceptions. Hawaiian bananas, which are shipped in small quantities to San Francisco, are wrapped first in a layer of soft paper, usually newspapers, then in a padding of rice straw, with finally an outer covering of banana fibre or leaves, the bundle itself being tied securely with a heavy hemp cord. Each bunch is baled separately and the curved end of the stem is allowed to extend through the wrapping to facilitate handling.

Canary bananas, which are shipped in limited quantities to British and Continental ports, are packed in strongly made wooden crates—the larger fruit one bunch to a crate, the smaller fruit two and sometimes three bunches to a crate. The bottom of the crate is first covered with a layer of straw; then the bunch is wrapped in a large sheet of paper and carefully placed in the crate, which is thereupon stuffed with straw. In the last few years cylindrical leatherboard drums have been used to a considerable extent in the place of wooden crates.



A BANANA PLANTATION IN THE DOMINICAN REPUBLIC.

torrid zone. In certain localities where the soil is good but the rainfall insufficient irrigation is practiced, but this is possible only where an abundant water supply is available, as the water requirement of the banana is enormous.

Central America offers ideal conditions for banana cultivation. The main mountain backbone runs along the Pacific coast, the lesser ranges to the eastward, leaving wide slopes, river valleys, and lowlands on the Caribbean side. It is in this section, a few miles back from the coast, at an elevation of not more than 250 feet above sea level, with its hot days and humid nights and with an annual rainfall of from 80 to 200 inches, that the wilderness of tropical jungle has made way for the greatest fruit farms of the world. All within the past forty years an enormous agricultural industry, with its related interests of railways, stores, docks, villages, and hospitals, has sprung up in a region formerly almost uninhabited. Central America may indeed thank the banana trade for by far the most progressive development and constructive influence which have ever reached its shores.

SCOPE OF THE MODERN PLANTATION.

The modern banana plantation is a marvel of system and immensity, all the more impressive because of its setting of primeval jungle. In the transformation within a few years from a wilderness of huge trees, palms, vines, ferns, and other tropical growth to a vast tract of cultivated land there is a succession of steps which can scarcely be contemplated by those familiar only with farming operations in the temperate zone. The surrounding country is first thoroughly explored as to its fitness for banana cultivation. Then comes the clearing away of forest and brush, the digging of the main draining ditches, the building of houses, railroads, and tramways, and the planting. Then follows the gradual development and extension until vast areas are pouring their product methodically and regularly into the holds of the ships at the loading ports.

The personnel of a farm consists of an overseer or "mandador," timekeeper, foremen, stockmen, and laborers. The land, when surveyed in the first instance, is laid out in sections of a size convenient for allotting the work and for keeping proper records of physical conditions, operating costs, and production from the time of planting. Aside from the necessary transportation, housing facilities, stores, and equipment, a supply of foodstuffs and merchandise must be made available at reasonable prices. Hospital treatment must also be provided in case of sickness or accident, and the general sanitary condition of the plantation and the welfare of its employees and laborers must be properly looked after in order to maintain an efficient organization.

The quality and condition of the fruit and its prompt and careful handling are the all-important factors. To dispatch the modern type of refrigerator steamer at regular and frequent intervals, with a cargo of from 40,000 to 75,000 stems of prime, freshly cut fruit, requires a vast area of good producing land, connected with the tropical port by railways whose total length may extend into the hundreds of miles. The railways in turn are fed by a still more extensive system of light tram lines. The fruit in some instances is subject to a railway haul of 70 miles. The riding, work, and pack animals required on the farms run into thousands, and a small army of employees and laborers is constantly engaged. Each plantation must have good telephone communication with its district headquarters and with a central office for the prompt distribution of cutting advices, control of deliveries, and operation of the fruit trains. The central office in turn communicates by cable or radio with the head offices and with the ships en route, and every effort is made to have the arrival of the fruit and the steamer at loading port coincide, as well as to have the fruit after it is cut put aboard the ship in the briefest possible time. The whole system forms a most interesting example of organization and attention to detail.

DEVELOPING THE NEW PLANTATION.

The first and most important step is the selection of the land. Many factors must be considered, such as climate, soil, rainfall, drainage, liability to damage by floods and hurricanes, and the feasibility of securing labor and supplying transportation.

The plantation is developed from virgin land, covered, as a rule, with forest and a dense tropical undergrowth. After the land has been selected and the surveying and drainage ditches completed, it is underbrushed, lined, and staked, after which it is ready for planting. Underbrushing, as the name implies, consists in chopping down the undergrowth with cutlasses ("machets") so that one may move about freely between the trees. Lining and staking consists in carefully laying out and marking the land with stakes set at the distance at which it is intended to plant the bananas, so that the young plantation will have regularity and orderliness. The distance between the stakes varies according to soil and climatic conditions. In Central America the planting distance is usually from 18 to 24 feet each way, and in Cuba and Jamaica, owing to the small growth of the tree, about 12 by 12 feet. As the plantation develops the underground rootstocks send up new suckers, or young plants, on all sides of the original plant. Only a few of these young plants are allowed to develop to maturity, but in an old plantation each hill, or mat, consists of from half a dozen to a dozen plants standing more or less

closely in an area which may be several feet in diameter; thus the alignment of a young plantation is gradually lost and the rows become irregular.

