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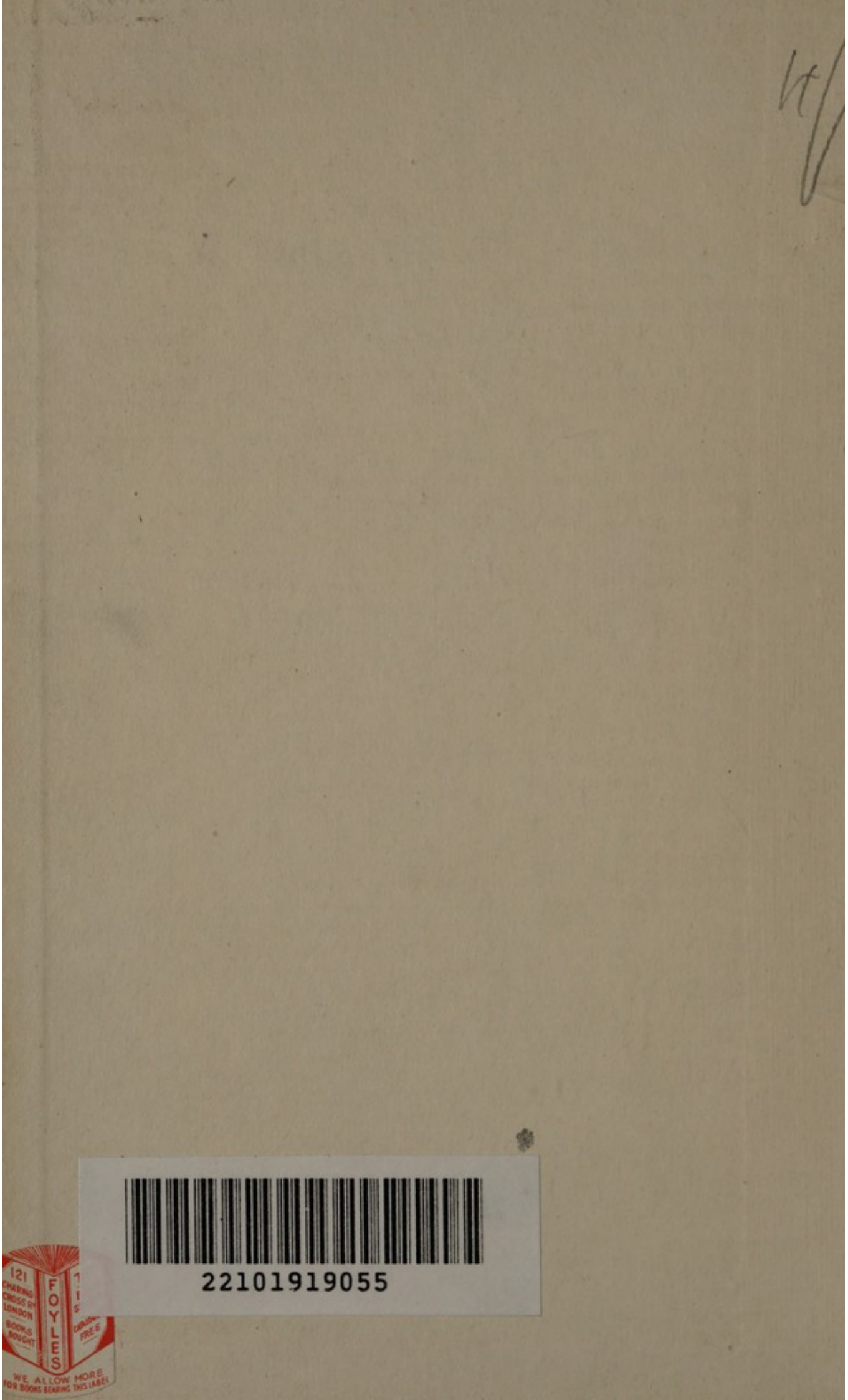
# ALL ABOUT COCONUTS

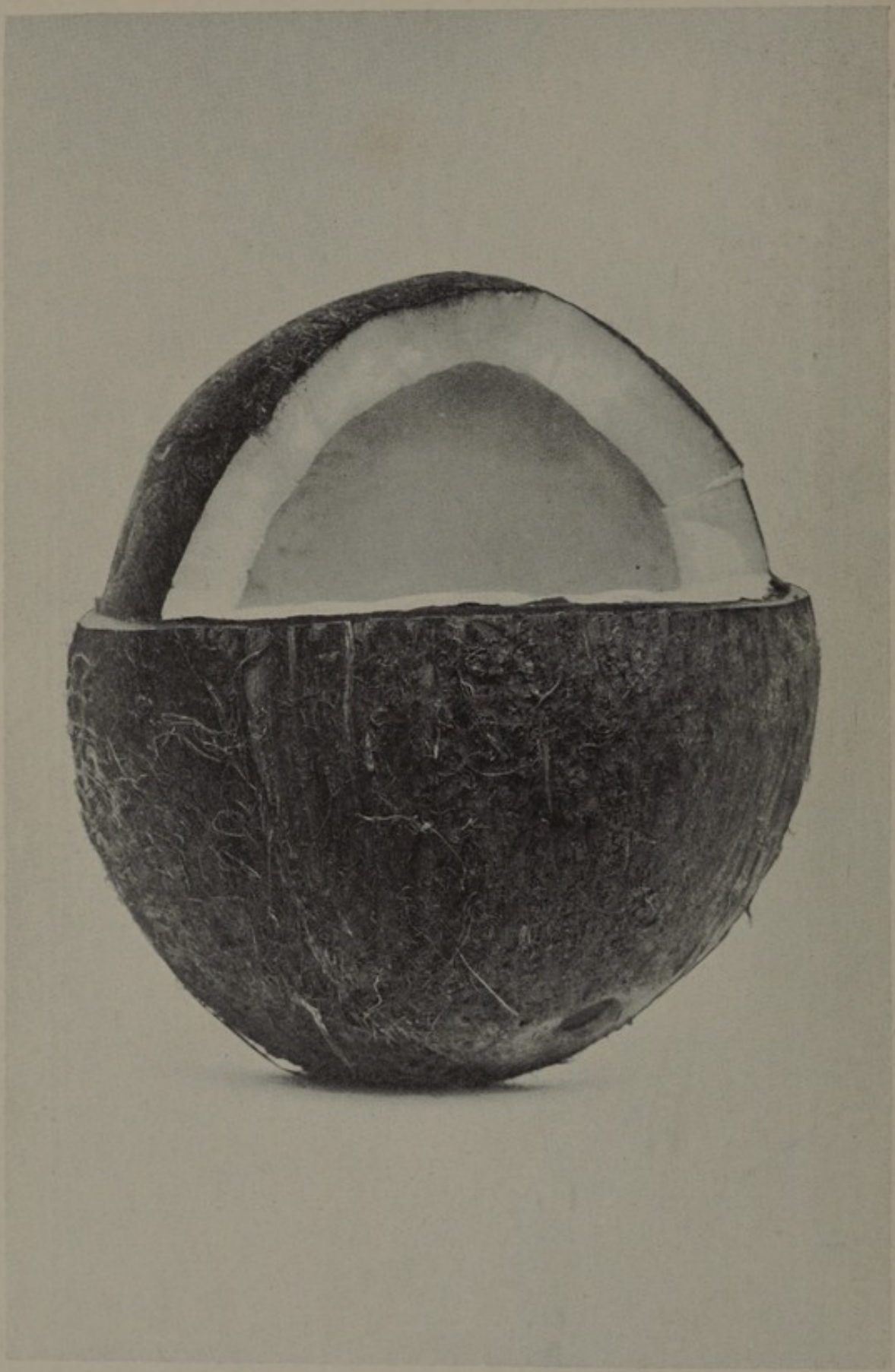
BY

ROLAND BELFORT

AND

ALFRED J. HOYER





*Copyright*] **Husked Nut Bisected, showing white flesh.** [*Eastern Palm Estates, Ltd.*

# All About Coconuts

BY ROLAND BELFORT

*Author of "The Future of Rubber Finance," "The Cables of the World," etc., etc.*

AND

ALFRED JOHANNES HOYER

*Late Planter and Merchant, East Africa, Zanzibar, etc.*

*FULLY ILLUSTRATED*

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# Foreword

IN these days of advancement one development follows so fast upon the heels of another that the marvel of to-day becomes the commonplace of to-morrow, and one has perforce to accept change and even revolution as normal phases of existence. Nothing illustrates this progress more clearly than the manner in which scientists and experts in every department are developing the world's latent wealth, particularly in the field of tropical agriculture. In a comparatively short space of time we have witnessed an expansion in the cocoa, rubber, and banana industries that has brought these commodities into the forefront of the commercial world, and, incidentally, proved highly profitable to those whose foresight enabled them to secure financial interest in the movement at its inception. Quietly but rapidly a revolution is being wrought in another product which forms the basis of several of our commonest household necessities—butter, soap, candles, and mats—and in which the scope for profitable enterprise is so great as to make it

difficult to present adequately and fairly the outlook without appearing to be unduly optimistic.

The lay reader will be able to form some idea of the gigantic strides made in the development of the coconut industry when it is mentioned that the value of the world's output for the year 1913 is estimated to exceed £70,000,000, or nearly double the world's output of rubber. Moreover, the market price of the principal product of the coconut (copra—the dried kernel) has nearly trebled in price in the last few years, whilst at the same time the cost of production—owing to the introduction of improved methods of cultivation and machinery—has been reduced.

The latter point is indisputable evidence of the profitable nature of the industry. If coconut cultivation was profitable when the product was sold at £10 to £12 per ton, what must be the profit of the industry with the market price at over £30 per ton? And it may be here remarked that many years ago, when copra was between £10 and £15 per ton, coconuts were christened "The Consols of the East," owing to the safe and profitable nature of the industry of coconut cultivation.

That we are only on the fringe of gigantic developments in the industry is shown by the fact that the existence of the food article which has been mainly responsible for the expansion in the

demand for coconuts—viz., nut-butter—is known only to a comparative few. Perhaps one in fifty has heard of it, and only one in a hundred has tried it. Yet, although it may appear to be looking very far ahead, nevertheless, many shrewd, disinterested persons have expressed the opinion, for which there is good foundation on medical, sanitary, and economic grounds, that it is only a question of time before butter made from vegetable fat will entirely supersede the butter made from animal fat.

The area available for coconut cultivation is limited owing to the peculiar qualities of soil and environment required for its successful cultivation, so that over-production, the bugbear of most industries, is practically impossible.

As the *Times* points out in an exhaustive article dealing with the industry :—

"Altogether the coconut is one of the most valuable of Nature's legacies. It is the fact, too, that there has so far been little increase of the area under coconut cultivation. Assuredly each year brings an increased number of nuts to the world's markets, but such increase does not represent the crops of new plantations, but rather increased crops from old estates—it is due to the circumstance that trees, hitherto only in partial bearing, have now come into full crop—wherefore there would appear to be small fear of over-production for many years

to come. Again, there is one very solid fact that must not be lost sight of. The world's coconut output is not available in its entirety for the manufacturing industries mentioned, for there is a very large native demand to be first satisfied. As rice or bananas constitute the national 'stand-by' in some semi-civilised regions, so, in countries where *Cocos nucifera* is grown, is the fruit of that tree indispensable to the native hordes who for generations have relied upon it for food, drink, cooking oil, twine for their fishing-nets, cordage, and what not. This native demand, of course, has to be satisfied before a single nut is sold to the foreign manufacturer or other outsider, and with native populations ever growing, we have here a further argument against the probability of over-production."

The industry presents unique opportunities for profitable investment of capital, either through the medium of holdings in companies formed to develop the industry, or in acquiring land suitable for cultivation. In the latter direction it is probably the finest opening the world offers to-day to the enterprising young man with moderate capital and some knowledge of agriculture. It has been stated by no less an authority than Sir W. H. Lever that about £2,000 spent in developing an estate of 200 acres will ensure an income of £2,000 per annum.

This work will have served its purpose if it

awakens an interest and leads but a few to inquire further into the present position and possibilities of the industry, and eventually to share in its development and profits.

So far little has been known of the subject outside the limited circle of planters, traders, merchants, and financiers who have been identified with its development. We trust that the information given in these pages will prove of practical value and thus contribute, in the measure of their utility, towards the development of what has been, and must long remain, without doubt the most profitable form of tropical industry, and in which some of our most enterprising colonies are largely interested.

## AUTHORITIES CONSULTED.

We take this opportunity of recording our grateful thanks for the courtesy extended to us by the authors of the following publications and the authorities enumerated below, to which we have had occasion to refer and from which we have ventured to make certain quotations :

*Coconuts—The Consols of the East.*
*The Cult of the Coconut.*
*The Coconut Planters' Manual.*
*Daily Mail.*
*Coconut Cultivation in the West Indies.*

*Coconut Cultivation in the Federated Malay States.*

*Mr. W. R. Cater, F.R.G.S.* (*photographs*).

*Bulletin and Annual Report of the Territory of Papua.*

*Coconut Growing in the Philippine Islands.*

*Malabar Estates and Planting Co., Ltd.* (*photographs*).

*The Tropical Agriculturist.*

*Tropical Life.*

*World's Work.*

*Coconut Culture.*

*The Coconut.*

*African World.*

Etc., etc., etc.

Our cordial acknowledgments are also due for the valuable assistance rendered by the numerous planters, merchants, and others, particularly the Eastern Palm Estates & Trading Syndicate, Limited, whom we have had occasion to consult on special features of the industry, and who have generously given us the benefit of their advice and their practical experience to confirm or revise our own.

ROLAND BELFORT.

A. J. HOYER.

# Chapter I

## The Commercial Value of the Coconut

IT is no exaggeration to say that the average man knows practically nothing of the coconut. He may be aware of the existence of coconut oil, and may even entertain some hazy notion of its value as a commercial commodity, but in the main he is satisfied that the coconut serves its principal purpose as an adjunct to the Bank Holiday revels of the more exuberant classes. Mention coconuts and the mere association of ideas will conjure up for him visions of a joy-day on Hampstead Heath with "three shies a penny" as the centre of attraction; or he may possibly recall an ancient farce in which the leading parts are allotted to a mariner, a monkey and a coconut. Suggest to him that the coconut is one of Nature's most remarkable products, that it is to-day an indispensable factor in the daily lives of millions

of his fellow-subjects, and that its cultivation is rapidly becoming one of the greatest and most lucrative industries in the world, and he will probably indulge in a smile that politely, but definitely, casts a doubt upon your sanity. This, of course, is typical of the average Britisher's attitude towards all things that do not come within his immediate ken; though it is only fair to say that his apathy disappears, like mist before the sun, when once he realises that a subject, previously dismissed as insignificant, possesses real importance. It is with the sole object of arousing interest in the immense importance of coconut cultivation to Great Britain to-day, both economically and financially, that these pages have been written.

At the outset it may be said that the development of the coconut industry since its inception, and particularly during the last decade, has contributed a chapter to the history of commerce that reads more like an Eastern romance than a record of hard fact; and to-day, with the demand for coconut products increasing by leaps and bounds, the outlook, whether for the planter, merchant or financier, is almost illimitable. In fact, the whole position may be summed up in the words of Sir William H. Lever, himself the founder of one of the greatest industrial undertakings of modern times, who, in his Foreword to "Coconuts: The

Consols of the East," says: "I know of no field of tropical agriculture that is so promising at the present moment as coconut 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 sweeping emphasis of this pronouncement, from one whose insight and commercial genius are beyond all question, must command the attention of everyone who professes interest in the world's industrial progress. Sir William Lever's views are supported by numerous authorities, including many who have been actively engaged in the industry for years. They have expressed themselves with equal emphasis regarding its future, and there can be no doubt that as a field for investment coconut cultivation offers attractions commercially, economically and financially that are difficult, if indeed possible, to find elsewhere.

Assuming that inquiry into the subject is justified, the questions that naturally arise are: what are the peculiar properties of this wonderful nut, what has caused the phenomenal demand for its product during recent years, and what definite proof can be adduced of its stability as a valuable and marketable commodity?

The best possible answer to the first of these questions is the enumeration of the manifold purposes served by the coconut and its products, which

will be found in these pages. Altogether, eighty-four separate, distinct uses have been found for these, the most important being identified with foodstuffs. In this sense the coconut still retains its original purpose, for long before its present value to the white man was ever contemplated it formed the staple article of diet in every coconut-growing region, particularly in the Pacific. Natives have always grown them more for their own requirements than for trading purposes, and this constitutes an important factor from a market point of view, for it assures a constant local demand quite apart from the world's general consumption. It has been estimated that each native consumes about sixty coconuts a month, these furnishing him with both meat and drink that require neither cooking nor preparation; indeed, he may be said to base his entire existence upon this remarkable nut, for it also provides him with shelter, profitable employment, and even raiment. In many regions, notably in Ceylon, natives calculate their wealth by the number of their coconut trees—twenty trees in full bearing being considered sufficient to maintain a man in comparative comfort throughout the year. They also provide dowries for daughters and pensions for widows, and thus justify their right to the appellation of the Consols of the East; indeed, they possess one distinct advantage over the world's premier stock, inasmuch as they repre-

sent an appreciating, instead of a depreciating, security. Some idea of the colossal scale of this local consumption may be gathered from the fact that hitherto the quantity of nuts exported appears insignificant in comparison. In India and Ceylon, for instance, coconuts form the staple food for millions of natives. In China and the Far East generally the demand is also enormous, and must inevitably expand with the opening up of the vast Republic. And in this connection it must be remembered that the value of coconuts consumed locally is precisely the same as that of nuts exported to European and other markets, and that in the event of competition between local and other consumers the produce would naturally go to the market where the highest prices prevailed. The advantage would rest solely with the planter.

Again, China must be an ever-increasing buyer of coconut oil, and for the following among other reasons. At the outbreak of the Russo-Japanese War, when Manchuria had become a household word to Europeans, and the products of the country had been studied and were known in the Western markets, great hopes were placed on the oil from the Soya Bean as a substitute for some of the more expensive edible oils. Oil producers in Europe and America made a sudden raid on this new commodity, and promised their buyers in turn all the advantages of the fats they had previously

been in the habit of buying. As a consequence, they denuded the Manchurian market of practically the whole of the production of the country. On the other hand, the Soya Bean had for many centuries been the sole source of edible and culinary oils supplied for China, the consequence being that when the Western nations bought up the whole of the available supplies, the Chinese housewife was forced to look elsewhere for suitable cooking materials, with the result that coconut oil from the East Indies and other places near at hand came into favour amongst them.

Now that many of the promises made on behalf of the Soya Bean have not been fulfilled, and Eastern consumers have reverted to the older, proved, and more satisfactory article, the production in Manchuria has fallen materially, because, although this oil can now be purchased on nearly as favourable terms as before the Russo-Japanese War, the Chinese consumer has, in the meantime, become accustomed to the use of coconut oil, and actually prefers it. Thus he is no longer an eager buyer of the home product.

It is obvious from this that it is only a very short time before China, with its teeming population of 600 millions, will be in the open market as a competitor against our Western buyers, the effect on the market naturally being to cause prices to appreciate, and to render the existing

shortage of supplies a far more serious problem than it is at the present moment.

It has been estimated by an expert that of the world's production of coconuts 50 per cent. is consumed in the East and elsewhere as food, and 20 per cent. transformed into oil for use in the above regions; so that only 30 per cent. finds its way into the European and American markets. These figures alone show how great must be the competition for coconuts and their products for many years to come.

The universal demand for coconut products is a comparatively recent phenomenon. It is only during the last few years that planters, traders and merchants have realised the importance of the coconut as an article of world-wide consumption, but when it was discovered that its products could be utilised in the manufacture of nut butter, nut lard and other similar foodstuffs the cultivation of the nut was recognised by experts as one that should be placed upon the firm and permanent basis that justly underlies most industries connected with the food supplies of the million. The discovery was indirectly brought about by the fact that America was no longer exporting animal fats, owing to its supplies being needed for home consumption. The reason for this was that while the population of the United States had increased by over 16,000,000 between

the years 1900 and 1910, there had been a marked decrease in the production of animal fats over the same period. During the last of these years, for instance, the Census of Production shows that throughout the States there was a decrease in cattle of 2,381,184, in hogs of 4,867,419, and in sheep of 1,000,000. In other words, supplies had diminished and demands had increased to such an extent that the States were not only using all the animal fat they could produce, but were compelled to supplement their supplies by imports. This shortage was not confined to the United States; in other parts of the world a similar situation had arisen, and it became obvious that the world's production of animal fats was decreasing. This meant, in plain English, that unless some substitute, equal in quality, purity and value, was immediately forthcoming to relax the strain on the markets, certain foods which are essential to mankind would rise to famine prices. The situation might have been righted by extensive cattle-breeding operations, but that is a lengthy process, and in the meantime a crisis would have arisen. Fortunately science and enterprise stepped into the breach, and the discovery was made that coconut products, of which there were supplies available, could fulfil the functions previously performed by animal fats, and in a very short space of time there was a world-wide demand for these

products. During the past four or five years the planters, traders and merchants engaged in the industry have fully realised its constantly-developing possibilities, but its importance in financial circles has yet to be recognised. There are excellent reasons, however, for concluding that this recognition will not be long delayed. Many well-informed authorities consider that a boom is probable in the shares of coconut companies; but, apart from that prediction, there is no doubt that among the leaders of the industry in the City there has been considerable, if quiet, activity which is likely to result in very important developments in the near future. Even without a boom, which is not an altogether unmixed blessing, the enormous demand that has arisen for coconut products cannot possibly fail to create marked activity throughout the industry, especially in the financial department.

The present position of the industry is unquestionably favourable. Its future stability and financial possibilities are amply demonstrated by statistics embodied in the ensuing pages; these statistics have been compiled with the greatest care and revised by recognised authorities. It may, however, be pointed out, here and now, that everything is in favour of the coming financial development. At the present moment the majority of the coconut estates of the world

are still in the hands of native proprietors, whose methods of exploitation are slow, primitive and wasteful. The land is cultivated in a careless manner; the trees are not properly watched and tended; artificial fertilisation is seldom resorted to; the preparation of the copra (the dried kernel of the nut from which coconut oil is extracted) is conducted on a dirty and wasteful system; the husks and milk of the nut are frequently wasted. Even in Ceylon, where coconut cultivation has attained a high level of efficiency, of the 2,300,000,000 nuts gathered annually only one-tenth of the husks are utilised. Now, the husks of 1,000 coconuts produce 1 cwt. of bristle fibre, worth 15s., and 5 cwts. of mattress fibre, worth 40s., or a total of £2 15s. Thus, even in Ceylon alone, over £4,000,000 is thrown away each year by the neglect of the husk; and while this waste has been going on the markets have been absorbing all the available coir fibre at high prices. and could have taken more, because the supply never quite equals the demand.

From these brief indications it will be seen that there is ample scope for British capital and enterprise to revolutionise the industry by introducing better planting methods, more scientific cultivation, labour-saving machinery, and the careful utilisation of many products that are now either wholly wasted or only partially turned to account. In this way

*Copyright]* **Coconut Flower System.** *[Eastern Palm Estates, Ltd.*

large sums can be made or saved, and estates which have yielded mediocre results brought to produce substantial profits.

From the Imperial standpoint, too, the coconut industry is of the highest importance. It requires no stretch of imagination to see that if it is largely controlled by British capital, as it doubtless will be, it will provide profitable occupation for innumerable young Britishers who qualify for positions on plantations in Malabar, Ceylon, the West Indies, Papua, and elsewhere in the Colonies. A proposal has already been mooted by Professor Wyndham Dunstan, of the Imperial Institute, for the foundation of an Agricultural College, say, in Ceylon, for the training of young tropical planters. Should this idea materialise, it will go far towards equipping those young men for the work of securing to the Empire the same preponderance in coconut planting that has been achieved in other tropical industries.

Another important point to remember is that an exhaustive study of the prevailing conditions shows that the coconut industry has scarcely emerged from its inceptive stages. Furthermore, when the development that is imminent has become an accomplished fact, it will be generally recognised that coconut cultivation is an industry less liable to competition, violent fluctuation, or sudden slumps than almost any other form of industrial

enterprise, the area for successful cultivation being limited by Nature, while the demand for the product is so constant and universal that it is impossible for anything like over-production to take place for many years to come.

## Chapter II

# The Coconut and its Products

BEFORE proceeding to the further consideration of coconut cultivation from a financial point of view it is advisable, and even necessary, to know something more of the coconut itself, and of the various purposes served by its products.

The coconut tree, botanically known as the *Cocos nucifera*, must not be confounded with that famous evergreen, the *Theobroma cacao*, whose pod-fruit yields the cocoa of commerce.

The coconut palm has a slender, branchless trunk, which attains a height of from 70 to 85 ft., and a diameter of 12 to 23 in. It is marked along its entire length, in transversal rings, by scars left by the leaves that fall, and two scars being thus formed annually its age can be readily ascertained. The stem is surmounted by a cluster of from twenty to thirty leaves, the youngest of them being in the centre. A full leaf is about 17 ft. in length, and from 4 ft. 6 in. to 6 ft. 6 in. in width. It is so hard in parts that it is used for thatching, fencing and

other similar purposes. The older leaves fall every year, scarring the tree in the manner described. The roots of the coconut palm shoot in very large numbers from the stem below ground, and spread out laterally in all directions. They are red in colour, about as thick as a man's finger near their origin, and sometimes attain a length of 50 ft. Around the trunk they form a practically compact mass, several feet thick, while further out they become separated from one another. Some of them penetrate for a considerable depth into the soil, but the majority occur within a foot or two of the surface, so that the tree must be classed as a surface feeder. The fruit of the coconut is more or less ovoid, its exact shape depending upon the variety of the nut. This also governs the size, which often surpasses that of a man's head.

Beneath the smooth outer skin is a fibrous covering, or husk, ranging up to two inches in thickness, according to the variety. Beneath this is the nut as known to commerce. Its shell, which is very hard, has three more or less longitudinal ridges and three well-defined hollows at the base, corresponding to the three original carpels. Inside the shell is a hollow white kernel containing much oil. This kernel varies considerably in thickness, according to the age and variety of the palm. When young it is thin and jelly-like, but as the

*Copyright*] **Coconut Palms vigorous at 60.** [*R. W. Cater.*

fruit matures it grows thicker and harder by absorbing the liquid contained in the central cavity of the nut. The germ or embryo of the nut is buried in the kernel at the basic end, near one of the three hollows in the shell above described. Young nuts are almost completely filled with liquid, but this is absorbed as they grow until, at maturity, the quantity is reduced by one-third.

In specially prolific regions, such as Malabar, trees begin to produce nuts as early as the end of the fourth year, and some do so even earlier, but the average period varies from four to six years, and substantial crops can, as a rule, be relied upon within six or seven years of planting. Of course, the length of this period depends upon locality, soil, methods of cultivation and many other conditions, including the ability of the manager. After this period the crop shows a steady increase in yield until the twenty-fifth year, when it reaches a maximum, which it maintains until the tree reaches the age of seventy. Then production diminishes, though satisfactory crops are borne for a further twenty, and in some cases thirty, years. In Ceylon palms have been known to yield fair crops when over a hundred years old.

What crop should a tree bear? Here, again, everything depends upon the conditions that prevail. Five or six fruit-bearing flower branches usually occur in a coconut palm at one time and

each may carry as many as ten nuts, consequently a mature tree always carries ripe nuts. A reasonable return from the whole of a big estate, according to an official estimate, would be from 50 to 75 nuts per tree. There are, however, certain fertile, well-situated, carefully-cultivated estates which yield as many as 100 nuts per tree per annum; while individual trees have been known to give 200 and even more medium-sized nuts in a year. This question is somewhat complicated and elusive, so greatly do conditions vary. An old planter recently remarked that taking the coconut world all round it is quite possible that the average would work out at forty nuts per tree per annum, but this is probably an unnecessarily conservative estimate.

It is calculated that every year about 8,000,000,000 coconuts are cultivated, besides the vast numbers that grow wild, and that the greater proportion of them is consumed as food in one form or another. In their production there is practically no waste; in fact, every part of the tree, from the root to the topmost branch, has a definite purpose and value.

Coconut oil, which is extracted from the dried flesh of the kernel (copra), is used on a colossal scale in the manufacture of nut butter, margarine, lard, soap, candles, etc. It is extensively used as a lubricant and also as an illuminant. It serves as an embrocation and is largely utilised by perfumers

in the preparation of brilliantine, cosmetics, etc. Glycerine is also a product incidental to the purification of coconut oil, which has even been used as a substitute for cod liver oil in cases of phthisis, many people preferring it, owing to its being more palatable than fish oil and less likely to cause nausea.

The coir, or fibre, which envelops the shell within the husk is used in a number of important industries, such as the manufacture of rope, cordage and cables ; mats, matting and mattresses ; oakum, fuel, brushes, etc.

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 carbo-hydrates.

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.

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

The stem is utilised 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 provides 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.

The stump produces a juice called toddy; the natives, to obtain it, make an incision in the stump and beat it until the juice flows. This ferments rapidly until it is transformed into palm wine. The juice contains a strong intoxicant called arrack, and native bakers use it instead of yeast.

Toddy also yields a sugar called jaggery, which is a popular article of diet in certain regions. Jaggery also makes a tenacious cement when mixed with the white of egg and lime from burnt coral or shells. This cement, when hardened, takes on a beautiful polish and closely resembles the finest white marble.

The milk, which is now practically wasted, could and should be utilised for making vinegar, and it is probable that arrangements will ultimately be made for pooling the output of adjacent plantations for this purpose.

The root of the palm possesses narcotic properties and is sometimes chewed by the natives of India instead of areca nut.

The list of purposes served by the coconut palm might easily be prolonged, but sufficient has been said to show that it renders a more signal service, and has a higher commercial value, than any tree known to man. Indeed, among natives it has become an object of worship in many regions and is venerated as possessing the greatest virtues. From the foregoing it will also be gathered that, quite apart from the main sources of profit, the coconut offers opportunities for the further development of numerous subsidiary industries in which every by-product can be used to advantage. With the march of science additional uses for coconut products will undoubtedly be discovered; as a

matter of fact, Germany to-day is conspicuously active in this field of research.

Of the coconut itself many varieties and qualities are produced in different parts of the world. Those from Malabar are regarded as the most productive and delicate in quality, points which are reflected in the prices obtained for them on the European markets.

The coconut flourishes in many other regions, notably in Ceylon, West Africa, the West Indies, Malaya, the Philippines, Java, British North Borneo, the Straits Settlements, East Africa, Papua, Samoa, Fiji, the Solomon Islands, Panama, Mexico, Brazil, the Seychelles, British Honduras, British Guiana, the Moluccas, Celebes, Sumatra, Zanzibar, Madagascar, New Caledonia, Gorgona Island, and Florida.

While about thirty varieties of the coconut palm are supposed to exist in various countries, European planters in most other Eastern countries only recognise five principal varieties: (1) The King coconut, which produces a handsome, pear-shaped nut of a bright orange colour. This is not usually sold in Eastern bazaars, being regarded as of sufficient distinction to constitute a suitable gift from a priest to distinguished visitors to the native temples. (2) An orange-coloured nut, but less handsome in shape than the above. (3) A nut of a pale yellow colour. (4) A nut about the size of a

duck's egg, something of a rarity. (5) The common coconut of commerce, *Cocos nucifera.*

In addition to these must be mentioned the double coconut, or coco-de-mer, a native of the Seychelles Islands, the fruit of the *Lodoicea Seychellarum.* This tree sometimes attains a height of 100 ft., with a stem varying from a few inches to 2 ft. in diameter, and very large fern-like leaves. The fruit is believed to be one of the largest known, and when the covering rind is removed, two oblong nuts, firmly united, are discovered. The fruit weighs from 30 to 40 lbs., and is borne in bunches, comprising nine or ten nuts, a bunch often weighing $3\frac{1}{2}$ cwt. It takes ten years to ripen, but the albumen, similar to that of the ordinary coconut, is too hard for food purposes. The shells and leaves, however, are in great demand, while the nut is regarded throughout a large area in the East as a sovereign antidote to poison, being the subject of many extraordinary traditions and fables.

It is difficult to pass from the subject of the commercial uses and values of the coconut without making some reference to rubber, especially as the two commodities are not infrequently bracketed together in the popular mind. Rubber and coconuts have this in common, that, with the limitations referred to in previous chapters, they are both largely grown in the same countries ; but there their similarity ends. Both economically and financially

they are as wide asunder as the Poles, and to institute a comparison between them is out of the question. It is advisable at the outset to dispel any delusion that may exist as to coconuts and rubber being on all fours with each other; the point is fully dealt with in a subsequent chapter which sets out the present position and prospects of the coconut industry.

## Chapter III

# The Selection of a Plantation

CONSIDERING the cost, length of time, and sustained effort involved in developing an estate from its initial stages to the point of production, it is obvious that questions of locality and site of a coconut plantation are matters of vital importance. If the greatest discrimination is not exercised in their selection, both time and money will be squandered in abortive effort; the work of correcting initial blunders, too, is both tedious and costly. Native and even other planters make many errors from ignorance or carelessness, the most general taking the form of irregular and crowded planting, which invariably proves a false economy, and results in an estate which could be made to pay handsomely by the mere application of proper methods of cultivation returning little or nothing to the owners. Europeans who acquire native properties have to deal with this error at the outset, for apart from the direct loss in coconuts it is necessary to leave ample space between the trees for catch crops, which can be made

to yield a substantial revenue while the fruit is maturing. Another advantage gained is that good wide spaces between the trees or groves permit the use of machines in tilling operations.

While the coconut tree is found in many tropical countries which furnish a sufficiency of water, it yields the best results between the latitudes 17° N. and 12° S., which are outside the hurricane zone. It has been cultivated for many centuries in the East, particularly in the islands of the Pacific Ocean. It is believed by some authorities that these islands were its original home, but it is equally possible that it is, like all other species of the genus to which it belongs, a native of tropical America, although its value has never been so highly appreciated in the West as it has been in the East. 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 favourable to the coconut, 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

*Copyright]* **A well-kept Field of Coconut Palms.** *[R. W. Cater.*

*Copyright]* **A Neglected Field of Coconut Palms.** *[R. W. Cater.*

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 coconut palm does not flourish on steep slopes nor in positions that are overshaded and sheltered, and it cannot tolerate the presence of stagnant water in the neighbourhood 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. Moreover, this proximity has a commercial importance, seeing that it facilitates transport and shipment—two very expensive items on a plantation located at any distance from the sea. On the other hand, coconut trees flourish in Ceylon on alluvial soil at some distance inland, but the period of bearing is deferred in such cases.

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 any 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. Coconuts 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. Mr. F. A. G. Pape, a retired planter of wide experience, considers that almost wholly level land, with just sufficient slope to ensure drainage, is ideal for a coconut plantation, provided the soil consists of a good layer of humus and porous substance underneath, *plus*, of course, a good supply of water that is always on the move. In selecting a locality for the plantation all these points have to be borne in mind. According to one practical authority "a very tangible proof of the fertility or otherwise of a region is in all cases the state of the surface growth. Where you find large and flourishing trees and herbage, there you may be sure that ideal conditions exist for your purpose; this surface growth may have been destroyed by some agency not readily discernible, and then, of course, it is necessary to employ the soil tests. . . . If you should find that the surface growth has been eradicated by hurricanes, and if you learn that these occur frequently in the localities you have marked out, then strike your tent and proceed elsewhere, for you are in the cyclone belt, where the labour and care of many years may be swept away and utterly annihilated in a half-hour. Those regions lying between the 13th and 18th degrees of latitude on both sides of the Equator are

the most frequently and disastrously visited by cyclones. In some localities they recur almost every third or fourth year, with ominous regularity."

Asked to name the various countries in the order of their desirability from a planting standpoint we should be disposed to mention: (1) Malabar, (2) West Africa, (3) Dutch East Indies, (4) Ceylon, (5) East Africa, (6) Malaya, (7) Papua, (8) the West Indies. Most of these regions are under British control and likely to prove, in certain respects, more agreeable and remunerative to Europeans. In the Philippines, Mexico, Panama and other foreign regions, the laws, customs, general system of living and character of the white population might not commend themselves to citizens who are accustomed to enjoy the maximum of personal liberty and general freedom of action. Naturally, the personal tastes and requirements of intending planters are likely to differ considerably, but there are few who would care to altogether disregard these considerations.

## Chapter IV

# The Coconut Belt

IN the last chapter various coconut producing countries were enumerated. It is now proposed to deal in detail with these and others, setting forth their individual and comparative merits. Only in this way is it possible to convey an adequate idea of the many grades and descriptions of the nut, all varying in quality, colour, fibrous texture, period of ripening, productivity, and commercial value.

### Malabar

The finest and most productive, as we have said, come from Malabar, where the soil, in conjunction with the climatic and other conditions, combine to favour the production of a generous, white-meated nut. The four points essential to the satisfactory growth of the coconut are : Sea air, sandy soil containing plenty of decayed vegetable matter (*humus*), abundance of fresh water,

*Copyright*] [*Malabar Estates & Planting Co., Ltd.*

**Specimen Malabar Tree in full bearing.**

and protection from strong winds—all of which advantages are obtainable on the Malabar Coast. There fresh water is invariably found at a depth of from 6 to 10 ft., while the annual rains bring down a mass of vegetable matter from the forests on the slopes of the Ghautz range of mountains which is deposited over the land. The mountains themselves form a natural wind-screen for the palms. Thus the Malabar Coast is recognised as one of the finest coconut-growing regions in the world, its products commanding the highest prices in the market; such superiority, in the case of copra, ranging from £2 10s. to £4 per ton over any copra produced elsewhere. The percentage of fat yielded by copra depends mainly upon the quality of the coconut. That exported from Malabar gives the highest yield and produces the best quality fat, the following being the percentages: Malabar, 68 per cent. (it requires only slight refining and the yield of oil has been as high as 80 per cent.); Ceylon and West Africa, 65 per cent.; West Indies, 63 per cent.; Dutch East Indies, 62 per cent.; Australasia, 60 per cent.; Manilla, 59 per cent. Apart from the foregoing natural advantages, the reputation for excellence achieved by the products of Malabar has resulted, in a certain measure, from the remarkable care with which the planters and merchants cultivate and prepare the nut as compared with the crude, careless, and sometimes really dirty methods

adopted in certain other countries, whose copra is often rank, pungent, and mouldy, even before shipment. Having then to run the gauntlet of ships' vermin, "sweating," and other unavoidable drawbacks, it can readily be understood that large quantities have to be discarded as unfit for use. At present, however, increasing competition, the enterprise of European experts and the high prices secured by superior qualities are stimulating planters and merchants in most regions to emulate the example of Malabar by devoting greater attention to the preparation of the product. While the exceptional natural advantages enjoyed by Malabar have resulted in the yield of such superior products, the value of the district as a coconut-growing region is further enhanced by the fact that although the Malabar territory is vast, there is only a certain portion of the land that possesses these natural advantages, so that companies holding land in the most favoured regions must inevitably see their properties increase in value from year to year.

## CEYLON

This is another important centre for coconut-growing, it being estimated that about 2,200,000,000 nuts are harvested in that island every year. At present there are some 929,000 acres of land under

*Copyright*] [*Underwood & Underwood.*

**Fruit of Coconut at different stages—from Blossom to Fruit.**

coconut cultivation, as compared with 200,000 acres in 1860, and the value of the trees has been estimated at £37,000,000. Of the total value of Ceylon exports, the products of the coconut represent about 23 per cent.