As the seeds of the banana are practically atrophied in the cultivated varieties, the planting is done with a piece of rhizome or bulb-root, containing a bud or eye, very much as potatoes are planted. A shallow hole about 12 inches deep is dug at each stake and a section of the rhizome, with the eye toward the bottom, is placed in the hole and covered with earth. These portions of seed-bulbs or "bits" weigh from three to four pounds each and are usually cut from rhizomes taken from adjacent vigorous cultivations.

When digging bits for planting, care is taken to see that each has at least one good eye. Only the larger bits are used, as a small bit produces a weak plant and requires more time and labor to yield fruit. After the bits have been carried to the place where they are to be planted, they are again inspected, any with a bruised eye being rejected.

With the completion of the planting and before the young plants have appeared above the surface of the ground, the felling of the larger trees is done, the dense tropical growth making this operation laborious and expensive. The tropical forest usually contains a large variety of trees, many of them of great size. It is not unusual to encounter giants of the jungle which requires considerable time for one man to chop down. Of these huge trees the *Ceiba* and the *Guana-caste* are the most frequently found. Where irrigation is necessary for the successful cultivation of bananas, the felling usually follows immediately after the underbrushing, and the whole mass is then burned, after which the land is lined, staked, and planted.

After the felling, the future plantation is an almost impassable tangle of stumps and trees, with interlocked branches and matted vines. In fact, its aspect at this stage is one of a heavy forest shorn off at the ground and laid flat in a tangled mass. The felled land gives the impression that one is in the wake of some devastating agent instead of in the midst of a plantation in the making. Through this mass must be cut the right of way for railway lines, narrow-gauge tramways, and roads. This stage is a very critical one in the building of a plantation; in case of a drought many of the bulbs may not germinate, which necessitates replanting later on, or the felled timber may catch on fire, which is disastrous to the planting. On the other hand, in the event of heavy rains, the areas may become flooded, which is equally disastrous to the young plants. To the outsider it might appear that felling the forest trees on the newly planted ground would entirely destroy the young plants; this, however, is not the case. The felling is done before the bits have started to sprout, and even if a log crashes down on the top of one of these bits, the plant will usu-



TYPICAL SCENES ON A BANANA PLANTATION.

ally grow up around the log and adjust itself to the situation. The enormous amount of logs, branches, leaves, and trash covers the ground like a mulch and instead of being destructive, actually establishes the most favorable conditions possible for the growth of the young banana plants. The hot, humid atmosphere and the wealth of fungus and bacterial organisms cause the felled trees to undergo rapid decomposition. The twigs and smaller branches quickly rot, adding to the humus in the soil. The larger branches decay more slowly; the huge trunks may withstand this action for several years, and are sometimes burned to get them out of the way.

About three months after planting, the plantation is ready for its first "cleaning." This consists in cutting down the smaller limbs and branches of the felled trees as well as chopping down the weeds and tropical growth that have sprung up, which, if left, would soon choke the young banana plants. From now on, at intervals of from three to four months, the plantation has to be cleaned. Through the various cleanings much of the original forest growth felled has been carried off or has decayed, although the stumps and logs of the larger trees may still remain. At each cleaning any failure of the original rhizome to come up, commonly termed "misses," or any damage to the young plants by felling or ravages of animals has to be overcome by "supplying," *i. e.*, replanting. This is usually done by using "suckers" (although "bits" are occasionally used) which are obtained from older fields and are, as previously described, young plants which have developed from the underground buds or eyes on the bulb or rootstock. By means of a sharp mattock they are cut cleanly off from the parent rootstock or "mat" and carefully removed so as not to break off the small roots. The green leaves are cut back, and the young plant is then set out in its place in the row and soon begins to take root and to send out new leaves. The success of the plantation depends in a great measure on the "stand" obtained from the original planting.

A great deal of other work must be done simultaneously with or soon after the planting, in order to be prepared to handle the crop which begins to come in from twelve to fifteen months later. As the banana plantation is established on virgin land, the operations may be a few or many miles from any habitation. Railway construction must follow closely behind the planting in order to bring in material and supplies for laborers and for construction. Quarters for employees and laborers have to be constructed, areas cleaned and pastures made for work animals, and tram lines laid down throughout the plantations as fast as the right of way can be cleared through the felled land. It is a race against time to accomplish all of this, in which the uncertainty of nature's elements plays an important part. Owing to the heavy and irregular rainfall, both farm and con-



BANANA PLANTATION SCENE IN COLOMBIA.

struction work are continually interrupted. The most promising outlook may be turned into disaster overnight by a flood, and several months' time and labor lost.

On account of the soft, porous nature of the soil and the heavy precipitation, it has been found more economical and efficient to supply the plantations with a system of light tram lines, rather than to attempt to build wagon or cart roads on which to bring out the fruit. The distance which the bunches of fruit can be carried by men or packed on animals over such land is very short, especially during wet weather. This necessitates a vast network of tramways, with the lines only a few hundred yards apart, the cars in many cases being hauled by draft animals.