According to a recent writer, it is suggested that with the arrival of the Dutch in Ceylon about the year 1656 the extension and cultivation of the palm was seriously undertaken. The principal coconut-growing territories extend along the north-western, western, and southern coasts of the island, also in the Jaffna peninsula, in the north and in the eastern provinces. Inland the extension has been considerable in the north-western and northern provinces. There are also portions of the central provinces where it flourishes, notably around Kandy, Gampola, and Matale. Coconut experts in Ceylon consider that the immense extensions since 1860 testify to the pluck, energy, and enterprise of the planters of Ceylon, who have had to surmount so many disasters during the past fifty years. The opinion is often expressed that the industry deserves greater assistance from the Government than has hitherto been accorded it, especially in the way of railway facilities, which, the planters contend, should be extended into the coconut-growing districts, so that transport might be facilitated and cheapened.

While enterprise in coconut cultivation is now

being developed throughout the world, it is generally recognised that it is in Ceylon that initiative and capital have secured for the coconut palm a high and comprehensive development, and it is there that many valuable lessons have been learned in the exploitation to the greatest advantage of Nature's most remarkable tree. Many districts that formerly had an unproductive soil and were mere barren expanses have since become clothed with luxuriant plantations, yielding excellent revenues.

Quite a hundred years ago, we are told, the western and southern coasts of Ceylon possessed the same continuous groves of palms as still present themselves, the number of trees between two points, Dondra Head and Kalpitika, being formerly calculated at 10,000,000. Of all the crops raised in Ceylon, coconuts cover by far the largest area of land; rice, tea, and rubber taking second, third, and fourth places respectively. In this connection may be mentioned the striking fact that although Ceylon is one of the four principal centres of the coconut industry, and one of the largest exporters of coconut products, the colony still imports annually considerable quantities of Indian and Malabar coconuts, besides thousands of cwts. of jaggery, Indian copra, poonac, and coir fibre. A very interesting account of the early development of the coconut industry in Ceylon was contributed

to *Ferguson's Coconut Planters' Manual*, by an anonymous writer, who says:

"During the first quarter of last century very little coconut oil was shipped from Ceylon to Europe, and it has been said that the first cargo of this product ever shipped from the island to Great Britain was taken by Captain Boyd, an Aberdeen navigator, who then commanded an East Indiaman, and afterwards became a partner in the firm of Acland, Boyd & Co. When the cargo reached its destination, there was difficulty in finding a purchaser, as there was no market at home for the oil. At length the proprietors of a wool mill, to whom it had been favourably reported upon for lubricating purposes, bought it up. About 1832, Messrs. Acland, Boyd & Co. established the first oil mill worked by steam, and the Ceylon trade in coconut oil became quite a popular investment among the local civilian and military classes. In the same year, already mentioned, 1820, Captain Steward took home a cargo of coconut oil, using the stems of the plantain plant to fill up the interstices between the barrels. It has also been stated that the first coconut oil mills worked by steam power at Colombo were established there by the then Governor, Sir R. Wilmot Horton, and their first shipment of oil was made to London on Government account, the mills being afterwards acquired by Messrs. Acland, Boyd & Co.

"Some years later, Messrs. Wilson & Archer started new mills, with a view to taking advantage of an improved process for separating the fat from the oleine of the coconut oil, enabling the oil to be maintained in a liquid state in cold, which had been invented by the father of Mr. David Wilson, the senior partner in the firm. This departure proved a great impetus to the trade, and as a result the area of land under coconut cultivation was rapidly extended. The decade which ended in 1850 was a period of vigorous planting by Europeans in Ceylon, and then, curiously enough, this was succeeded by ten years of inactivity. Thereafter the natives took up the industry, and widely extended their operations, especially in the Western Provinces, where they brought under cultivation large areas of jungle. At this time the native population was enjoying much prosperity, owing largely to the success of coffee-planting from 1850 and onwards, and also to the fact that the Government had opened up to industrial enterprise the reserves of Crown land in the low country.

"By the year 1860 it is known that there were in Ceylon 250,000 acres of coconut palms in European-owned and native-owned plantations. By 1893 these figures had grown to 650,000 acres, of which all but some 50,000 acres were owned by natives. Since then there has been, of course, a radical change in the conditions of ownership,

Europeans having acquired large areas from the natives from time to time."

At the present moment there is throughout Ceylon, as in Malabar, a great scarcity of land suitable for successful coconut-growing, and there is no doubt that the value of such properties must appreciate accordingly.

## WEST AFRICA

Owing to the fact that the coconut palm is indigenous to the West Coast of Africa, the industry of coconut-planting is one that is now commanding special attention as offering vast possibilities for profitable exploitation. Private planters, companies, and investors are now realising that there are fortunes to be made by the systematic and scientific cultivation of this highly-profitable product. Not long ago the Agricultural Department of the Gold Coast Government reported that the natives were making extensive plantations of coconuts, and that in a number of cases the trees were receiving very careful attention. Around the villages adjacent to the sea coast, and in many others several miles inland, coconuts flourish and yield excellent crops. Greater interest is also being displayed in the preparation of copra, which yields 15 per cent. more oil than the oil palm grown on the coast. So far the coconut has not been exploited in West Africa to an extent commensurate with its

value and importance, the very prodigality of Nature having led the natives to neglect its cultivation. They have practically confined their attention to palm oil and rubber, but with the immense increase in the market price of the coconut and its products, there has recently been a great revival in West Africa, and a period of increased activity may be regarded as a certainty of the near future.

The supply of coconut palms in West Africa is practically illimitable. All along the low-lying coast of Sierra Leone, along the French Ivory Coast, at the mouth of the Volta River, and on the salt marshes at the delta of the Niger, the palms flourish and should reach perfection, though, generally speaking, the plantations are under native ownership, and the result has usually been faulty cultivation and considerable waste. The first planting of coconuts here was inspired by missionaries, but as the natives were not very energetic they failed to give the trees the necessary attention, so that immense quantities of nuts have been allowed to fall to the ground and rot. Under proper cultivation and supervision, a substantial revenue might have been secured by the owners of the majority of the best groves. The Agricultural Departments of the various Governments are now making every effort to induce the natives to adopt more systematic methods of

cultivation. On the other hand, the phenomenal rise in the price of copra during the past four years has awakened a number of European firms trading in the country to the possibilities of this industry, and induced them to interest themselves in its development by up-to-date methods. A notable example of this activity is furnished by Messrs. Lever Brothers, of Sunlight Soap fame, who have secured a vast area of coconut-growing land and started planting on their own account. They intend, it is stated, to spend quite £1,000,000 in the development of these plantations, and this far-sighted policy can scarcely fail to assure them an ample and regular supply of coconuts for their own manufactures and thus render them independent of the fluctuations of the markets. It is estimated that in about six years' time their plantations will be yielding millions of coconuts per annum.

Altogether, there is no doubt that the West Coast of Africa offers an attractive field for planters and others prepared to develop coconut estates by scientific, up-to-date methods, for which the conditions are exceptionally favourable, because :

(1) The climate and soil are peculiarly suitable for coconut cultivation and the products of some of the best plantations in West Africa should compare favourably even with those of Malabar.

(2) There are large tracts of land available at moderate prices, for those who can secure the ear of the chiefs.

(3) Native labour is plentiful and cheap.

(4) West Africa is better situated as regards proximity to European markets than the Middle East, which now supplies the major portion of European consumption. This proximity is important from two standpoints, freights being somewhat cheaper and the produce arriving in a fresher condition and therefore commanding a higher price.

(5) The West African coconut regions, being outside the hurricane zone, escape those destructive storms which occur in many other tropical countries.

### FEDERATED MALAY STATES

The Federated Malay States not only cultivate rubber on a vast scale, but also coconuts, which can be grown under favourable conditions on the flat, alluvial land near the coast. Good land is also available inland, and if situated near the large towns or the mining communities, better prices can usually be obtained from the sale of the nuts. About two years ago, large areas of land were taken up in Perak and Selangor by European companies for the purposes of coconut cultivation. Lower Perak is said to be the most important district

with regard to coconuts in the Federated Malay States, as it comprises 27 per cent. of the total acreage in the country. A very large acreage is in course of development by an important European company in the Kuala Langat Coastal district. A vast area of excellent coconut land exists uncultivated in the northern part of the Kuala Selangor district, but access to it at the moment is not easy.

At present the area under cultivation yields sufficient nuts to manufacture about 65,500 tons of copra, should all the nuts be used for that purpose. There is here an immense and profitable field for the collection and utilisation of the various products of the coconut, some of which are now wasted.

These States have in coconuts a rapidly-developing and profitable industry; the acreage of this product in the Peninsular (exclusive of the native kampongs and inclusive only of estates of over 100 acres in extent) aggregate 73,467 acres at the end of 1912. Most of this was under coconuts alone, but there were 12,470 acres interplanted with coffee and other crops. Even during the past few months the developments have been increasingly rapid. It is calculated that at the present moment the shipments from the Straits Settlements (Singapore) aggregate about 2,300 tons per week, or at the rate of about 120,000 tons per

annum. The coconut plantations were distributed as follows :

| | Acres. |
|---|---|
| Federated Malay States ... ... | 24,008 |
| Straits Settlements ... ... ... | 21,703 |
| Johore ... ... ... ... ... | 684 |
| Kedah and Kelantan ... ... ... | 10,859 |
| Trengganu ... ... ... ... | 3,743 |
| Total ... ... ... | 60,997 |

## DUTCH EAST INDIES

Another region in which coconut cultivation is conducted on an extensive scale is the Dutch East Indies, whose area, including Java, Sumatra, Borneo, Celebes, New Guinea, etc., comprises about 1,751,000 square miles with 40,000,000 inhabitants. Of this total area Java represents about 120,000 square miles and 30,000,000 inhabitants. The preponderating commercial importance and influence of Java are demonstrated by the fact that the trade of this, one of the world's largest islands, represents about 60 per cent. of the total figures for the Dutch East Indies, Sumatra's proportion being 20 per cent., the remaining 20 per cent. being contributed by the other islands.

The Moluccas Islands enjoy an excellent reputation for coconut growing, and the copra produced there is of a good grade. The soil is mainly sandy, the rainfall is favourable, and the general position of the islands facilitates the growth of the palm.

The mode of cultivation hitherto adopted by the natives has not, of course, yielded very brilliant results, their methods being somewhat primitive.

Until recent years, most of the coconut trees throughout the Dutch East Indies belonged to the local natives, but now, with the exception of some large properties owned by Dutch and other Europeans, the Chinese have become the principal owners. Besides cultivating the coconut on their own estates, they have their agents in all the numerous surrounding islands, who collect the nuts and ship them in the husk, or dry, to Macassar. So important has this trade become that the Indian and Chinese moneylenders, eager to secure the nuts at bargain rates, will advance on growing trees to the natives, sometimes for two or three years ahead, on condition that they be allowed to purchase the nuts at prices fixed *at the time of making the advance.*

The Chinese and the Dutch have, up to the present, been most favourably placed for securing control of the coconut areas, and of the islands where the nut grows, as in most cases they have the advantage of knowing the natives and speaking their language. European firms who have endeavoured to deal direct with the natives without the assistance of an agent conversant with the native customs and language have found their efforts fruitless, as a rule, the prices demanded and

the conditions imposed having been unacceptable. But those who are well represented on the spot by men who possess sufficient local knowledge to approach the natives in the right way, are generally able to make some very profitable "deals."

The Dutch Government has, in recent years, made the conditions of foreign ownership of land and other property much easier, and all that is necessary is to register a company, either in Java or in Holland, to enable the British proprietor to secure his title. While it is still necessary for all exports from the Dutch Colonies to be shipped in vessels flying the Dutch flag, this drawback has been overcome, so far as British shippers are concerned, by some of our British steamship companies placing certain of their vessels under the Dutch flag, so that the question of transport now presents no difficulties.

A considerable proportion of the coconuts and copra produced in the Dutch East Indies is shipped to Singapore, the principal regions, in their order of importance as producers of coconuts, being: Java, Borneo, Balit Lombok, Matina and Anambas Islands, Celebes, the Moluccas, Sumatra and East Coast, and Acheen. The value of these shipments to Singapore aggregates about $15,000,000 per annum.

There is no doubt that the Dutch East Indies constitute a lucrative field for the exploitation of

the coconut, and we understand that important developments are now pending in the Moluccas, whereby a large area of coconut land will be brought under cultivation on the European system by an influential group which has coconut estates in various parts of the world and has recently acquired the above-mentioned area from the Dutch Government on very favourable terms.

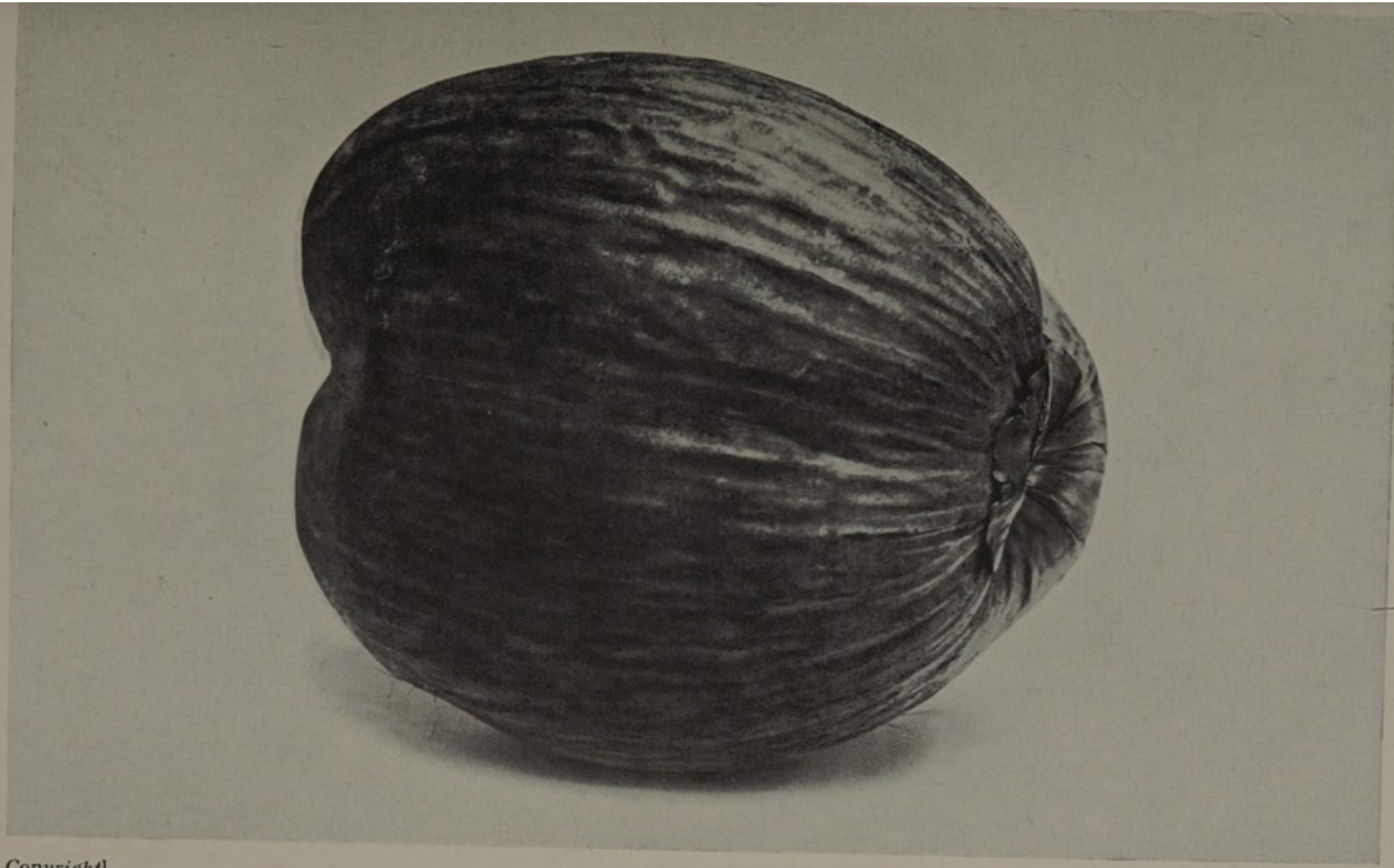
Hitherto these islands, being situated out of the track of the great ocean trade routes between the Far East and Europe, have not been recognised by the world at large, according to their merit, and consequently they have not developed with the rapidity that their enormous resources would fully justify. Despite this neglect, however, the Dutch have made wonderful progress during the past twenty years and are likely to continue their forward policy. This isolation has naturally affected the coconut industry, European capital for planting purposes having flowed more freely into Ceylon, Malabar, and other more prominent regions. But with the improved health conditions throughout these islands, the greater activity of the Dutch Government and the Colonial Administration and the ever-growing demand for the coconut, it is practically certain that the coconut industry in these islands will attract the special attention of European planters, capitalists, and investors, who cannot fail to be impressed by the eagerness of

Chinese and Indian merchants and moneylenders to secure control of the wealth-producing coconut and its products.

## PAPUA

Papua, or British New Guinea, has very promising prospects as a coconut-growing country with its 58,000,000 acres of land, of which only about 350,000 acres have been taken up under lease on easy terms, the Government declining to sell any land outright. The natives of the British section of the island own some 35,000,000 trees, planted on 350,000 acres of land, at 100 to the acre. With regard to the prospects, an official of the New South Wales Agricultural Department reports as follows: "Altogether, it costs about £6,450 to bring an estate of 500 acres up to the sixth year, or £13 per acre. In the seventh year the trees should give 40 nuts each, or 100 tons of copra. In the ninth year this should increase to 60 nuts. For catchcrops, the planter has the choice of robusta coffee, pepper, ramie, vanilla, ground nuts, tapioca, etc. The trees are said to start yielding at five years, and they bear heavily at eight or nine years. Healthy trees will live at least sixty years." Not long ago *The World's Work* gave a capital account of the coconut industry in Papua, of which the following is an extract:—

"The coconut palm produces from 100 to 120 nuts per year; 6,000 nuts make one ton of copra.



*Copyright*] **Entire Coconut Fruit.** [*Eastern Palm Estates, Ltd.*

Each coconut tree, when mature, gives an income of from 2s. to 3s. 6d. annually. The planter with 25,000 coconut palms may be certain of a handsome income for one hundred years or longer. There is another source of revenue open for the planter which is remunerative beyond belief to the man of small capital. While waiting for the returns from his plantation he may trade with the natives by barter of calicoes, beads, ornaments, axes, knives, wire, fishing hooks, scrap iron and mirrors in exchange for copra and other valuable products which all find a ready market in Sydney. The profits of one trader amounted to 400 per cent. in fifteen months in direct trade with the natives."

The present position in Papua has been thus summarised by the manager of one of the largest coconut plantations in the island: "The territory is situated outside the hurricane zone, has an agreeable climate and a plentiful rainfall, except in the dry belt of the Central Division. Thus the planter has every advantage which Nature can bestow to render his enterprise successful. The soil is considered equal in richness to anything in the world; and in the course of a few years, when Australia has realised what a valuable asset she possesses right at her very doors, Papua will have become the most prolific and richest exporter of tropical products outside of Ceylon. Land is

easily obtainable on the most liberal terms, and labour is plentiful and cheap."

## WEST INDIES

During the past fifteen years there has been a considerable development in the West Indian coconut industry, and the Government has made serious efforts to promote further activity by providing authentic and useful information for planters and others regarding the cult of the coconut—notably, a very practical and complete booklet, *Coconut Cultivation*, from which we have ventured to make certain extracts.

For many years no attempt was made to cultivate the coconut on any large scale in the islands of the Lesser Antilles, with the exception of Trinidad. Yet there are many situations in which the coconut can be grown to advantage—such are the open, low-lying coastal lands, having a light, porous soil and a moderate rainfall. So far most of this territory has been neglected, no attempt having been made to render them productive. Yet with the expenditure of a moderate amount of capital and labour they might be converted into successful and highly remunerative coconut plantations. The palm is found on all the islands, but in the majority of cases, until quite recently, no estates had been permanently established for its cultivation, nor had its products been utilised for any but purely local purposes.

But owing to the impetus given to the coconut industry by rising prices considerable activity has been displayed in the West Indies, as elsewhere, and we may expect to see this movement develop. Labour is plentiful—men, women and children all working. The metayer system, explained on page 67, not only enables the planters to save considerably on the cost of planting, but, when sugar prices are good, to make a profit during the period that the coconuts are arriving at maturity. Transport facilities generally are excellent, a preponderating proportion of the exported coconuts being marketed in New York.

In the West Indies the by-products of the coconut have not been, as a rule, turned to much account. But with the introduction by European commercial experts of more scientific methods there is no doubt that such sources of additional profit will be studied and developed.

The export of coconuts from Jamaica was reduced by the hurricane of 1902 to 4,000,000 per annum, but during 1912 a total of 20,000,000 was reached.

### ZANZIBAR

The Island of Zanzibar, distant from the East African coast about twenty-five miles, comprises an area of over six hundred square miles, the soil, generally speaking, being of remarkable fertility. Coconuts, cloves, chillies, rubber, fruits, etc., grow

in profusion. Labour is plentiful and cheap, and the climate is favourable to the white man. Hitherto coconuts have not been cultivated on the island with any particular energy, but greater attention is now being paid to this profitable branch of tropical agriculture.

As far back as 1893 Zanzibar was exporting some £90,000 worth of copra per annum, while the native consumption accounted for a further quantity of coconuts. To-day the population, Arabs, natives, etc., aggregates over 200,000, and the exports of copra and palm oil nuts amount to about 12,000 tons per annum, valued at approximately £205,000. The greater portion of the copra produced is shipped direct to Marseilles, only small shipments being made to the United Kingdom, Germany, and India. The area under coconuts in Zanzibar, as throughout East Africa generally, is reported to be on the increase, and there is every probability that this expansion will continue, as the demand for coconut-growing lands in favourable regions is certain to be maintained for some time to come.

### OTHER COCONUT-GROWING CENTRES

In the Philippines the American Government agricultural experts are devoting special attention to this industry, about which a vast amount of information has been collected and disseminated, not only by the Government authorities, but also

by independent investigators like Mr. Dean Worcester, who is of opinion that :

"After fifteen years of observation in the Philippines I have reached the conclusion that no branch of agriculture there offers such certainty of steady and assured returns from comparatively small investments as does the growing of coconuts, especially in the South Philippines, where they flourish to a degree nowhere excelled and seldom equalled in other countries."

Extensive areas of unoccupied land suitable for plantations are available, and a number of companies have been carrying on operations under the most promising conditions. Labour is fairly cheap ; pests and diseases are not over-troublesome ; the soil and climatic conditions are favourable. About £9,000 is needed to bring an estate of 2,500 acres to the producing stage, allowance being made for the revenue derived from subsidiary sources. As to yields, an acre of planted coconuts should produce about 2,000 nuts per year, or 50 nuts per tree. In many districts the average is quite 60 per tree. Indeed, as many as 128 nuts have been taken from a single tree in a year.

Probably few people realise that to-day the Philippines produce a notable proportion of the world's copra supply. At the same time, it must be added that the quality of the copra and oil produced is decidedly inferior to the average standard

established in other regions. It is estimated that there are on these islands 35,000,000 trees, of which about 25,000,000 are in bearing. The annual harvest aggregates 1,000,000,000 nuts, which produce for export 125,000 tons of copra and 1,540,000 imperial gallons of oil, besides immense quantities of tuba, or toddy. One authority estimates the total annual value of the industry at present at just over £2,000,000.

Most experts agree that coconut cultivation in the Philippines has suffered considerably from the wasteful methods adopted and the general customs of the country. There is no doubt that the gradual introduction of systematic and scientific cultivation, combined with the elimination of several archaic customs, will result in a considerable increase in the output of coconuts and in the quality of their products in these islands, where, at present, the industry only yields about half of what it might be made to produce under proper conditions.

Along the coast of the Isthmus of Panama coconuts exist on a large scale, as they have done during the past four hundred years. It has, indeed, been claimed that the coconut palm originated on the islands and coasts around the Gulf. The conditions for cultivation are here very favourable—an ample rainfall, protection from winds, very suitable soil. About 500,000 nuts are shipped monthly from Panama to the United States,

mainly to New York and Philadelphia. These are the famous San Blas nuts, said to be among the finest in the world after the Malabar nut, which has long held the premier position. The planters claim that they command the highest price in the New York market of any nuts. At the time of writing the quotation is about £10 per 1,000, as against about £7 for the finest Jamaica nuts. Generally speaking, the palms come into bearing between the fifth or sixth year, though occasionally they do so in the fourth year. The cost of landing 1,000 nuts in New York being about £3, it will be seen that this leaves a profit of from £1 to £5 per 1,000 nuts on the basis of present quotations. The forthcoming opening of the Panama Canal and the increased railway facilities have caused coconut land values to increase considerably, and further appreciation is probable, both American and British financiers having awakened to the vast possibilities of this industry in those regions.

British Guiana produced in 1912 over 1,000,000 coconuts and 128,739 lbs. of copra, there being about 12,240 acres of land under cultivation. The Government authorities report that there is abundance of land suitable for the purpose, and, given proper cultivation and drainage, the present yearly crop could be largely increased. We are told that the potentialities of this colony in connection with coconuts are undoubtedly great, its most urgent

need being "a steady influx of enterprising colonists with brains and capital."

British India and its dependencies constitute an important field for coconut enterprise. Although the tree will grow as far north as Lucknow, it flourishes in its most prolific effulgency on the Malabar and Coromandel coasts. Years ago it was estimated that the Malabar coast alone produced between 300,000,000 and 400,000,000 coconuts per annum, and this region, as we have already stated, is still regarded as the finest in the world for coconut growing. The Coromandel coast would seem to be almost equally prolific; at all events, some years ago the native State of Travancore exported not less than £500,000 worth of coconut products. Over half a century ago Travancore was said to possess about 6,000,000 coconut palms. A very large area of the Madras Presidency is under coconut palms, and elsewhere in India the tree is widely, if less systematically, cultivated.

Cochin China is very rich in coconut palms, and they find a congenial home in New Caledonia, especially in the north-eastern coastal region, where they seem to enjoy a northern aspect. The Island of Tahiti is another fertile source of coconut supply, and exports millions of coconuts yearly, besides large quantities of copra and other products of the palm. Considerable shipments also take

place from the Marquesas and the Tuamotus Archipelago: one single island, Anaa, having been said to possess more than seven millions of the palms.

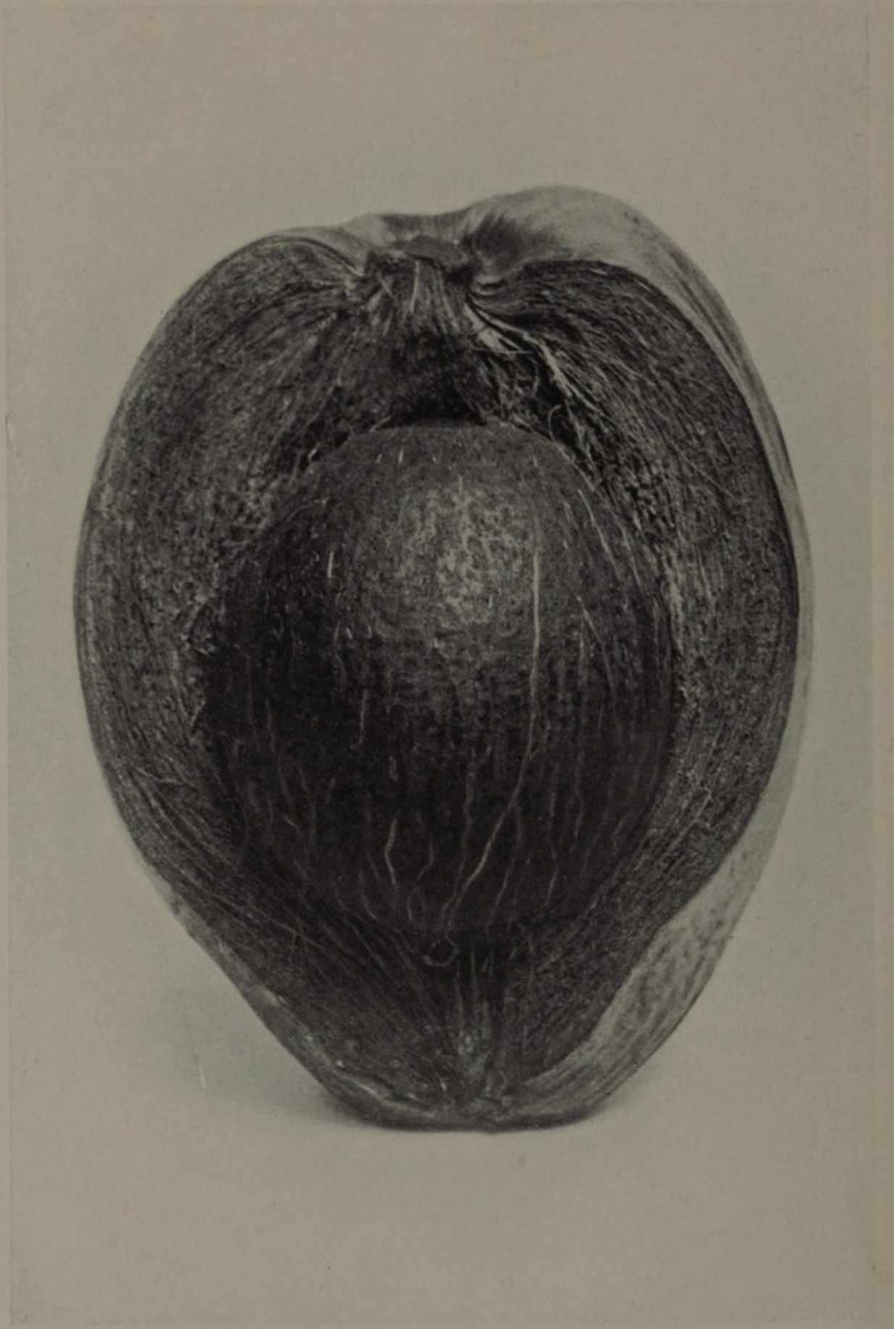
While estimates are frequently made of the total cultivated area throughout the world, these are necessarily approximate, it being obviously difficult to determine the exact statistical position, which is constantly varying. Then, of course, there are the vast tracts of land in different countries where the coconut grows wild in quantities that can scarcely be ascertained and are not included in these estimates. But we think that the following figures, supplied by the officials of the Eastern Palm Estates and Trading Syndicate, Ltd., will be found approximately correct:

| | Acres. | Nuts. |
|---|---|---|
| British India and Dependencies ... | 380,000 | 1,400,000,000 |
| Central America ... ... ... | 370,000 | 300,000,000 |
| Ceylon ... ... ... ... | 800,000 | 2,200,000,000 |
| Eastern Archipelago, including Philippines, New Guinea, and Straits Settlements ... ... | 260,000 | 2,000,000,000 |
| Java and Sumatra ... ... | 220,000 | 500,000,000 |
| Mauritius, Madagascar, Zanzibar, Seychelles, and Reunion ... | 130,000 | 50,000,000 |
| Pacific Islands, including Fiji and New Caledonia ... ... ... | 270,000 | 350,000,000 |
| Siam and Cochin China ... ... | 100,000 | 100,000,000 |
| South America ... ... ... | 500,000 | 700,000,000 |
| West Indies... ... ... ... | 110,000 | 125,000,000 |
| West and East Africa ... ... | 100,000 | 150,000,000 |
| Total ... ... | 3,240,000 | 7,875,000,000 |

## Chapter V

# The Cost of a Coconut Estate

AN easy and simple method of demonstrating the cost of a coconut estate would be to quote figures ascertained in connection with an average property, but so variable are the conditions in the different coconut planting regions that it is somewhat difficult to select any one estate as an example of cost and general exploitation. For instance, uncleared land can be bought at anything from 2s. to £5 per acre, according to region, location and labour conditions. In the West Indies uncleared land costs 10s. to £5 per acre; in Ceylon, 10s. to £20; in Papua, where the land is never sold outright, but rented on nominal terms to encourage settlers, land can be obtained on very favourable terms; In German New Guinea, 2s.; in the Philippines, from 8s. 4d. to 21s. 3d.; in German East Africa, from 6s. 8d. to 13s. 4d. per acre. In Malaya the price asked for estates in bearing ranges from £30 to £60 per acre and upwards, and not long ago it was stated that the Vallambrosa



*Copyright*] [*Eastern Palm Estates, Ltd.*

**Section of Fruit, showing Embedded Nut.**

Rubber Co. paid £40,000 for the mere option to purchase an estate of some 10,000 acres for the sum of £400,000.

The labour conditions are equally divergent. Thus, in the Congo it is available on a large scale for 2½d. per day; in German East Africa the rate is from 6d. to 8d.; in Malaya it is at least 1s.; in the Pacific Islands and East Africa it seldom exceeds 6d.; but in Malabar, Ceylon, Papua, and the West Indies it varies from 1s. to 1s. 3d. per day. According to one authority, a great deal of this labour is based upon contract, the prices working out approximately as follows for each thousand nuts:—Picking, 1s. 8d.; husking, 2s. 6d.; splitting for copra-making, 2s.; copra-making (sun-drying in four days' sun), 9s., which brings the total cost of gathering and converting into copra 4,000 nuts, representing one ton of copra, to about £3 1s. Cutting, bagging and carriage aggregate another £1 per ton, making a gross total of about £4. This, however, may be considered a very conservative estimate, the average cost working out at about half this figure.

Then there is the question of the manager and his salary. The man who is sufficiently experienced and gifted to act as administrator and planter on a large coconut estate is comparatively rare. He must be able to control the staff, white and native, keep the accounts, prepare the reports and statistics

and generally make the estate pay dividends. In a word, the ideal manager is born, not made. He commands a salary of, say, from £500 to £900 per annum, and this may have to be increased as the industry develops, for with new estates being organised there will be increasing competition for his services, and he will be called upon to assume greater responsibility. This has led to the suggestion of a Tropical Agricultural College, referred to elsewhere, for the training of young men to fill these important and lucrative positions. It is remarkable how quickly a good manager's reputation spreads, not only among Directors and other officials, but also among the natives, who keenly appreciate firm, just control, and will often leave a second-rate man in order to join the estate of a popular "boss." The really gifted manager, therefore, can command labour at critical moments when others are clamouring for it in vain. This is the triumph of experience, tact, and personality, without which qualities none can really succeed in the control of a coconut plantation. The right man must have a sound mind in a sound body; be prepared to meet sudden emergencies and even disasters; be something of a doctor, and even practise a little simple surgery in cases of need, for where natives are constantly using sharp instruments like the cutlass, and are exposed to bites, etc., accidents are not long in happening. He must also act as his own

Chief of Police, for without sleepless vigilance he is liable to lose a notable percentage of his crop by "lifting."

In this connection an authoritative opinion is well worth quoting:

"The man to be selected should not only know personally every individual under him, his likes and prejudices, how he fares and how he conducts himself, even to the cares and little worries of his family, but he should have in mind, like the doctor in the hospital, a note of each tree and its progress, as well as a shrewd idea of what produce, stores, and implements are on the estate, and how it goes with the animals and livestock generally. He should not be unduly pestered with nerve-racking worries of lesser importance that can be well attended to by his assistants, nor asked to elaborate too frequent official reports and investigations, which are irrelevant to the matter in hand, but which may be demanded by a nervous Board not well up to the work personally, and therefore at the mercy of some over-zealous shareholder or scientific faddist at home."

This subject may be left with the final remark that money spent by any Board on the housing and general welfare and comfort of the manager and his staff will always prove a sound investment. Some companies are sufficiently generous and well advised to encourage the development of amuse-

ments for the staff—boating, riding, tennis, etc.—all of which makes for improved mental and physical health, and promotes a feeling of well-being which is reflected in the general efficiency and success of the estate.

In order to furnish an approximate idea of the cost of opening up estates in various regions, figures are here appended for an estate in Malaya, one in the Pacific, another in West Africa, and a fourth in Ceylon. As regards the Malay estate, the figures are furnished by Mr. L. C. Brown, Inspector of Coconut Plantations for the Federated Malay States, the estimate being for developing and bringing into bearing 500 acres of coconuts in the coast district:—

FIRST YEAR'S EXPENDITURE.

| | £ |
|---|---|
| Premium (£175), quit rent (£58), surveyor's fee (£58)... | 291 |
| Felling (£700), draining (£700), seed (£321) ... ... | 1,721 |
| Fencing (£175), lining and planting (£117) ... ... | 291 |
| Coolie lines (£58), bungalow (£140) ... ... ... | 198 |
| Tools (£29), stationery (£12), medical (£175) ... ... | 216 |
| Weeding, first six months, at 3s. 6d. per acre ... ... | 525 |
| Contingencies ... ... ... ... ... ... | 118 |
| Superintendence ... ... ... ... ... ... | 420 |
| | £3,780 |

| | |
|---|---|
| Second year: Rent (£58), weeding (£700), superintendence (£420), medical and contingencies (£233) ... | 1,411 |
| Third year: Same as second year ... ... ... | 1,411 |

| | £ |
|---|---|
| Fourth year: Weeding (£420), superintendence (£420), medical and contingencies (£233), rent (£58) ... | 1,131 |
| Fifth year: Weeding (£350), rent (£58), superintendence (£420), medical and contingencies (£233) ... | 1,061 |
| Sixth year: Rent (£116), weeding (£350), superintendence (£420), picking (£35), curing (£132), transport (£132) ... ... ... ... ... ... ... | 1,185 |
| Seventh year: Various items as in sixth year, *plus* some additional expenses ... ... ... ... | 1,727 |
| Eighth year: As in seventh year, *plus* additional items ... ... ... ... ... ... ... | 2,018 |
| Ninth year: As in eighth year, *plus* additional items .. .. .. .. .. .. ... | 2,263 |

REVENUE.

| | £ |
|---|---|
| Sixth year: 10 nuts per tree, 1,130 pikuls of copra (133⅓ lb. to the pikul), at 18s. 8d. per pikul (220 nuts to the pikul) ... ... ... ... ... ... | 1,055 |
| Seventh year: 3,400 pikuls of copra, at 18s. 8d. per pikul (30 nuts per tree) ... ... ... ... | 3,147 |
| Eighth year: 4,500 pikuls of copra, at 18s. 8d. per pikul (40 nuts per tree) ... ... ... ... | 4,200 |
| Ninth year: 5,650 pikuls of copra, at 18s. 8d. per pikul (50 nuts per tree) ... ... ... ... ... | 5,273 |

The above works out at approximately £14 5s. per acre up to the sixth year, after which the estate becomes self-supporting. When a catchcrop like coffee is planted at the same time as the coconuts, the revenue derived from it considerably reduces this outlay.

"On rich alluvial soil," adds Mr. Brown, "trees

have been known to give fruit in their third and fourth years, but on the whole an average of, say, 10 nuts per tree in the sixth year, 30 nuts per tree in the seventh, and 50 nuts per tree afterwards, is all that can be expected; though with good cultivation the crops are often in excess of this estimate. Inland, the trees do not come on so quickly; in fact, it is usually not till after the eighth year that the trees come into bearing. An average return of copra, under ordinary circumstances, is 4.30 pikuls per 1,000 nuts, but this percentage is often greatly exceeded where proper attention is given to its manufacture. The average price of coconuts for five years (1905 to 1909) has been a little over £3 10s. per 1,000, and that of copra 17s. 8d. per pikul."