After the primary construction period has passed, a large force of laborers is constantly required to keep down the rapid tropical growth and to give each section its cleaning and supplying at the proper time. Old drainage ditches have to be cleaned out and new ones dug. There are innumerable small bridges for the tramroads over the ditches and small creeks which require constant attention and repair, especially after each heavy rain, during which many of them are washed away. Part of this labor is also organized into cutting gangs for harvesting the fruit on cutting days.

In addition to the labor involved in keeping in check the riotous tropical vegetation, the banana plantation must be ready for other emergencies. At times excessive rains cause the rivers to overflow their banks and change their course, which results in great damage to or total destruction of large banana areas, as well as heavy damage to the main roadbed and bridges. Occasionally a hurricane may sweep through a district, causing a total loss of the crop. Windstorms of a velocity not exceeding 20 to 30 miles an hour often prove very destructive to banana plantations, especially to the trees bearing fruit ready for cutting, which, on account of the heavy weight of the bunches, are more apt to be blown down. Then again, a drought may occur which seriously retards or damages the fruit; also ravages of insect pests, such as locusts, must sometimes be combatted. All these and other conditions necessitate frequent revision of the estimate of the plantation output in order that ships of the proper carrying capacity may be supplied.

HARVESTING THE BANANA.

As previously stated, the trunk of the banana plant, or tree, as it is commonly called, is nothing more than a bundle of leaf-sheaths. Three or four weeks after the rhizome has been planted, the first leaf appears above the ground, and in the course of about twelve months the plant will have reached a height of from 20 to 40 feet, depending upon climatic conditions. Usually by the tenth or eleventh month



TYPICAL SCENES IN THE BANANA FOREST.

Upper: Bananas about to be clipped from the tree. Lower: Bunches of bananas having been placed alongside railway are now being loaded into ventilated cars for transportation to seaport.

from the time of planting, the stem which is to bear the fruit has pushed itself up from the rhizome through the center of the stalk, and the blossom has "shot" or appeared in the center of the crown of the leaf-sheath. From three to five months are then required to develop a bunch of bananas ready for cutting, this fruition period varying considerably with the soil and climate.

The banana is a very prolific reproducer, and after the first crop it is necessary to cut down many of the young plants or suckers in order that they may not become overcrowded. Up to a certain limit the fewer suckers allowed to grow from a single rhizome the more hands or clusters of fruit will be produced by the remaining trees originating from that root. Usually only from two to five of the most promising shoots are allowed to grow up to supply fruit later. This process of cutting away some of the shoots is termed pruning and is a work that requires skill and judgment to produce the best results. Therefore, as the plantation comes into bearing, there are always new shoots coming to maturity to replace those which have already borne fruit and have been cut down, so that after a time the production becomes practically continuous over a period of several years. There are certain areas where, as a result of a single planting, the trees have continued in production for twenty years.

As fruit of various stages of development is coming on at the same time a practiced eye is required to select the bunches of proper grade to be cut for shipment. Cutting of the fruit in a given section is done once, and frequently twice, a week. A cutting "gang" usually consists of three men: The "cutter," the "backer," and the "muleman." The "cutter" uses a long pole with a special knife attached to the end. He nicks the trunk of the tree a few feet below the bunch, and the weight of the bunch causes the trunk to weaken and bend where it has been cut. The top of the tree with its bunch of fruit is steadied by the pole to avoid its coming down with a rush and crushing the fruit. It is eased down until within reach of the "backer," who receives the bunch on his shoulders and the "cutter" severs the bunch from the tree with a machete and cuts off the blossom end. The "backer" immediately carries the bunch on his shoulder to the nearest pack road or tram line, and the "cutter" then cuts down the tree itself near the ground, where it quickly rots, the decayed stalk forming humus which acts as a good fertilizer for the soil. The fruit is then carried out on pack animals or loaded on tramcars for transportation to the railway. In some instances, where the railway is very near, the bunch is "backed" right out to the track. In others it is first "backed" a short distance, then packed on a mule, and finally loaded on tramcars. The pack by animals as well as the haul by trams is of varying distance, depending on the location of the land with respect to the railway and



GLIMPSES OF COSTA RICA'S BANANA INDUSTRY.



PLANTAIN FOREST IN NICARAGUA.

The platano, known to the English-speaking world as the plantain, is the largest member of the banana family. The cultivation of bananas in Nicaragua is one of the most important sources of the country's wealth.

tram facilities. Pack and tram animals are employed on some farms, while on others small locomotives are used on the trams instead of animals on account of the long heavy hauls.

TRANSPORTING THE FRUIT TO THE LOADING PORT.

Upon arrival at the railroad two methods are employed in loading the fruit on railway cars, depending on the quantity of fruit assembled at one point, the location, and the track facilities. Where possible, the trams are run to sidings or spurs of the main line, and the fruit is passed from the tramcars to the waiting railway cars as fast as it comes out from the farm. In other cases the bunches are placed alongside the track on turf or wooden platforms and covered with leaves, to be loaded subsequently on fruit trains by loading gangs who travel with them.