Furnishing a complete contrast to this estimate and showing what the Germans are doing in the coconut industry, which they are exploiting with their characteristic thoroughness, are the figures contained in "Die Kultur der Kokos-Palme" by Lieutenant Zapernack, which deal with an estate comprising some 1,250 acres of land in Micronesia:—

| | £ |
|---|---|
| 1,250 acres of land, at 2s. per acre ... ... ... | 125 |
| Survey fees and registration ... ... ... ... | 50 |
| Boats: One sloop, one rowboat ... ... ... ... | 300 |
| Expenses for keeping boats in order (six years) ... | 90 |
| Carried forward ... ... | £565 |

| | £ |
|---|---|
| Brought forward ... ... | 565 |
| Tools for six years : Spades, hoes, axes, etc. ... ... | 90 |
| Fifty labourers and their living for three years ... | 250 |
| Fifty additional labourers ... ... ... ... | 250 |
| Wages, 100 labourers at 6s. per month ... ... ... | 1,080 |
| Seed nuts ... ... ... ... ... ... ... | 75 |
| Manager's house, coolie lines, other buildings ... ... | 500 |
| Wages, one assistant—free station and £10 per month | 720 |
| Salary and living for the manager ... ... ... | 900 |
| Total ... ... ... ... | £4,430 |

The above works out at less than £3 per acre, and an average nett return of £10 per acre is considered to be a very conservative estimate.

For purposes of further comparison we give the following summary of the cost of opening up 2,000 acres in West Africa, where the land does not require so much spent on clearing as in Ceylon or the Malay States, while rents are somewhat lower.

Two thousand acres are quoted as a standard, for upon an estate of this area sufficient produce can be grown to justify a complete organisation, including an oil mill and plant for making fibre.

The trees begin to bear in from four to six years, and produce about 10 nuts per tree the first year of bearing. In the seventh year they produce upon

an average 30 nuts per tree ; in the eighth year, 50 ; ninth year, 70 ; tenth year, 80 nuts per tree, and so on, increasing until their 20th year. From this point on to the fortieth year they are at their best, and they continue to bear until they attain 100 years of age, many trees yielding from 200 to 400 nuts annually.

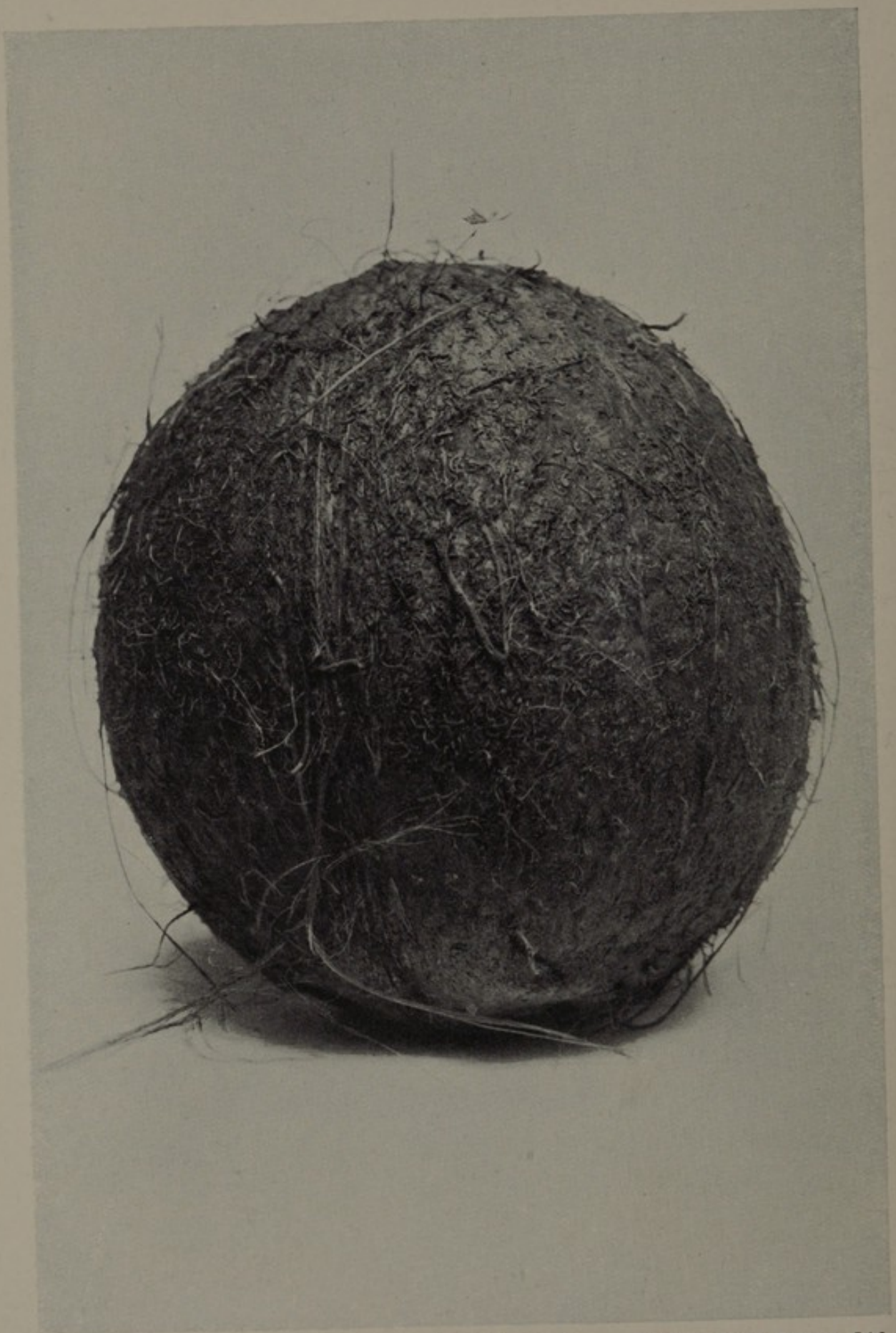
The cost of developing 2,000 acres is as follows :

Rent, £100 ; felling and draining, £2,500 ; plants, £500 ; buildings, £500 ; tools, etc., £250 ; weeding, £1,000 ; superintendence, £1,000 ; contingencies, £1,000.

| | £ |
|---|---|
| The first year's cost would therefore be ... ... | 7,850 |
| Second year : Rent, weeding, superintendence ... | 2,600 |
| Third year : Rent, weeding, superintendence ... | 2,600 |
| Fourth year : Rent, weeding, superintendence ... | 2,100 |
| Fifth year : Rent, weeding, superintendence ... ... | 2,100 |
| Sixth year : Rent, weeding, superintendence ... ... | 2,100 |
| Coir fibre plant ... ... ... ... ... ... | 1,000 |
| Copra drying plant ... ... ... ... ... | 1,000 |
| Total ... ... ... ... | £21,350 |

Accepting these figures, the total capital outlay up to and including the sixth year would work out at just over £10 per acre.

In the sixth year the returns should pay the upkeep and give a profit as follows :—140,000 trees yielding ten nuts per tree=1,400,000 nuts, which produce :



*Copyright*] **A Husked Coconut.** [*Eastern Palm Estates, Ltd.*

| | | | |
|---|---|---|---|
| 350 tons of copra, at £21 per ton ... ... | | £7,350 | |
| Cost of making copra, £8 per ton ... | £2,840 | | |
| Overseer ... ... ... ... | 750 | | |
| | | 3,590 | |
| | | | £3,760 |
| 200 tons of coir fibre, at £12 per ton ... | | £2,400 | |
| Cost of making coir fibre ... ... ... | | 550 | |
| | | | 1,850 |
| | | | £5,610 |
| Less upkeep of plantations ... ... ... ... | | | 2,100 |
| Net return in the sixth year ... ... ... ... | | | £3,510 |

In the seventh and succeeding years the expenditure and returns would be :—

| — | Upkeep. | Returns. Gross. | Returns. Net. | Capital Outlay. Percentage on. |
|---|---|---|---|---|
| | £ | £ | £ | % |
| Seventh year ... | 2,600 | 12,280 | 9,680 | 40 |
| Eighth year ... | 3,500 | 18,800 | 15,300 | 66 |
| Ninth year ... | 4,300 | 27,320 | 23,620 | 100 |
| Tenth year ... | 5,500 | 36,080 | 30,580 | 133 |

Spreading the whole of the outlay over these ten years, the average annual return, before allowing for administration, would therefore be just over 33 per cent.

Moreover, copra being at present nearer £30 than £21 per ton, and likely to sustain its price, the actual results to-day would be quite 100 per cent. better than those in the above calculations.

As regards Ceylon, the following is an estimate furnished by Ferguson's *Coconut Manual* of the

cost of planting and cultivating 200 acres of coconut up to the tenth year, including interest on money expended:

FIRST YEAR'S EXPENDITURE.

| —— | | Cost. | Interest. | Total. |
|---|---|---|---|---|
| | | Rs. | Rs. | Rs. |
| Value of land, 200 acres at Rs.20... ... | | 4,000 | | |
| 19,500 selected seed nuts, at Rs. 75 per 1,000 | | 1,463 | | |
| Repairing and tending nurseries ... ... | | 120 | | |
| Felling, clearing, and fencing ... ... | | 3,000 | | |
| Drains, roads, and bridges... ... ... | | 200 | | |
| Lining 24in. by 24in. and holing 3ft. by 3ft. | | 1,250 | | |
| Filling in 18 in. and planting ... ... | | 350 | | |
| Weeding, 8 months ... ... ... | | 1,600 | | |
| Watching ... ... ... ... ... | | 160 | | |
| Buildings ... ... ... ... ... | | 1,000 | | |
| Tools and implements ... ... ... | | 200 | | |
| Superintendence ... ... ... ... | | 2,000 | | |
| Contingencies ... ... ... ... | | 200 | | |
| Total ... ... ... | | 15,543 | 1,243 | 16,786 |
| Second year... ... ... ... ... | | 5,440 | 1,779 | 7,219 |
| Third year ... ... ... ... ... | | 5,490 | 2,359 | 7,849 |
| Fourth year... ... ... ... ... | | 4,920 | 2,942 | 7,862 |
| Fifth year ... ... ... ... ... | | 5,590 | 3,625 | 9,215 |
| Sixth year ... ... ... ... ... | | 8,115 | 4,563 | 12,678 |
| Seventh year ... ... ... ... | | 5,940 | 5,404 | 11,344 |
| Eighth year, including picking and gathering crop ... ... ... ... ... | | 5,785 | 6,299 | 12,084 |
| Ninth year, including picking and gathering crop ... ... ... ... ... | | 8,510 | 7,484 | 15,994 |
| Tenth year, including picking and gathering crop ... ... ... ... ... | | 8,720 | 8,780 | 17,500 |
| Total ... ... ... | | 74,053 | 44,478 | 118,531 |
| *Less* receipts: | | | | |
| Eighth year: | | | | |
| 130,000 nuts at Rs.27... | Rs.3,510 | | | |
| Ninth year: | | | | |
| 250,000 nuts at Rs.27... | 6,750 | | | |
| Tenth year: | | | | |
| 420,000 nuts at Rs.27... | 11,340 | 21,600 | 2,942 | 24,542 |
| Net cost of estate ... ... | | — | — | 93,989 |

The foregoing estimate is obviously based on ultra-conservative calculations, the working expenses allowed being exceptionally liberal; no

allowance is made for catchcrops or the system of goiya, or gratuitous labour, in vogue in Ceylon, which would represent a notable increase in revenue, while the receipts, at current prices for coconuts, would be more than double the amount specified. Thus, for the eighth, ninth, and tenth years the receipts would be nearer Rs. 40,000 than Rs. 21,000. Moreover, the crop would increase year by year until it attained about 750,000 nuts in the 15th year. And, with liberal cultivation and fertilisation, it should attain 1,000,000 nuts per annum. This yield should be maintained, if not increased, up to the 70th year, so that, altogether, very substantial profits would ultimately accrue, rendering this 200 acres of land, with its very moderate yearly rental, a most attractive investment, yielding high dividends over a period of about sixty years.

Considerations of space preclude the inclusion of other examples, but it may be said that every region has its peculiar advantages and drawbacks, which serve to equalise, to a great extent, the general results achieved. In some regions land may be cheaper or labour more plentiful; while in others the markets may be closer, or climatic conditions more favourable. Thus, while the geographical distribution of the coconut is extremely wide, ranging from the West Indies to the far Pacific, the prospects for profitable exploitation are in most regions decidedly bright, for reasons which have already been explained.

## Chapter VI

# The Plantation

CERTAIN problems confront the planter when he sets out to clear and prepare his estate, whatever the character of the land. It is generally covered with virgin forest, secondary jungle, or grass, as the case may be, and the work of preparation involves great patience, effort, and judgment. Obviously, the first condition presents the greatest difficulty, but, on the other hand, the effort expended is amply rewarded by the freshness and productivity of the soil, which has escaped the impoverishment that results from crop-raising.

In planning out the estate, special care must be exercised in allotting positions to the manager's quarters, the storehouse, factory, gardens, etc., which must be so situated that the roads and paths intersecting the property converge in their neighbourhood. The prudent manager will next see that wherever possible the estate comprises plenty of useful fruit trees and bamboo, which are practically indispensable, the first for feeding the natives

employed on the land and the latter for fencing and other useful purposes.

In coconut planting, as in all industries, whether tropical or otherwise, the question of labour is always important and frequently perplexing. The planter may be able to employ the natives living in the locality, or he may be compelled to import labour, as in Ceylon. The latter system is costly, for it places upon him the burden and expense of housing, feeding, and doctoring the natives, and even providing them with amusement for their spare hours. Such workers need constant supervision in their daily routine. Unless firmly, albeit kindly, treated, they are liable to sulk, strike, and even desert at the most critical moment of the estate's development—that is, the period of planting out the young seed nuts, when the maximum effort is necessary in order to get the work done quickly. Thus it pays to treat them with consideration, to feed them in the manner to which they are accustomed when at home and to keep them generally healthy and contented.

Planting methods vary according to local custom in different regions, but, generally speaking, labour throughout the coconut belt is plentiful, cheap, and fairly efficient when under competent European supervision. In the West Indies a system obtains which is both popular with the natives and profitable to the planter. This is the metayer system,

under which the natives obtain the loan of a tract of land on which coconuts are already planted. These they cultivate at their own expense in return for the privilege of interplanting sugar cane, or other suitable crops. Half the sugar or other produce thus raised is retained by the natives, and half is delivered to the owner of the plantation, who, as a rule, pays them an additional penny per tree per annum to encourage careful cultivation. By this system the planter secures an estate bearing mature coconut trees for a trifling outlay; his young plantation is tended and kept free from weeds without cost to himself, and in addition he secures a profit by the sale of his half share of the sugar produced. This is by no means an inconsiderable return, for, according to *The Cult of the Coconut*, on one estate the natives were cultivating 10,000 newly-planted coconut trees, and delivering annually to the owner 500 barrels of sugar, valued at 30s. per barrel, or a total of £750. On another estate they were tilling 12,000 trees, and delivering to the owner 200 barrels of sugar, worth £300. As the coconut trees attain maturity, the roots spread so as to render this system of cultivation difficult; the estate is then taken over by the owner and the natives commence similar work on another property. In Ceylon the Goiya system, which is often employed, is somewhat similar to this metayer method and works fairly well.

Another system is to carry out clearing and other operations by contract among villagers in the district—an excellent arrangement, especially if the men adopt the American plan—that is, all work under the man directly employed by the planter.

Having finished their contract, he and those who have helped him go elsewhere and work for another planter on similar lines. This system of intelligent labour co-operation enables the planter to deal directly with one responsible native, who can stimulate the activity of his co-workers better than any European could ever hope to do.

In British North Borneo and elsewhere the planter frequently agrees to a price per tree with the natives, for which they clear the land, plant the trees, and hand them over when they are about three years old. During this period the natives are allowed to draw a reasonable amount on account, and the balance is paid when the trees are finally examined and the transaction completed. From the planter's standpoint this is also a satisfactory arrangement, because the natives perform all the work of clearing, developing the seed nuts, planting out, subsequent maintenance, protection from pests, etc., while he pays only for trees delivered in a sound, productive condition. On the other hand it pays the natives, who grow whatever they choose between the trees for their own use. Moreover, while the system provides them

with cash and a means of raising food, it enables them to remain practically their own masters.

Whatever may be the character of the land, it must be thoroughly cleared at first if the planter expects to avoid a number of costly, irritating drawbacks in the future. Lalang and elephant grass must be uprooted, the quickest and most effective method being the use of a plough wherever possible. Lalang especially is most difficult to eradicate and equally dangerous to leave in the ground, for it reproduces itself with startling rapidity, shooting its roots deep down in all directions. This obnoxious grass not only retards the growth of the crop, but when the trees do come into bearing, which is usually later than when the estate is clean, the yield is meagre and unprofitable. Again, there are many varieties of the wild palm that have to be eradicated, for they increase and multiply with all the vigour and persistency that characterises the majority of weeds.

When the clearing work has been completed the felled trees, stumps, and other refuse that have collected are carefully stacked in big piles and thoroughly dried under the rays of the sun for anything from a few days upwards, according to circumstances. Considerable ingenuity is required to arrange the piles in such a manner as to make certain that everything, including the dampest portions, will burn properly. The planter, selecting

*Copyright]* **Cleared Estate, showing Lalang Jungle in background.** *[R. W. Cater.*

a day when wind and weather are favourable, orders a general "burn-out." Special care must be taken to prevent the fire from getting beyond control and spreading too far. A second "burn-out" is sometimes necessary before the clear-up is completed. These operations not only destroy pests, but also provide ash and other elements which when utilised as manure enrich the soil.

Having cleared the estate, the next step is to devise an efficient system of drainage and to carry the same into effect. Where the land is undulating in even slopes, little or no artificial drainage is required, but on low, flat alluvial soil this operation is of great importance. In certain regions, including the Federated Malay States, it is advisable, on such estates, to have drains dug all round the proposed clearing before felling the jungle or secondary growth. "This is especially the case," says that Government's expert, "wherever the soil is of a peaty nature, and here, after the clearing is burnt off, it is of advantage to keep the land exposed for as long as possible, say at least six months, during which time attention should be paid to further drainage if necessary. The coconut tree is probably no more affected by sour land than most tropical plants. At the same time, stagnant water must sooner or later have a very deteriorating effect on the trees."

When the area selected has been cleared and

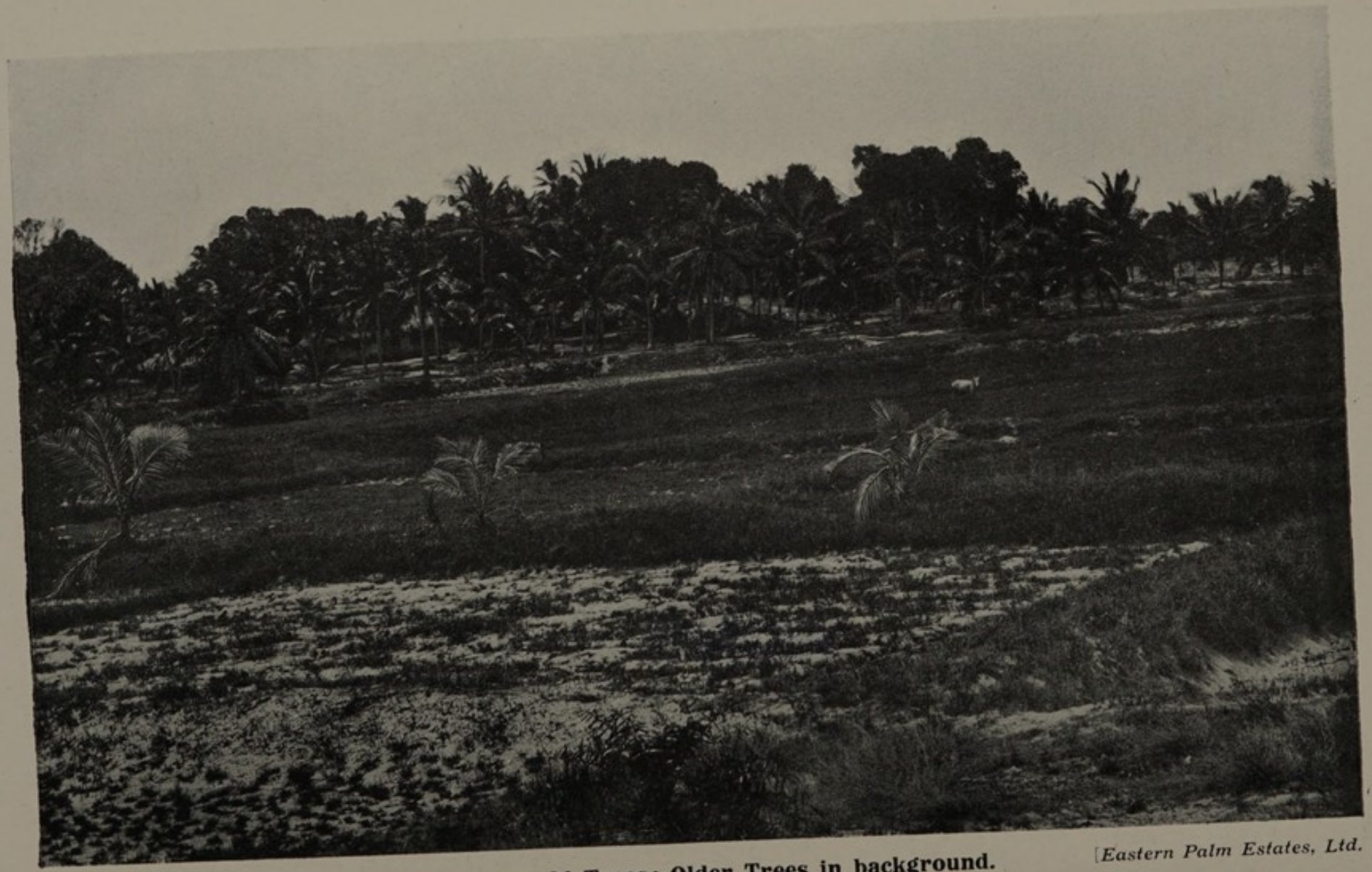
drained, the process of lining and holing the land is commenced, that is to say, it is marked off and the position of each tree located. The former operation is important, a regularly-arranged plantation not only presenting a smarter appearance but being more easily dealt with than one that has been laid out in a slovenly manner. Generally speaking, the greater the space allowed the better for the trees and the larger the crop, for the palms thrive best with plenty of space, light, air, and water. The crown of the palm is at least 30 ft. across, and in our opinion that space should divide the trees. Too close planting is false economy and results in a diminished yield. The system adopted varies considerably, according to the West Indian Government expert, but on average soils the holes bored should never be less than 25 ft. apart from centre to centre each way, which gives sixty-nine trees to the acre. On rich soils they should be dug at distances of 30 ft., or even 35 ft., giving forty-eight or thirty-five trees respectively to the acre. The holes are better arranged in triangular than in square form, so that those on any one row are opposite the centres of the spaces between those of the two adjoining rows. The holes themselves must be dug 3 ft. square and 3 ft. deep, and should be left open for some time after planting. In the best soil 2 ft. by 2 ft. is ample. When the plants are ready the soil taken from the

hole should be mixed with well-rotted manure or leaf mould, and the hole filled in with this mixture to a depth of 18 ins.

Everything being prepared, and an ample supply of labour recruited, the young plants must be carefully removed from the nursery at the commencement of the rainy season. The best age for effecting this removal is a point upon which experts differ widely, the period they fix varying from three to eighteen months, according to circumstances. During this operation the native workers need close supervision, as they frequently injure the roots of the seed-nuts by careless handling. Any broken root should be cut off close to the nut by means of a sharp knife. The young plants being thus transferred to the field are forthwith planted in such a way that the surface of the nut is just covered by the soil in the hole, while it is not less than 15 ins. below the level of the surface of the field. Should the weather be dry, the plants must be watered after the completion of these operations, and in the event of the drought continuing, this watering operation must be repeated every three or four days for the first three weeks at least.

Planting operations having been completed, the planter has to organise the maintenance of his estate, study the question of catchcrops, and solve other knotty problems. In order to keep them healthy and vigorous, the young trees must have

constant care and attention. One of their principal needs is a liberal supply of moisture, and whenever the natural sources are not available recourse must be had to artificial supplies. To manuring, which plays such an important part in the maintenance and development of an estate, we have devoted a special chapter. As regards clean weeding, opinions again differ among experts, much depending upon the locality and the soil itself. In some centres estates are cleaned three or four times a year, while in others even double this attention is needed; on the other hand, many plantations are kept in excellent order with, say, four cleanings in six years. The Malay Government expert considers that the land is always the better for being kept clean and well weeded; but after the trees are in bearing, unless the catchcrop be coffee, grass may be allowed to remain, even where there are fruit trees. The coconut trees themselves should be circled and dug round, if possible, every three months, and where coconuts only are planted, ploughing over the whole land periodically to a depth of 9 ins. will be found highly beneficial. Special efforts must be made to protect the young trees from the attacks of noxious insects, wild animals, high winds, and the damaging depredations of cattle, if any, though where the trees have attained a fair height, and cattle cannot reach the leaves, they may with advantage be allowed to



**One-year old Trees; Older Trees in background.** [*Eastern Palm Estates, Ltd.*

graze over the plantation. No bushes, stumps, or refuse should be allowed to accumulate, as they encourage the rhinoceros beetle and other pests, as explained elsewhere. As the trees advance in age the radius of the circle dug up should be increased—for one-year-old trees 2 to 3 ft. from the stem will suffice; for two-year-old trees this radius should be increased to 4 ft., and so on. When the tree reaches maturity and is in full bearing the circle is about 8 ft. from the stem.

Some managers keep grass and sand round the plants, but many consider that this is practically useless. "Burning the grass when dry," says one authority, "is also useless, as it injures the palms, retards their growth and, further, deprives the land of the benefits which it derives from the grass as it rots."

There are plenty of plantations which yield substantial amounts from catchcrops before the coconut trees come into bearing; indeed, cases have been known of estates paying all their expenses and even showing a profit by prudent management in this respect. The period that elapses between planting and initial production varies, as we have already explained, from about three years in some districts to about seven in others, but of course the trees do not attain their maximum productivity until several years afterwards.

## Chapter VII

# The Science of Catchcrops

NOTHING in connection with coconut planting creates so much discussion or causes such wide difference of opinion as the question of catchcropping, mainly because the value of such crops cannot be standardised in any one district. They vary to a great extent according to the situation, soil, climate, etc., of each estate; and, of course, the human element, here as elsewhere, plays an important part in the business.

Those who have practical experience of the subject are frequently astonished and sometimes amused at the faddish preference displayed by one manager for certain crops, which his neighbours often regard as totally unsuitable or unprofitable. So many men; so many minds.

The principal reason for cultivating catchcrops to-day is this: the plantation, as we have seen, takes from four to seven years to arrive at the stage of production, and a prudent manager naturally desires to cultivate in the meantime such

subsidiary crops as will yield an immediate revenue. Formerly they were resorted to because planters considered it imprudent to trust entirely to one product, whose market value might, under disastrous conditions, fall to such an extent that its cultivation would be rendered unprofitable. This actually occurred some years ago with coffee in Ceylon.

It is doubtful whether many people realise to-day that rubber was at one time merely a catchcrop, whose interplanting with permanent crops such as coconuts, tapioca, gambia and pepper was enforced by law. This was in Malaya, where on many estates Chinese squatters are even now allowed to plant catchcrops rent free as a return for keeping the land clear of weeds.

For the checking of disease and the eradication of the noxious lalang these subsidiary crops are invaluable ; in their absence it would be impossible to prevent that weed from overrunning the estate. Catchcrop cultivation necessitates deep digging, the constant tilling and weeding of the soil, which ventilates it and materially improves its condition.

In certain districts, notably in Malaya, the coconut itself has been known to fill the *rôle* of catchcrop, but experts quickly discovered that it was far too valuable an asset to treat in that way, seeing that it was sufficiently productive to constitute a principal crop, even before its indispensa-

bility as a dietetic constituent had been established. There are to-day plenty of Rubber Companies which will only find financial salvation in replacing unprofitable rubber by the more productive coconut.

According to one leading authority, the four conditions which constitute the essentials of a catchcrop are (*a*) that it should not injure the main crop; (*b*) it should yield a harvest as soon as possible; (*c*) its cultivation should not necessitate any specially skilled labour; (*d*) the preparation of the resultant products should not involve the acquisition of any costly machinery. We consider that he might have added (*e*) that the crop should be immediately and conveniently marketable and prove sufficiently remunerative to compensate, in a measure, for that trying financial period which must elapse before the coconut palms reach the profit-producing stage.

When an estate has been cleared and the tree stumps removed or burned, it is usual to start growing some crop while the nursery is being prepared.

The most suitable catchcrops are generally admitted to be cotton; soya beans; manioc (tapioca or cassava); sugar; sweet potatoes (batata); chillies, ground nuts, or peanuts, maize, pineapples, cotton, sizal and, if it is not straining the term, cattle and pigs.

Ground nuts are chiefly valuable for their fertilising properties. In the United States a yield of from 1,500 to 3,000 lb. of nuts per acre can be obtained. Ground nuts and coconuts thrive on similar soil. In Tropical Africa the yields are not so high as elsewhere, although the ground nuts produced are more valuable, as they contain a greater percentage of oil. There is always a brisk demand for this class of oil in the European markets, and good shelled nuts realise upon an average about £12 10s. per ton. The oil extraction does not necessitate expensive machinery, and the residue, which contains quite 7 per cent. of nitrogen, furnishes valuable food for cattle, and manure. African unshelled and shelled ground nuts yield 32 and 50 per cent. of oil respectively, and oil extracted locally in East Africa has been valued as high as £40 per ton.

Tapioca and pineapples are very exhausting to the soil, although the former product has long been a favourite, owing to the fact that it always commands a ready market. Popular with the natives as an article of diet, it is, in some regions, used as the basis of the staple food in substitution for rice. As regards the soil-exhausting drawback, that practical authority, Mr. Frederick Knocker, says: "Tapioca greedily absorbs from the soil a far larger proportion of nourishment than should fall to the lot of a catchcrop, burrowing far and deep

into the ground with its huge roots. In fact, anybody in England desirous of obtaining a striking impression of what progress the tapioca plant can make in two or three months towards monopolising the land should spend a few hours in his garden diligently unearthing a four or five-year-old horse-radish! It is from its abnormally large roots, averaging the size of a man's arm, that the tapioca of commerce, and, incidentally, arrowroot, is derived."

Having raised his catchcrop, the planter's next problem is the market. In this connection the local market constitutes one of the elements of success, for much depends upon raising products for which there is a prompt and profitable demand. Moreover, the demand must be sufficiently steady to guarantee a permanent outlet and the market must be in close proximity to the estate to save the cost of bullock or other transport.

Whatever catchcrops may be decided upon, it always becomes necessary to eliminate them after the fourth year of tree-planting, and to replace them by some cover-crop, such as Mimosa, or Jack beans, which are permanently maintained. "The leguminous plants to which the Mimosas and the beans belong," say the authors of *Coconuts*, "are the most advantageous of all, because they give up a goodly percentage of nitrogen to the soil, through the root nodules and their rotting leaves and

stalks. Some of the Mimosas contain as much as 24 per cent. of nitrogen, and the beans up to 18 per cent.; sweet potatoes are also good, as they can be cultivated in deep rows, a good distance away from the coconuts themselves. Such leguminous plants not only spread rapidly and prevent the lalang from coming up again, but will provide fodder for the domestic animals on the place. The Mimosa family, which are indigenous to most localities where coconuts grow, are among the most useful of these 'cover-plants,' especially on estates with cattle."

But the Mimosa has one fatal drawback; it is cursed with numerous and particularly penetrating prickles. From these the coolies' feet suffer intensely, not always immediately, owing to the toughness of their skin. They frequently have lacerated feet unknown to themselves, until suddenly the torn flesh develops a serious and painful wound. Cattle also suffer from these prickles.

At first sight there appears something incongruous in including cattle and pigs in this category, but many competent authorities regard these as one of the most promising and profitable subsidiary industries of a big coconut estate, where they can usually be introduced about four years after planting, when the palms have attained such a height that cattle cannot injure them. There are regions, notably the Philippines, where cattle are

allowed to graze on coconut estates when the trees are only 2½ years old, but this is considered by most experts as far too early. The value of cattle on an estate may be said to be fourfold, because they serve for transport purposes, they manure the land, they fetch a good price, both as animals or as meat, there being always a good local market, and far from injuring or retarding the development of the principal crop they expedite its period of maturity and increase its productivity.

"The animals will keep down the vegetation and add fertility to the soil," says Mr. Hamel Smith. "At Zamboanga experiments made resulted in the palms bearing at one to one and a half years earlier than when not grazed with cattle. Such fertilising methods applied to an old grove nearly doubled the product of the trees." After demonstrating the tremendous scarcity of cattle and pigs throughout the world in an exhaustive study of cattle as a catchcrop, in which he gives many practical hints to planters and others who contemplate adding cattle-raising to their estate, the author concludes: "I maintain, therefore, that any estate, be it owned by one individual or a company or syndicate thinking of taking up coconut planting on a large scale, should seriously consider the whole question of running, let us call it, a cattle ranch and coconut plantation at one and the same time."

It occasionally happens that directors of coconut companies in London think they can solve the complicated problem of catchcrops better than their managers, ignoring the fact that such attempts are decidedly dangerous. Success depends almost entirely upon individual and local conditions, which manifestly can be better gauged by the man on the spot than by directors thousands of miles away. The latter seldom increase the company's revenue by their zeal in this respect. When the Board is composed of practical men all such questions are left entirely in the hands of their managers, who have the necessary experience, and are equally anxious to score a success.

Altogether, catchcrops may be said to play an important part in coconut enterprise, for they can not only provide, under favourable conditions, a fair revenue while the principal crop is unproductive, but they are of considerable assistance in the protection and development of the estate.

## Chapter VIII

# The Seed-Nut and the Nursery

IT is quite unnecessary to dilate at length upon the importance of the seed-nut in coconut cultivation, for obviously the utmost care and discretion are called for in its selection.

It is true, of course, that almost any nut will germinate and produce some sort of plant, but the planter who aspires to establish a permanent and productive estate must take care that the trees from which he selects his seed are strong and vigorous, and that the nuts gathered are of the finest and most suitable varieties only. Patient investigation and careful comparison alone can discover these. "The better the nut the finer the tree" is a maxim that long experience has proved and sanctioned.

Many experts consider that seed-nuts should always be selected from healthy, thriving trees between twenty and thirty years old, and known to produce a sound, well-conditioned nut. But

there is considerable difference of opinion on this as on other points connected with coconut procedure. At least one eminent authority places this limit between the twelfth and twentieth year, which, he maintains, is the period of the highest vitality of the coconut palm tree. Practical experience, however, indicates that this period varies according to locality, and in some districts it may be found that between twenty and twenty-five years is the more usual limit. The trees selected should, whenever possible, be on an estate in the district in which the new plantation is to be located. In this way the general conditions of soil, location, climate, etc., will be practically identical and the seed-nuts can be selected and transported with the minimum of time, trouble and expense.

In visiting other estates in search of the finest seed the shrewd planter will not fail to closely observe the general character of the trees and their nuts; the bearing qualities and healthy appearance of the former and the general appearance of the latter; and the state of the plantation as regards weeds, pests, and disease. "Roundish nuts, with a full-looking skin, without grooves or too marked elongation or protuberance are invariably the best," says one expert. "Exceptional size is not so much to be desired, as it will generally be found that this quality is mainly made up of

husk at the expense of the meat." These medium-sized, roundish nuts, either reddish brown or green in colour, are usually preferable to the oblong yellowish variety. The kernel should be thick and the husk thin. By inserting a knife until it reaches the shell, the thickness of the husk can be easily ascertained.

The seed-nuts must have ripened on the tree, and must be exactly ripe. It is by shaking that the condition of the nut can best be tested. Should it be unripe it will give forth a dull, heavy sound; when ripe it gives a sharp, clear sound. The natives are remarkably clever in testing nuts by a tap of the finger nail, and the planters, after a little observation and practice, become equally expert in this operation.

Nuts selected for seed should not be carelessly thrown down from the tree, but plucked and lowered by hand, or dropped into a net, so that they may not be exposed to the slightest risk of damage. Nothing is more expensive, or irritating, than to discover, several months after planting, that a number of seed nuts have cracked kernels, and are consequently absolutely useless for reproductive purposes.

It may happen that the nuts, even when ripe, still contain a considerable quantity of water, in which case they need curing—that is to say, drying—for a period that practical planters estimate at

from one to four weeks, though some assure us that it can be done in three or four days. This "curing" must not be effected in full sunlight, as the heat may cause the kernel to become partially cooked, in which state its germinating power is greatly impaired, if not altogether destroyed.

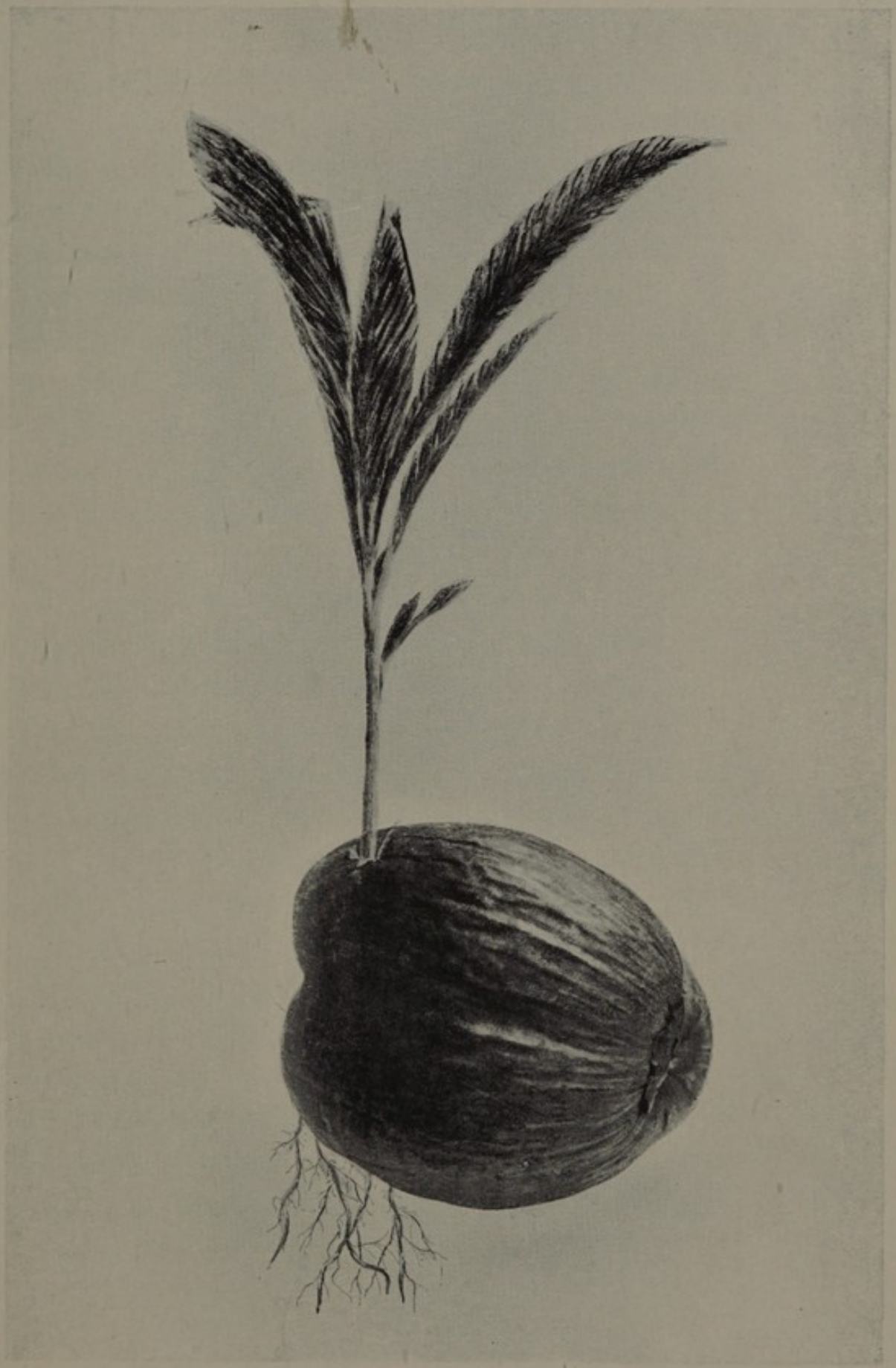
The planter finds it necessary to buy more nuts than he apparently needs, some authorities placing the surplusage as high as 50 per cent. Even this margin, if adopted, would seldom result in waste, for there is always loss of seed to be made good from many causes, including unsuitability, ravages of insects and vermin, accidents during transportation, and failure to germinate. For planting-out purposes, therefore, extra seed is always required.