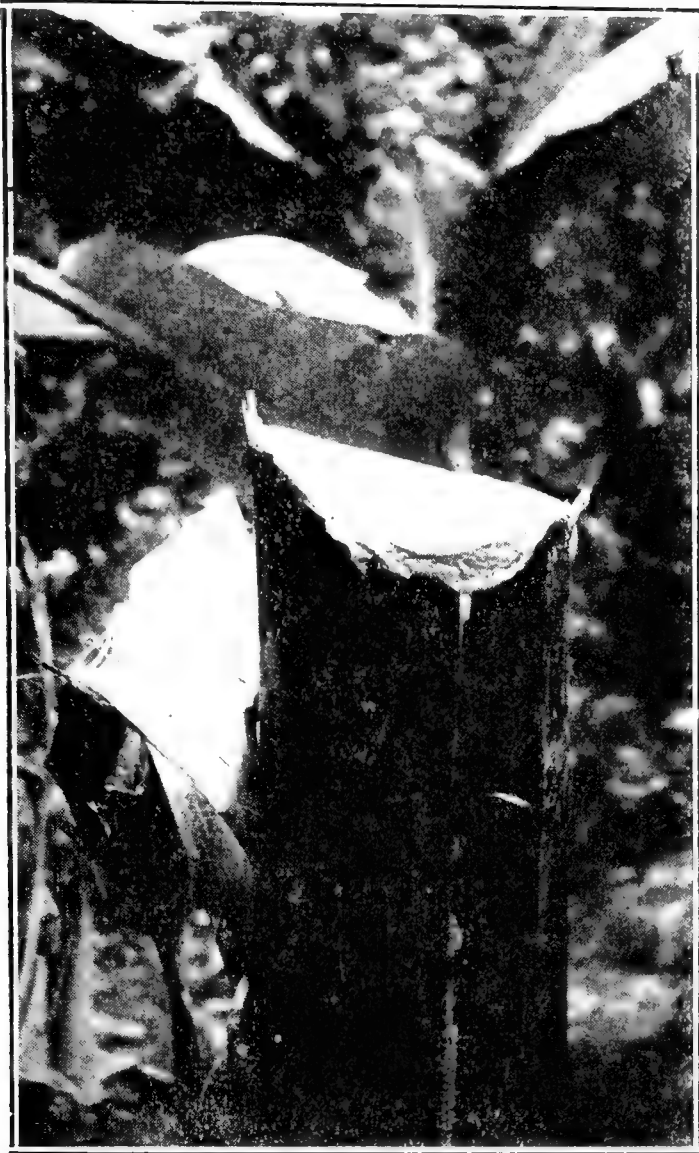
Definite loading orders are received in advance of the arrival of the steamship. In due course cutting orders are transmitted to the district headquarters, based on the carrying capacity of the ship, and the estimated quantity of fruit of the required grade and quality ready for cutting in each district. District headquarters distributes orders for the required amount among the farms and each farm overseer in turn makes his allotment to the individual sections and to the cutters, and sees that everything is in order to start the cutting at daylight the following day. Rigid inspection is enforced by the farm overseer, foremen, selectors, and traveling inspectors, from the time the cutting commences until the fruit is loaded on railway cars.

Special trains of empty banana cars are started out from the terminals as soon as cutting is well under way, each with its inspector and loading gang. These trains travel over the banana lines, receiving the fruit which has been placed alongside the track, picking up the cars loaded at sidings and assembling them at central points. As fast as sufficient loads are assembled they are forwarded to the port in trainloads of from twenty to forty cars.

LOADING THE BANANA CARGO.

The loading of the steamer begins immediately upon the arrival of the first fruit train at the port. The cutting orders and the schedule of the fruit trains are so arranged that a continuous flow of fruit to the loading port is insured. The loading of the steamship continues day and night without interruption until completed, cargoes of 75,000 bunches being loaded in twelve to fifteen hours.

At all the principal banana-loading ports, the cars of fruit are switched to the dock and the bananas carried to conveyors or loading machines, which take the bunches into the holds of the steamship. The fruit on its way from the cars to these loading machines is



A banana stalk as it looked when freshly cut
at 10 a. m.



Same stalk showing the growth in the center
20 minutes later.



Stalk 8 hours after cutting.



Identical stalk 31 hours after cutting.

PHOTOGRAPHS ILLUSTRATING THE RAPID GROWTH OF THE BANANA PLANT.

again inspected and all damaged or defective bunches and bunches showing excessive fullness or the slightest yellow color are rejected on the wharf. Experienced gangs of laborers under direction of foremen receive the fruit in the holds of the steamship where it is carefully stowed in the various compartments and bins. These bins are constructed of wooden bars called "shifting boards," similar to the old farm gate, and prevent the fruit from rolling and becoming crushed. Each class of fruit, i. e., the nine, eight, seven, and six hand bunches, is usually stowed separately, and stowage plans are prepared, showing the location and quantity of the different classes, to facilitate the proper discharge of the cargo upon arrival. The bunches are stowed on end, resting on the larger end or butt of the stalk, in from one to four tiers or with one or more tiers standing and one or two tiers laid horizontally thereon. The interstices between bunches, between hands and stalks and between the fingers, form natural channels for the circulation of air.

As the loading of each deck is completed, the delivery end of the conveyor is raised to the deck above. On completion of the loading of the top deck, the conveyor is removed, the hatches are put on, and if the vessel is a refrigerator ship the cooling of the cargo is begun. In the process of respiration bananas absorb oxygen and throw off carbon dioxide in large quantities and the problem is to carry fruit well ventilated within a narrow range of temperature. It is the rule to precool the holds of a refrigerator ship for a period of about 24 hours prior to loading, and when loaded to reduce in the briefest time possible the temperature of the fruit to the desired degree and to maintain it at that point.

THE BANANA STEAMSHIP.

To transport bananas with any degree of success, specially designed steamships are necessary. Both refrigerator and naturally ventilated vessels are used in this trade, particular attention being given to the feature of ventilation and air circulation.

The holds of a modern banana-carrying steamer are divided by several decks, which in turn are subdivided by vertical partitions into a number of compartments of a convenient size, the entire vessel being heavily insulated to prevent the transmission of heat. The fruit is cooled to the required temperature by refrigerating apparatus. The air is passed over brine coils, which cool and dry it, and is then circulated by fans through the fruit holds. Most people will be surprised to know that the refrigerating machinery used is much more powerful than is required for a steamer of similar capacity carrying frozen meat, although banana cargoes are carried at a much higher temperature. In the case of bananas, the refrigerating appa-

ratus must contend with the heat generated by the respiration of the fruit itself.

Naturally ventilated ships, which are generally used on the shorter runs, are equipped with large ventilators placed at convenient points to supply fresh air and draw out the stale air. These ventilators are manipulated by turning the large intake cowls to or from the direction of the wind.

During the entire voyage the fruit is carefully inspected at regular intervals every few hours, day and night, and the temperatures of the fruit holds closely observed and recorded. In the winter season, while the ship is approaching the Northern Atlantic ports, it is some-



BANANA UNLOADING MACHINES AT NEW ORLEANS.

times necessary to use artificial heat in maintaining the desired temperature of the fruit.

The voyage from the various banana shipping ports of Central America and Jamaica to New Orleans, Mobile, or Galveston consumes from three to a little over five days; and to Boston, New York, Philadelphia, or Baltimore about seven or eight days, according to the distance, route, and the speed of the vessel; while the voyage to England consumes about fourteen days. On account of the longer ocean voyage the bananas shipped to the English market are of a thinner grade, *i. e.*, less fully developed, than the fruit sent to the United States.

DISCHARGING THE BANANA CARGO.

The problem of discharging banana cargoes varies according to the local conditions which exist at the different ports. As soon as the ship reaches the home port and while she is approaching the wharf, the hatches are opened up, weather permitting, and the work of discharging the cargo begins immediately the vessel is made fast.

When a cargo of bananas is being discharged the wharf presents a very busy and interesting scene. It is, however, an orderly operation under direction of the superintendents and stevedores, and a few minutes' observation reveals the wonderful speed, accuracy, and sureness of a system evolved from long experience in the handling of banana cargoes.

At New Orleans, Mobile, and Galveston the wharves are equipped with unloading machines, each having a capacity of 2,500 bunches an hour. The great booms of these machines are lowered deep into the holds of the ship and at the sound of the gong the wheels start whirring. Suddenly up come the big green bunches in the canvas pockets of the endless chain, then across and down to the wharf, to be turned out automatically onto horizontal belt conveyors.

At New Orleans the wharf is also completely fitted with mechanical conveyors of elaborate and ingenious construction, which transport the bananas from the unloading machine to the door of the refrigerator car. In the case of Mobile and Galveston, however, the bunches are lifted from the horizontal belt conveyors to the shoulders of men who march in continuous ant-like lines to the aisles between the many rows of refrigerator cars and deliver the fruit at the car door. Inspectors are located one on each side of the delivery belt, and as each bunch reaches the point of discharge its destination is called out in accordance with its condition, quality, and classification.

At the Eastern ports, i. e., Boston, New York, Philadelphia, and Baltimore, where the piers are not railway terminals, as is the case at New Orleans and the other Southern ports, the unloading of banana cargoes is done by hand. The men are placed on stages in the hatchways of the vessels and the fruit is passed up by them from one man to another and is taken out either through the side ports or through the deck hatches, as is most convenient. The ship is usually discharged on both sides simultaneously, the fruit being unloaded into drays or automobile trucks on the wharf and into railroad cars on floats on the offshore side. When loaded, the car floats are towed to the various railroad terminals where the cars are transferred to the land terminals by means of float bridges. At Boston a considerable portion of the fruit is trucked to the railroad yards and loaded directly into cars.

Bananas are inspected and weighed at the seaboard by men specially appointed or licensed to do this work. The inspection is very rigid and any fruit showing the slightest evidence of damage or degree of maturity which forecasts early ripening is rejected for interior shipment and sold locally. The fruit is carefully weighed after it is loaded in the railroad cars or drays, as the case may be, the cars and drays being first weighed empty and the tare recorded.