Whenever these nuts have to be moved from place to place, such operations should be performed with the utmost care, in order not to detach the delicate germinating cores from their hold on the upper end of the kernel, just under the germinating holes, where the rootlets issue. Any resultant damage would be likely to seriously interfere with the subsequent growth, if not to arrest it altogether. Some planters utilise donkeys for the transfer of the seed-nuts, but the best and safest way is to move them on bamboo stretchers carried by men.

This is the system advocated by most up-to-date plantation managers, and although it appears the slower method, it is the most economical, as the germinating core is the vital spot in the coconut. Most frequently it is heart-shaped, and fills the bulk of the cavity left by the milk in the interior of the kernel. It is buff-coloured, of a cellular, spongy consistency, and emits a pleasant sweet odour like a flower.

In conclusion, it must not be overlooked that at this critical stage certain pests become abnormally active, being attracted by the young and tender vegetation of the seed-nuts whose core is their special objective, it being one of their favourite tit-bits.

Seed-nuts having been selected, the next care is to plant them in carefully located nurseries. For this purpose a planter usually chooses a fairly large, flat, well-drained piece of land with a light soil, or, as some prefer, a gently sloping position which facilitates drainage. The location should be as central as possible, and not too far from the area to be planted, so that the seedlings may be transported with the minimum of trouble and risk. There should be good water facilities for irrigation purposes, otherwise wells must be sunk. While not in all cases essential, there is a great advantage if the spot chosen is shaded by trees. Dealing with this question, one



*Copyright*] **Seed Nut after Germination.** [*Eastern Palm Estates, Ltd.*

authority points out that " in Malaya, the Philippines, and certain other regions, the natives form a natural nursery by collecting a lot of nuts side by side under a heavy shade tree, like the mango or the jackfruit, and leave them there until plants of roughly 2 ft. in height have grown out of them. Thousands of seed-nuts can be thus sheltered, the chief drawback being the impossibility of giving the nuts individual attention, owing to their being too close together." Generally speaking, where such shade is not available, it must be provided by the erection of shade roofs, which can usually be built at low cost from materials obtainable on the spot.

The soil of the nursery should be well forked to a depth of from 16 to 18 inches, well pulverised, and all large stones, stumps, grass, roots, etc., carefully removed, so that the entire nursery is thoroughly clear and clean. It should then be divided into beds from 3 to 4 feet wide, with narrow paths intersecting them to facilitate inspection and general tilling work.

Mr. L. C. Brown, Inspector of Coconut Plantations in the Federated Malay States, regards the selection of seeds as being of the greatest importance, as we have already pointed out. His experience shows that it is better not to plant them for a month or two after they have been picked, so that the outer rind may get thoroughly

dry, and the husk be allowed to harden. The seed-nuts imported from Penang and Province Wellesley into the Malay States have done very well indeed; excellent seed may also be obtained from Kuala Selangor, Kuala Langat and Lower Perak.

Whenever the soil shows a tendency towards dampness it should be raised a little above the surrounding land, a precaution that is seldom necessary in a well-drained area. Trenches six inches deep must next be dug in the beds, and the nuts placed in rows, about one foot apart, and laid in a slightly oblique position, with the acute end of the nut *downwards*. This is the system adopted in the Malay States, but curiously enough the Government experts of the West Indies recommend that the nuts be laid horizontally, with the end somewhat *raised*. In no case should they be placed in a vertical position. The soil that has been dug out of the trenches is then replaced until the nuts are covered to such a depth that only about a quarter of the upper part of each projects. The whole bed must then be covered to a depth of six inches with straw or grass. The question of watering depends a great deal on local climatic conditions. So long as the leaves look fresh and of a dark green colour during drought they need not be watered, but if they begin to look yellowish, moisture is at once required. It is not advisable

to add manure, as this is calculated to attract ants, beetles, and other pests.

Satisfactory germination of seed-nuts is sometimes obtained in the Federated Malay States by another method: the nuts are tied in pairs by strips of their outside husks, and hung along bamboos supported at a height of about six feet above the ground, and so placed that the seedlings are protected from too much exposure.

In this position the leaves and roots soon begin to shoot, and the young plants are ready to be removed to the clearing at the customary period, which is usually when they are from six months to one year old.

Germination lasts, on an average, from three to four months; those nuts which, when planted soon after picking, do not germinate before five or six months have elapsed, are not likely to become vigorous seedlings. The young plants must be left in the nursery until they are about a year or fifteen months old, and have produced a more or less copious crop of bud leaves, when they are ready to be planted out.

In these, as in all other operations connected with coconut cultivation, the procedure varies according to locality, climatic conditions and the personal views of the planters—most of whom have special methods to which they pin their faith. Thus, some adopt the plan of getting

ready the whole plantation at once and planting the nuts directly into holes which have been prepared for them. But all agree that this preliminary stage in the nursery is of vital importance, and that ceaseless vigilance is needed if a fine crop of coconuts is to be secured.

## Chapter IX

# The Question of Fertilisation

THE importance of properly fertilising and cultivating the soil from which all vegetable wealth is produced is strikingly demonstrated by Mr. O. W. Barrett, Superintendent of Experimental Agricultural Stations in the Philippine Islands, who, in an official communication, recently pointed out that only a small percentage of the cultivators of vegetable products know the prime functions and qualities of root plants. He estimates the total annual value of the marketable products of cultivated plants at £5,000,000,000, and states that there is an unnecessary and unconscionable loss of about 15 per cent. of the world's normal production, the wastage equalling some £800,000,000 in value. These figures—which, of course, include the coconut—give one furiously to think. Certainly a due appreciation of their significance is calculated to stimulate the planter in his effort to secure the maximum output of

his estate. To do this he must not only select the finest seed-nuts, plant them with care, and keep his land in good order, but he must thoroughly understand how to fertilise the soil by approved scientific methods. Scientific fertilisation, in plain English, means the return to the soil of those vital constituents—nitrogen, potash, phosphoric acid, lime, etc.—which former cultivation has absorbed.

During the first two or three years it is rarely that artificial fertilisation is required, the young plants deriving ample sustenance from natural water supplies. But as the trees grow older, a dressing of pen manure should be lightly stirred in near the extremities of the roots—that is, at a radius of some six to eight feet or more from the trunk. This system infuses nitrogen and humus into the soil, while taking nothing out; moreover, the presence of humus increases its water content by augmenting its capacity to retain moisture.

The system advocated by the Malay Government expert is as follows:—A trench is dug half-way round the tree about 9 in. in width and, say, 1 ft. in depth, close to the extremity of the roots. This trench is left open for a short time, then the manure is filled in and covered with the soil that has been excavated. The following year the tree is again treated in a similar manner. Experience shows that it benefits greatly from this artificial stimulation, and reaches a good, robust condition, when

an improvement is observable in both the quantity and the quality of the fruit.

Here again everything depends upon the estate and the region in which it is situated, for a fertiliser that proves highly successful in one case might be practically valueless in another. The formulæ recommended by scientists must usually be put to practical tests before their suitability can be ascertained. But one thing is certain—scientific, systematic fertilisation can be made to increase the yield of trees by anything from 5 to 20 per cent.

The need of adequate supplies of water at all times cannot be too strongly emphasised, says *Coconuts : The Consols of the East.* "Water must be constantly at the disposal of the palms, to convey in solution the plants' mineral and nitrogenous raw food from the root to the crown. The quantity of mineral food which the tree takes up is roughly proportional to the amount of water which it absorbs. Increasing the plants' transpiration has, then, the same effect on them as applying a fertiliser to the ground ; without the water the fertiliser will do little or no good."

Continuous aspiration is accompanied by constant transpiration. Calculations made by an American expert of the total water transpiration of an entire tree per day show that it varies from 28 to 75 litres. Even at the former rate the

annual transpiration of an average tree would be approximately 2,250 gallons. Mr. Herbert Walker, writing on the same subject in the *Philippine Journal of Science*, says: "It seems that the nutriment comes, not from the soil in which the trees are actually growing, but from an inexhaustible supply of water, laden with plant food. . . . The underground water supply would account for the flourishing condition of trees in a sandy soil near the sea, even in times of drought, when individuals further inland in higher and less permeable ground would be dying from want of water."

Fish manure, when it can be obtained in good quality and at a reasonable cost, is strongly recommended as the best for coconut trees. Bone dust is also excellent, but the price practically prohibits its use on ordinary estates. Guano is not only very costly, but also too strong, and rapidly exhausts itself. Certainly crops improve soon after it is applied, but this is only for a comparatively short period, and to secure good results the quantities of this fertiliser have to be successively increased. Whenever used, however, the Peruvian variety is considered the best, because it is more easily soluble, and disintegrates more readily.

As the trees come into bearing, they will require large quantities of potash and phosphorus, these elements entering largely into the composition of

the fruit. They may be introduced in the form of potash, or Kainit for potash, or bone meal for phosphorus, according to the needs of the soil. All fallen leaves and coconut husks not otherwise utilised should be removed, burnt, and the ashes forked into the ground from time to time with the other fertilising materials.

On the other hand, there are many experts who consider that some planters are disposed to exaggerate the importance of artificial fertilisers, which, they contend, do not always yield results commensurate with their cost, and lead to the neglect of natural fertilisers that are available. These experts maintain that most of the constituents necessary for raising healthy, productive coconut trees, such as dead leaves, husks, shells, table and fish manure, ashes from burnt timber and other refuse, are to be found on every plantation, and that it only remains for those responsible to utilise these natural fertilisers to the best advantage.

Where cattle and other domestic animals are kept, as in Ceylon, they furnish adequate fertilising matter, which, when mixed with some artificial product, constitutes an excellent stimulant for the soil. In addition there are plenty of patent fertilisers specially prepared to favour different crops, each one being accompanied by directions which enable the planter to select the most suitable for

his special purpose. The potash salt known as "Kainit" finds favour with a number of planters. It is especially valuable for coconut palms, because of the salt it contains, which conserves the moisture in the soil and is a preventive against insects and other pests.

The payability, to coin a word, of systematic, scientific fertilisation wherever necessary cannot be too strongly emphasised, and in view of the immense and growing demand for the coconut and all its products, there is no doubt that planters will be disposed to devote great attention to this department of the industry.

It is a fallacy to assume that cheap manuring is either economical or profitable. It is never cheap, and is often harmful. Experiments in different countries have proved that the application of well-balanced manures containing nitrogen, phosphoric acid and potash gives the highest yields and the most profitable returns.

As it does not come within the scope of this work to enter into the technical phases of the question of fertilisation, we can only advise those readers who are anxious to further investigate these problems to consult the book to which we have already referred, "*Coconuts: The Consols of the East*," in which the subject is dealt with in the fullest detail, and with unquestionable authority.

## Chapter X

# Diseases and their Cure

THE coconut palm, like most tropical plants, is subject to a number of diseases caused by parasitic vegetable organisms, fungi and bacteria. These diseases vary in their effect according to locality and the promptitude with which they are discovered and eradicated. There are many varieties known to planters, the principal being: *Bud rot, root disease, stem-bleeding disease* and *leaf disease.* With the exception of the second, they may be expected to attack trees of all ages from four years upwards. The trees present a very similar appearance when suffering from any one of these diseases, the leaves in every case drooping and looking yellow and sickly, while in some cases the tips of the leaflets may be broken and hang downwards. Such leaflets are dry and greyish in appearance and are attached to unhealthy parent leaves.

*Bud rot* appears in the heart of the crown of the tree, its presence being indicated by the above changes. It is characterised by a complete rotting

of the terminal bud and the surrounding soft tissues, the whole cabbage or central bud presenting an unhealthy appearance. Sometimes the drying-up of the central shoots cannot be observed until many of the lower leaves have turned yellow or brown. If the disease reaches a certain stage the terminal bud falls over and the complete death of the tree follows, though frequently a ring of healthy-looking green leaves is left at the top, which remain green for some time after the bud has fallen. When the tree is cut down the planter discovers that the bases of the young leaves and of the still undeveloped flower stalks, as well as the soft tissues at the top of the stem, are affected by a soft brown rot which exudes a most unpleasant odour. All the other portions of the tree, the roots and remainder of the stem, will be found quite healthy, a feature which distinguishes this disease from root or stem-bleeding disease.

The most eminent authorities have concluded that bud rot is caused by a species of bacteria, and one at least considers that it is probably due to the fungus *pestalozzia palmarum*. The Indian form of this disease is caused by a fungus belonging to the genus *pythium*. Bud rot is prevalent in most coconut growing countries to a greater or lesser degree. The cause of the disease in Eastern Cuba has been proved to be a bacterial organism practically identical with *Bacillus Coli* (Escherisch) Migula.

*Copyright]* **Typical Field of Young Coconut Palms (Malabar).** *[Malabar Estates & Planting Co. Ltd.*

The most exhaustive study of bud rot has been made by Mr. John R. Johnston, an American Government scientist, who says it is believed that birds and insects are carriers of this disease, although that theory requires confirmation. It is certainly transmitted from place to place on the green unhusked coconuts. On the other hand, it is generally found that bud rot, if not caused, is considerably encouraged by humidity, young trees being more susceptible in this respect than old ones. In Trinidad, where the disease is not of a very infectious character, it is frequently due to unfavourable conditions of soil, drainage, etc. Experts claim, therefore, that improved conditions of cultivation, better drainage, and a more richly manured soil would do much to wipe out this disease; such, in fact, has been the experience in Ceylon, where it has caused serious trouble.

Very drastic and prompt must be the action taken on any estate where bud rot has developed. We may quote a practical authority, Stockdale, who says: "All trees showing signs of the disease must be cut down and destroyed. When the planter is certain that it is nothing but bud rot it should be sufficient to cut 4 or 5 ft. off the top of the diseased trees and bury them deeply in lime, as it would be impossible to burn such rotten masses as diseased buds. The remainder of the trunk and all rubbish should also be collected and burned, other-

wise these may serve to harbour other pests which may become destructive. The felling and destroying of diseased trees is undoubtedly an expensive process, but the neglect of these precautions may make all the difference between a trifling loss of trees and money and a serious epidemic."

*Root disease*, the origin of which is at present unknown, only attacks trees that have commenced to bear, its symptoms resembling somewhat those of bud rot. The leaves are the first to reveal its presence, for they begin to wilt and then turn yellow, the change manifesting itself first at the tips and afterwards extending all over the leaflets. Finally the latter dry up, blacken and sometimes hang down from the cabbage, though frequently the leaves do not hang down, but the petioles or sheathing bases break across, leaving the sheathing portion on the trunk, while the expanded portion either falls to the ground or hangs down. The West Indian Government mycologist states that usually the outermost ring of leaves is the first to be affected, though a middle ring often becomes wilted and yellow first, while the leaves outside and inside it are green. Once the yellowing of the leaves has taken place, the diseased trees usually shed most if not all of their nuts, irrespective of their age, while the flowers subsequently produced do not set. Finally the terminal bud rots and falls over, when the tree dies. The earlier symptoms resemble

those shown by trees suffering from drought. It is, however, easy to discover the existence of the disease by examining the roots themselves and the first two or three feet of the stem. If the roots are really attacked, close inspection will reveal a diseased condition of their outer tissues. When the tree is cut it will be seen that a red discoloration, extending from the ground level for a distance of two or three feet upwards, is present in the stem; this may occur as a ring outside or as a general discoloration of the tissue near the centre of the stem. The death of the roots and the red discoloration of the stem are the two absolutely distinguishing signs of the condition.

Drastic remedial measures should be adopted immediately any disease is discovered. The infected trees should be cut down, their roots carefully dug up and the whole burned; the soil from which the tree has been taken should be given a good dressing and be well forked over and, as a further precaution, the infected area should be isolated by a trench 2 ft. deep and 2 ft. wide, the soil from this being thrown on the infected land. This should be allowed to rest for a year before fresh trees are planted. When root disease first appears the whole of the drainage and general condition of the estate should be promptly and thoroughly overhauled and all defects remedied as a precaution against further infection.

*Stem-bleeding disease* is caused by a fungus, *Thielaviopsis paradoxa*, according to the West Indian Government mycologist, who adds that it is also responsible for a form of rot among pineapples and a decay of cane-cuttings, its spread in plant tissues being dependent upon the amount of sugar which they contain. Stem-bleeding has caused considerable trouble in Ceylon, and the Katana Agricultural Society diagnosed its symptoms and effect as follows :

1. The oozing from the trunk of a rusty or dark-coloured liquid.
2. Followed by wounds on the trunk.
3. In about two or three years the skin of the trunk drops out.
4. The top portion of the tree gradually becomes thin.
5. To about the depth of 3 or 4 ft. the roots wither, either wholly or in part.
6. The tree dies after five or six years, or sooner.

Not till the liquid begins to ooze out is the disease revealed and then the process of decay has already commenced.

This disease is not so destructive as bud rot, and in some coconut-growing regions it does not appear to be prevalent. The swiftest remedy is to cut out and burn the infected tissues, a chisel and mallet being considered the best tools for the purpose ;

so that the water may run off easily, slanting cuts are preferable. When the diseased portions have been removed, the surface of the tissues should be carefully burnt with a torch to dry them and the wound dressed with tar. One expert recommends for this operation *hot* tar, which will prevent the attacks of beetles. "The latter were," says Mr. Hamel Smith, "at first considered the cause of the disease, but examination showed that they bored into the stem only *after the tree was dead.*"

*Leaf disease*, also caused by the *pestalozzia palmarum*, is found in several other plants, notably tea and Para rubber plants.

Coconut planters frequently observe leaves which appear to be dropping and on which the tips of those leaflets remote from the stem are greyish in colour. This condition appears to spread gradually to the leaflets nearer the stem, and when all the leaflets of the terminal two or three feet have become badly diseased, this portion breaks down, and, if the whole leaf is borne in a position between the horizontal and the vertical, the terminal portion remains hanging downwards. When the whole leaf occupies a position between the horizontal and the trunk of the tree, the terminal portion does not usually break off. Inspection of the leaflets themselves reveals the fact that the tips and many parts of the edges are dry and dead, and that on other parts small yellowish spots, more or

less regular in shape, occur scattered about the surface. "These spots more frequently appear first on the under sides of the leaves," says the authority already quoted, "they extend in area, and often run into another forming irregular blotches. As they increase in size, they change from a yellowish colour to a greyish-white in the centre, and are bordered by a distinct margin, usually a deep greenish-brown colour. Finally, small greyish-black pustules are seen in the grey parts of the spots on the upper surface of the leaves. These are the fructifications of the causative fungus. When a large number of spots have collected on a leaf, it assumes a yellowish appearance and becomes grey and withered. It may remain hanging on the tree for some time, but it finally drops. As a result of the diseased condition of the leaves, the number of nuts borne on consecutive flower stalks diminishes and finally no flowers are set. In very bad cases, the terminal bud is left standing alone and eventually this falls over and the tree dies."