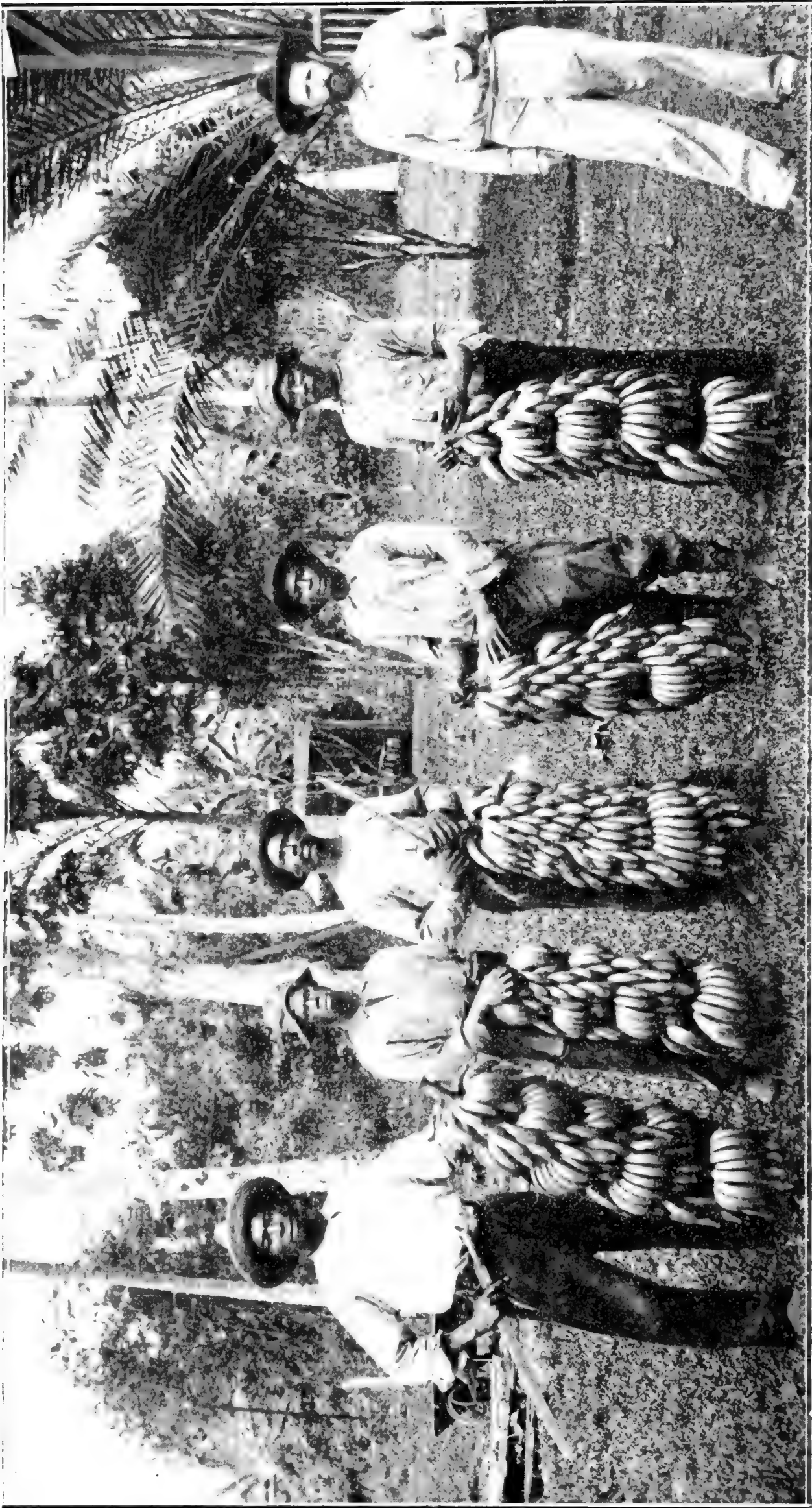
All bunches are carefully counted with checking machines giving accurate count of the bunches as they pass through the car door (the machines used at New Orleans and Mobile working automatically), and the passport of the green bunch is thereafter the railroad bill of lading instead of the ship's manifest.

BANANA SHIPMENTS BY RAIL TO INTERIOR POINTS.

After having been thoroughly inspected and equipped before being placed for loading, the cars, as previously stated, are weighed empty, and when loaded are again weighed. These cars are then made up into trains which are dispatched over the various roads on fast schedules. Caretakers, called banana messengers, travel through with the trains, inspecting, taking temperatures, and arranging the ventilating devices in transit; or resident messengers, who perform the same service, meet these trains at regular intervals in order to inspect the fruit and arrange the ventilation. The shipper's office at seaboard and consignees are kept in close touch with the banana cars through telegraphic advices from messengers en route and resident messengers and superintendents of fruit houses, and through this service many losses incident to transportation are avoided.

The fruit is carried into widespread territory in refrigerator cars which, in most cases, are equipped with false floors or floor-racks, providing an air space of four to six inches in depth under the load. By cooperation between shippers and the various railroads and car lines, these refrigerator cars have been brought up to a high standard, although much experimental work is still being done to improve design and construction. The banana traffic is of great importance to the railroads of the United States, a very large proportion of the importations being transported by them. Usually the haul is long and in the opposite direction to the bulk of other railroad traffic.

During the warm season the cars are refrigerated. Constant refrigeration in transit is obtained by initial icing at seaboard and reicing en route as needed. Large cakes of ice are used, and the ventilators of the car are carried open to some extent to provide the necessary amount of fresh outside air to preserve the vitality of the fruit and at the same time to prevent over-refrigeration near the floor of the car. Large cakes of ice present to the atmosphere less surface in proportion to the weight than crushed ice or small cakes,



BANANAS AS CUT FROM THE PLANT.

Bananas and plantains are the leading fruit foods of the world. Boiled or baked, they are a substitute for bread. From banana flour an acceptable bread can be made, especially when mixed with wheat flour.

therefore melting more slowly and producing a cooling effect over a longer period. Convenient icing stations are established by the railroad companies at various divisional and junction points, and the cars are quickly iced in transit on advance notice given through the messenger service.

In the winter season the banana cars are papered and more or less heavily strawed according to the weather conditions so that the tiers of firmly stowed bunches may be well fortified against the northern cold. At seaboard points during the winter months the cars are given an initial heating before they are loaded. At eastern seaboard points the cars are again heated after being loaded and before the cars are started on their way. For winter emergencies great fruit houses equipped with heating plants are placed at convenient points, the largest, located in southern Illinois, handling 72 cars at one time. If unusually cold weather prevails and produces lower temperatures in the cars than desired, they can thus be heated on the way to destination and the fruit warmed to the required degree. For the further protection of some of the shipments destined for the northern part of the United States and Canada, car heater stoves are provided by the railroad companies at convenient points. With these stoves the required temperature can be maintained during extremely cold weather and in emergency when trains are snowbound or otherwise delayed.

The distribution of bananas throughout the United States is, generally speaking, as follows: The fruit imported through the Gulf ports is distributed all over the Southeast, south of the Ohio and Potomac Rivers, the Central West, and through the great territory lying west of the Mississippi River, including western Canada, while the fruit imported through the Atlantic ports is distributed mainly in the Eastern States, north of the Ohio and Potomac as far west as Columbus, Cleveland, and Detroit, the New England States, and eastern Canada.

SELLING THE BANANA.

The larger portion of the bananas imported is marketed through sales branches, located in all the important centers of the United States and Canada, which solicit and receive orders for the fruit from the jobbing trade in their territory. These orders are telegraphed or telephoned by the branches to headquarters at the seaboard for acceptance and are usually received before the cargo of bananas is discharged, although orders are taken at times for cars which have already been shipped from the seaboard. A large portion of the fruit arriving at Atlantic ports is sold locally by auction in truck lots. Bananas are sold to the jobbing trade on the weight basis and many retailers have now adopted the practice of selling by weight instead of by quantity.

HANDLING BY THE JOBBER.

The successful banana jobber is on the lookout for his shipments, unloads them quickly, and devotes great care to the physical handling of the fruit in order to avoid scarring and bruising. When the railroad car is unloaded at a distance from the banana rooms, the wagons or trucks which are used for transporting the fruit are provided with straw or hay. In case the car is placed at the jobber's unloading platform, an overhead track with trolley hooks is frequently used to convey the bunches separately to the banana rooms.

In winter, protection is given against chilling by thoroughly strawing the wagons in which bananas are transported, and by covering each load with blankets or tarpaulins. In most of the northern territory vans, somewhat resembling those used for carrying furniture, heated with small stoves, are used for unloading, and stoves are often placed in the cars. When the car is placed at the jobber's unloading platform, canvas windshields are employed to protect the fruit while moving from the car door to the interior of the building.

A part of the jobber's distribution is represented in the shipment of single bunches of bananas by freight or express and special crates of various sizes and designs are manufactured and used for this purpose. The returnable crate is constructed of oak slats with a burlap bag suspended within and so tied to the structure that the bunch can not be bruised by contact with the outer frame. The nonreturnable crate is made of light slats in which the bunch of bananas placed in a paper bag manufactured for the purpose is packed with hay or straw. The jobbers handling the smaller classes of fruit frequently use cylindrical cardboard drums strengthened with wooden bottoms and hoops.

BANANA ROOMS.

The care and ripening of the green fruit in the banana rooms of the jobber form an important link in the long chain of operations extending from the plantation to the retail distribution, and the present advanced type of banana room has been designed to simplify handling and to place the banana on the market as a matured product at its highest intrinsic value.

The bunches are hung systematically in the banana rooms from ceiling hooks with proper spacing to permit the requisite air circulation and with a view to convenience in handling.

As ripening is recognized as a vital phenomenon resulting from changes taking place within the cells of the fruit, it is necessary to have normal, wholesome conditions in the banana room. Provision is made for fresh air circulation and for the maintenance of the required degrees of humidity and temperature. The room is well insulated and fitted with special heating and refrigerating apparatus

in order to maintain an even temperature against exterior weather conditions. The heating appliance is so designed that the products of combustion are conveyed to the exterior. A gravity system of ventilation constantly supplies fresh air and removes the vitiated air resulting from respiration of the bananas, which increases rapidly during the ripening period.

Bananas treated in a room of this description not only develop the color, firmness, flavor, and food value requisite in the matured product of highest quality, but the losses which ordinarily occur through shrinkage by evaporation and through over-ripening and decay are minimized.

HANDLING BY THE RETAILER.

The retailer's approved practice is to hang the bunches of bananas where they will be readily seen, but subject to as even a temperature as possible and to a circulation of fresh air. In winter due care is taken to protect the fruit from draughts of cold air, and the bunches are covered with paper bags or wrappings in case the temperature is low at night. In severing the bananas from the stem a specially designed banana knife is used to avoid tearing the skin and exposing the pulp. This point of retail service should be always insisted upon by the purchaser.

FOOD VALUE OF THE BANANA.

In food value and flavor the banana easily takes its place at the head of the list of raw fruits. Moreover, it surpasses most of the vegetables in *energy value* and in *tissue building elements*. It is one of the few fruits which reach the highest perfection in food value and flavor when harvested green and allowed to ripen after being severed from the tree or plant. It is always cut green, even when consumed locally in the tropics, for the reason that if allowed to ripen on the plant it loses its delicious flavor and becomes insipid. The banana reaches the hands of the consumer in a germ-proof package, sealed by nature herself. No worm, blight, or insect sting affects the fruit pulp, for its glove-like skin protects it from contamination of all kinds. It costs less per pound the year round than most of the common native vegetables or fruits.⁴

⁴ Prof. Samuel C. Prescott, of the Massachusetts Institute of Technology, one of the foremost authorities in the United States on foods and their relative nutritive values, in 1917 wrote as follows:

“The banana to-day provides more actual food for the same cost than any other fresh fruit or vegetable, or fish, meat, milk, or eggs. The combination of banana with milk in proper proportion, or its utilization as a vegetable to supplement a diet containing a small amount of meat will produce a ration which is ample to take care of the body needs. Meats are essentially protein foods and as such are more adapted to the development of tissue than to the quick production of heat, while the banana, on the other hand, is less a tissue-forming substance, but is comparably more effective in supplying the heat-giving materials. In a crude way we might say that the proteins are the foods which make good the losses due to wear and tear in the machinery of the body, while the carbohydrates are the foods which keep the machinery in motion and do work. From this standpoint it is seen therefore that the banana because of its higher carbohydrate content along with a certain amount of protein, would be a more useful all-round food than a pure meat diet in which the amount of carbohydrate is nil.”



A TROPICAL FRUIT VENDER.

Above picture represents a typical vender of not only bananas but of other delicious fruits. At such fruit stands one is often able to purchase quantities of fruit at a very trifling cost.

A common mistake is made in eating the fruit before it is thoroughly ripe. The riper the fruit, the more wholesome and easily digested it is, as the starch in the green banana is converted gradually into sugar in the ripening process. The fact that the skin is yellow, however, does not necessarily mean that the banana is fully ripe. As a matter of fact, the best state in which to eat the banana is when the ripening process is so far advanced that the skin begins to darken and becomes slightly discolored, for then the pulp is mellow, the sugar and flavor-giving compounds fully developed, and the fruit itself easily digested. When it is desired to ripen bananas they should be kept at a moderate temperature, but never in the ice chest, a mistake very frequently made, as, instead of hastening the ripening process the low temperature retards it and damages the fine flavor which develops with normal ripening. Ripe bananas, like other ripe fruits, are nutritious and especially good for growing children.⁵

While the banana can be prepared for the table in various ways, it is surprising to find that a vast number of people are amazed to learn that it can be served baked or fried, or cooked in many other ways. The American and European people are just beginning to appreciate the possibilities of the banana when cooked and served for daily consumption as a vegetable.

The public, which has long regarded the banana as a luxury, is just awakening to its value as a daily food. Increased use both in its raw and cooked state will stimulate further production and so render stable an important factor in the world's food supply. The continued development of the industry means an increase in the food supply of the countries importing bananas as well as an improvement in the commercial prosperity and living conditions of the countries from which they are exported.

⁵ The following results of an analysis reported in 1906 by Atwater and Bryant, working under the auspices of the United States Department of Agriculture, show the average composition of the edible portion, i. e., without the skin or peel, of the apple, orange, potato, and banana:

	Water.	Protein.	Fat.	Carbo- hydrate.	Ash.
Apple.....	84.6	0.4	0.5	14.2	0.3
Orange.....	86.9	.8	.2	11.6	.5
Potato.....	78.3	2.2	.1	18.4	1.0
Banana.....	75.3	1.3	.6	22.0	.8

A glance at the above figures will make plain that the banana contains three times as much protein as the apple, nearly twice as much carbohydrate, and three times as much fat as the orange; also that it approximates closely the potato in analysis and exceeds it by about 20 per cent in its fuel or food value.



THE PAN AMERICAN UNION is the international organization and office maintained in Washington, D. C., by the twenty-one American Republics, as follows: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Salvador, United States, Uruguay, and Venezuela. It is devoted to the development of commerce, friendly intercourse, good understanding, and the preservation of peace among these countries. It is supported by quotas contributed by each country, based upon their population. Its affairs are administered by a Director General and Assistant Director, elected by and responsible to a Governing Board, which is composed of the Secretary of State of the United States and the diplomatic representatives in Washington of the other American Governments. These two executive officers are assisted by a staff of international experts, statisticians, commercial specialists, editors, translators, compilers, librarians, clerks, and stenographers. The Union publishes a Monthly Bulletin in English, Spanish, and Portuguese, which is a careful record of Pan American progress. It also publishes numerous special reports and descriptive pamphlets on various Pan American subjects of practical information. Its library, the Columbus Memorial Library, contains 55,000 volumes, 200,000 index cards, and a large collection of maps. There is also a collection of 25,000 photographs, lantern slides, and negatives. The Union is housed in a beautiful building erected through the munificence of Andrew Carnegie and the contributions of the American Republics.