The remedial measures are :

1. The destruction of the spores of the fungus to prevent its spread. This is effected by cutting away and burning all the outer, badly-attacked leaves, while all dead trees are destroyed. When the attack is severe it may become necessary to spray the infected trees, and even adjacent healthy trees, with Bordeaux mixture or some other fungicide.

2. Improvement of the health of the plantation by cultivation, drainage and manuring.

Although coconut palms are exposed to the usual pests and diseases common in all tropical countries, it is equally true that most of these can be safeguarded against and their ravages minimised by the exercise of general preventive care, the use of the best fungicides and insecticides available and the adoption of drastic measures whenever the symptoms appear. Moreover, with the enormous expansion of the coconut industry, every question connected with it is being studied and investigated by scientists with greater minuteness than ever; new remedies and methods are being discovered and fresh views and information disseminated for the benefit of planters and others, to assist them in securing and maintaining healthy, productive estates.

As the space available does not permit of an exhaustive survey of these subjects, we cannot do better than refer those readers who are desirous of further investigating them to the very informative reports, etc., published by the Government authorities in the West Indies, Ceylon, the Philippines and other coconut-growing regions. In addition there are, of course, the special technical works published by scientists who have devoted years to the study of tropical agriculture and the investigation of the various fungi and pests found in tropical countries.

# Chapter XI

## The Extermination of Pests

COCONUTS are no more immune than other tropical plants from the attacks of insects, which cause considerable damage unless their ravages be arrested by timely preventive measures.

These insects may be grouped in three principal classes :—(1) Those which suck the juices from the plants, (2) those which feed on the leaves, and (3) those which bore their way into the roots and stems.

The principal member of the first class is the Bourbon Aspidiotus (*Aspidiotus destructor*), a scale insect which occurs on the leaves, where large numbers are often clustered together, thus presenting the appearance of a scurfy or scaly layer. Separate insects are not very conspicuous, but masses of them are easily seen. The scale itself is flat, whitish, thin and papery, with a pale yellow central spot. It generally occurs on the first leaves of young plants, older leaves are also affected,

and in both cases the attacked areas at first turn yellow, then subsequently dry out, so that dead patches are formed. At times the fan-shaped or typical coconut leaves developed remain quite free, even after the first leaves have been attacked, as the plants seem to outgrow the effect of the scale. Other sucking insects are the coconut snow scale (*Diaspis boisduvalii*), the coconut mealy bug (*Pseudococcus nipæ*), the black line scale (*Ischnaspis longirostris*), the glassy star scale (*Vinsonia stellifera*), and the white fly (*Aleyrodicus cocois*).

These pests are more or less destructive, the white fly being, perhaps, the most dangerous, as it generally attacks young coconuts either in the nursery or in the field. When nursery plants are attacked, it is essential to treat them with some insecticide before they are transplanted into the field. The majority of these pests may be kept well under control by means of an oily or soapy wash, such as kerosene emulsion or whale oil soap, while the glassy star scale and the black line scale are more easily destroyed by a rosin mixture. These washes are usually applied by means of a spray pump or a garden syringe, but young plants in the nursery may be treated by dipping them into a tub or trough of suitable size, or by sponging them with the insecticides. A practical bulletin recently issued by the West Indian Government sets out some valuable directions for the treatment

of pests, and also contains recipes for the preparation of various insecticides. There are also, of course, a number of special insecticides manufactured by various firms which render useful service in this connection.

A curious fact is that all species of scale insects in the West Indies are controlled by natural enemies, which consist of parasitic and predaceous insects and parasitic fungi. It is, moreover, considered most likely that other insects such as minute internal parasites and the lady bird and other species which devour the young and adult scales are the most efficient.

Among biting insects are the caterpillars of a large butterfly (*Brassolis sophoræ*), which have been found, in British Guiana and Trinidad, to feed on the leaves of the coconut palm, seriously injuring the trees and diminishing the yield of nuts. These caterpillars attain a length of about 2½ inches when fully grown. They feed, we are told, at night, and rest during the day in large nests which they construct by tying the leaflets of the coconut together with silken threads spun for the purpose. These insects can be controlled by cutting away the leaves to which the nests are attached and destroying the larvæ by crushing or burning them. They may also be destroyed by means of a spray consisting of a solution containing arsenate of lead. Similar caterpillars are found in other regions, and

*Copyright]* *[Underwood & Underwood.*

**Five-year-old Trees in a Responsive Soil.**

one species met with in Panama is said to be controlled by a parasitic fly.

The principal boring insect is the palm weevil (*Rhynchophorus palmarum*), which constitutes a serious pest, notably in the West Indies, where it is, however, less prevalent than it was in former times. The adult is a large black weevil about 1½ in. in length, equipped with a long snout or proboscis. The pupa, or chrysalis, is enclosed in a large cocoon made from the fibres of the plant in which the grub has developed, and is about 3 inches long, and 1½ inches in diameter. The female weevil deposits eggs in the tissues of the food plant, and it is probable that wounds of all kinds offer favourable situations for this purpose. When the eggs hatch, the grubs bore through the tissues, and, becoming fully grown, form pupæ within the host plant. Healthy coconut trees are less liable to attack than are those in a dead or dying condition, a fact which naturally suggests that all dead or dying trees should be cut down and destroyed as soon as discovered. Sometimes, however, it may be advisable to cut the trunks into short lengths and leave them on the ground as traps for egg-laying beetles. Where weevils are known to occur all wounds in the stems or buds of the coconut trees should be plugged at once in order to exclude these pests; in Eastern countries a mixture of sand and tar is used for this purpose,

though for shallow wounds a dressing of tar usually suffices.

The great moth borer of the sugar cane is said to attack coconuts in Trinidad, and a very similar pest is found in certain Eastern countries.

An extremely active enemy of the coconut palm is the rhinoceros beetle (*Oryctes rhinoceros*), which is very common in the Philippines, Ceylon, Java, India, West Indies, and other regions. The female of this species lays its eggs in the decaying trunks of trees and in any heap of decomposing vegetable matter that may have accumulated. These beetles display a decided preference for the nuts germinating in the seed beds, invariably attacking the sweet morsels contained in their heart; they also bore into young trees or into the heart of the mature ones. Their presence is revealed by the large hole they make in the tree, and by the denuded appearance of the leaves. The utmost vigilance should be shown in tracking down and destroying these beetles before they secure a footing on an estate, otherwise it will need endless time and trouble to suppress them. In many regions the beetles are extracted from the holes they have bored in the trees by means of a length of stiff wire with a barbed end, and the holes filled with a mixture of zotal and dry sand. Fine dry sand should afterwards be applied copiously to the cavities at the junction of the leaves with the

trunk, in order to prevent the beetles from making fresh holes.

Messrs. Smith and Pape suggest another very effective method of dealing with this pest: "A very good remedy also is the setting out on poles of 'buglights'; these are made of lighted charcoal placed in baskets, made of hoop-iron, which are then stuck on poles about the plantation at night time, when the beetles are most prone to swarm. Large numbers of them will be attracted to the light, when they can be beaten down by men and boys with brushes, and so caught and killed."

Other remedies include spraying the crown and the tree with a mixture of Paris green and flour, thinned out with 10 or 12 gallons of water for each tree.

The Asiatic palm, or red beetle (*Rhynchophorus ferrugineus*), also causes considerable damage wherever it appears. A Philippine expert, Señor Vicente Reyes, points out that it has been observed that coconut palms, whose green leaves, blossoms and fruits appear in perfect condition, fall to the ground without apparent reason, as though struck by a hurricane. The palms from the roots to about 7 ft. high are completely undermined, the interior pulverised like sawdust, and filled with nests of these insects, which have penetrated the roots and gnawed their way upwards, deriving sustenance from the trunk. The red beetle is

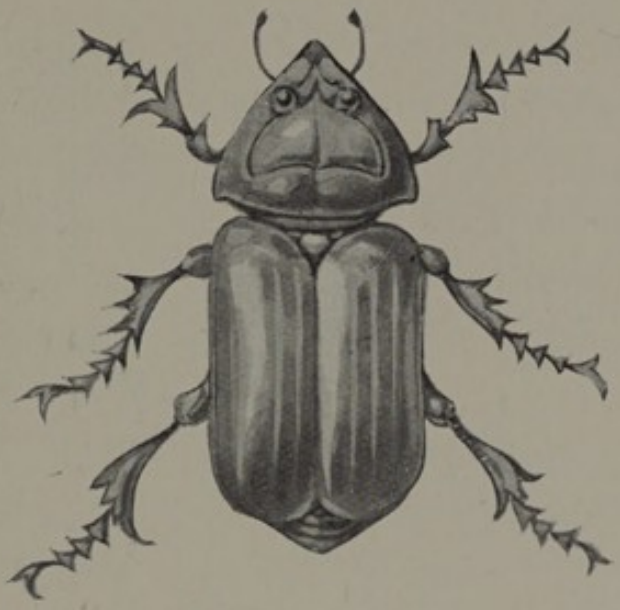
considered by many experts as almost more destructive than the rhinoceros. It is nocturnal in its habits, and flies by night to deposit its eggs.

When this beetle once penetrates the palm its expulsion is extremely difficult, and it is usually found expedient to cut down and burn the tree, taking care that all insects and larvæ are destroyed at the same time to prevent further propagation.

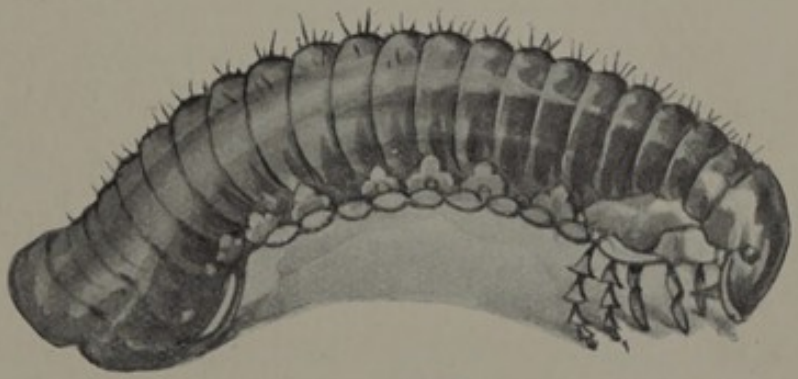
Another troublesome pest in certain regions is the white ant, especially where ground has been newly opened. The burning of the original vegetation deprives them of their usual nourishment, causing them to seek the juice as well as the germs of the nuts, to reach which they bore through the shell. This sometimes destroys young plants wholesale, and necessitates the use of arsenic solutions and smoking out for their eradication. Two practical methods of keeping them away are: allowing no rubbish or decaying wood about the estate; constant hoeing and weeding.

There are, of course, other pests more or less destructive, including the shot-hole coconut weevil, which punctures the palm from top to bottom with its exit holes; the four-spotted coconut weevil, which only attacks the very small dead trees, and certain others which attack the leaves, but not usually to such an extent as to constitute a menace to really healthy trees.

Altogether, among commercially valuable trees,



**Rhinoceros Beetle.**
*(Oryctes rhinoceros)*



*Copyright]* *[Eastern Palm Estates. Ltd.*

**Larva of Rhinoceros Beetle.**

as an expert points out, few are attacked by so small a number of insects as the coconut palm, although the destructive capacity of these is considerable. On the other hand, most of the pests that do occur can be either eliminated or their operations rendered ineffective by careful cultivation, the constant watching of the trees and the application of certain well-known insecticides, which can always be kept ready at hand.

In certain regions the coconut trees are exposed to other troubles, including the destructive exploits of the wild pig, the ravenous appetite of the rat, the visits of wild foxes, large bats and squirrels. Wild pigs can be kept within bounds only by the erection of strong fences, or by hunting them down, or poisoning them. These pigs are addicted to nocturnal raids, during which they commit serious damage, especially among the young plants. Rats climb the trees to attack the embryo fruits, and various measures have to be taken to prevent them from doing so, including the fixing to the trunks of a species of inverted, spiked umbrella, beyond which they cannot pass. Some planters favour tarring a ring round the trunks, while others believe in the efficacy of rat poison. In Ceylon many native planters believe that the braying of a donkey will so terrify the rats that they will seek a quieter region! One authority recommends the introduction of the

mongoose, the rat's most terrible enemy. He adds, however, that "where poultry and eggs are important factors in the estate, there the mongoose is sure to be. Nothing can keep him away, until he alone remains!"

## Chapter XII

# The Coir Fibre Industry

PROMINENT among the more valuable products of the coconut palm is the coir fibre of commerce, which was first exported from the East to Europe as far back as the middle of the sixteenth century. The manufacture of coir from the husk of the coconut acquired great importance under the Dutch, as many as 3,000,000 lb.—of cordage chiefly—being annually produced and exported, principally to Batavia and the Cape of Good Hope. The port captains of Colombo and Galle were, says Ferguson, allowed to manufacture or sell on their own account; the former 600,000 lb., and the latter 500,000 lb., of coir cordage. In the early days of British influence the manufacture fell off, the natives considering the work only fit for low castes; but to-day it affords extensive employment among the people, on the coast especially, in the south and the west. Great progress has been made in the industry during the

last three-quarters of a century, though it was not until the Great Exhibition of 1851 that coir rope and coir matting really attained commercial importance in Europe.

The finest coir fibre is produced in Malabar, though some excellent qualities are imported from the Laccadives, Madras, Ceylon, Singapore, and certain other districts. In the West Indies, too, a certain quantity is produced, but very little of it is exported as there is a considerable local demand for fibre. Locality, soil, climate and proximity to the sea all exercise a considerable influence over the quality of the fibre, which is marketed in varying degrees of fineness, according to the class of the coconut. The collection of the fruit at the exact point of fibre-maturity, the age at which the nut is cut and husked, and the method of preparation are also highly-important factors. The commoner and coarser fibres are obtained from old nuts, and the lighter qualities from the new. Malabar nuts are regarded as the finest from a fibre standpoint, as they produce an article of the purest hue and texture. So marked is its superiority that every effort has been strained to imitate it by means of bleaching processes, although these destroy the quality of the fibre if it be good, and if common render it almost worthless.

We are told by a practical authority that coconut fibre is long, elastic, springy, easily manipulated

*Copyright]* **Natives Husking Coconuts (Malabar).** *[Malabar Estates & Planting Co. Ltd.*

within certain limits, and eminently suitable for manufacture where lightness, cleanliness and great indestructibility are requisite. It will stand water, is almost impervious to wind and wave, damp and rain, and it flourishes in the saline breezes of the sea; it does not harbour vermin, and emits no unpleasant odour; but it will *not* stand bleaching.

The methods of preparation vary in different regions, it being generally recognised that in the Laccadives, on the Malabar coast and in Ceylon, the art has attained a greater perfection than elsewhere. The usual plan is to remove the thick fibre covering from the nut before it is fully ripe by means of a stout, sharp spear-head, whose shaft is embedded firmly in the soil to such a depth that the spear-point projects above the ground rather less than waist high. The native then holds the nut in his hands and strikes it upon the spear-point with a downward rotary twist and thus, with apparent ease, removes the husk, which is generally split into three portions. By this method one good worker should split 1,000 nuts per day, and records have been made of 3,000 nuts. The work is, however, not only hard, but calls for considerable dexterity and wrist strength. In England husking has often been done by men armed with two fine-pointed steel chisels, who, with practice, can husk from 1,000 to 1,200 per day each.

Considering the importance of the industry one would have thought that engineers could have evolved machinery for the mechanical stripping of the fibre; but so far our inquiries show that, while various attempts have been made to construct a practical mechanical method for performing this operation, the only successful machine is one into which the complete husk and nut are passed, and divided into three portions by circular cutters or millers. These cut right through the husk, shell and nut, all of which fall under the machine, and are then separated one from the other, the husks being taken away to the soaking tanks.

In this process of soaking the principal consideration is its duration: if too prolonged, the fibre becomes weakened, and darkens in colour; if curtailed, the subsequent extraction and cleansing of the product becomes more difficult. The most approved tanks are constructed of strong brick, iron or wood. The soaking process is now considerably shortened by the injection of steam, which increases the temperature of the water, and thus softens and improves the fibre. Its further separation is largely effected by hand. After being beaten with heavy mallets, it is placed in the sun and then again beaten and rubbed between the hands until it disintegrates freely. The spongy matter on and around the fibre falls away in a sort

*Copyright*] **Native Women Making Coir Yarn (Malabar).** [*Malabar Estates & Planting Co. Ltd.*

of powder, leaving it bare, clean and ready for the market. In Malabar and other regions a great deal of this work is done by women and children on very low wages. When quite clean the finished article is arranged into a loose roving preparatory to being twisted, which is done between the palms of the hands in a very ingenious way so as to produce a yarn of two strands at once. In Ceylon it is generally calculated that three large nuts will yield six lb. of coir.

In the early days of the industry coir fibre was employed almost solely as a substitute for horse-hair in the stuffing of mattresses, cushions, etc., but its scope has been so extended that to-day the purposes it serves are innumerable. In the course of time, thanks to ingeniously-constructed machinery, it has been rendered sufficiently fine for the loom, and matting of different textures and colours is now produced on a very large scale. It is also made to combine with wool in the manufacture of carpets and rugs of great durability and richness of effect, 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 to cover soil in carpet bedding as a

protection to the bulbs from slugs, to pack between pots of cuttings, and other similar 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. Large quantities of coir yarn are manufactured in Malabar, the exports being 661,148 cwt. in 1912. Immense quantities are also manufactured in Ceylon and sent to the Straits Settlements, and in 1912 103,862 cwt. of coir yarn and 234,565 cwt. of coir fibre were exported from the same source.

The imports of coir yarn into the United Kingdom in 1911 and 1912 were as follows :

| From | 1911 | | 1912 | |
|---|---|---|---|---|
| | Cwt. | £ | Cwt. | £ |
| India ... ... | 255,188 | 220,224 | 222,293 | 201,763 |
| Ceylon ... ... | 75,207 | 67,219 | 74,973 | 71,246 |
| Germany ... | 4,049 | 4,681 | 5,482 | 5,786 |
| Other countries | 575 | 560 | 1,147 | 1,171 |
| Total ... | 335,019 | 292,684 | 303,895 | 279,966 |

The market prices of these commodities are subject to variation, but the movements are usually within a fairly narrow limit. During the past

twelve years prices generally have shown an upward tendency, which will probably be maintained. The following comparison of prices over the past two years indicates the general movement:

COIR FIBRE.

| — | Per Ton Sept. 1911 | Per Ton Oct. 1913 |
|---|---|---|
| | £ | £ |
| Cochin ... ... ... | 10 to 20 | 12 to 25 |
| Calicut ... ... ... | 9 ,, 15 | 11 ,, 17 |
| Ceylon ... ... ... | 9 ,, 12 | 10 ,, 13 |

COIR YARN.

| — | Per Ton Sept. 1911 | Per Ton Oct. 1913 |
|---|---|---|
| | £ | |
| Alapat ... ... ... | 32 | £34 10s. |
| Angenjo ... ... ... | 20 to 30 | £24 to £35 |
| Mat yarn ... ... | 15 ,, 20 | £12 10s. to £22 |
| Roping ... ... ... | 11 ,, 16 | £14 10s. to £20 |
| Ceylon yarn ... ... | 13 ,, 16 | £18 to £26 10s. |
| Weaving ... ... | 17 ,, 25 | £21 to £27 10s. |

*Alapat*, which commands the highest price of all, is a weaving yarn.

*Angenjo* is a hard, twisted yarn employed in the manufacture of heavy rope for ships' hawsers, etc.

*Ceylon* yarn is mostly used for fine rope making, weaving, and similar purposes.

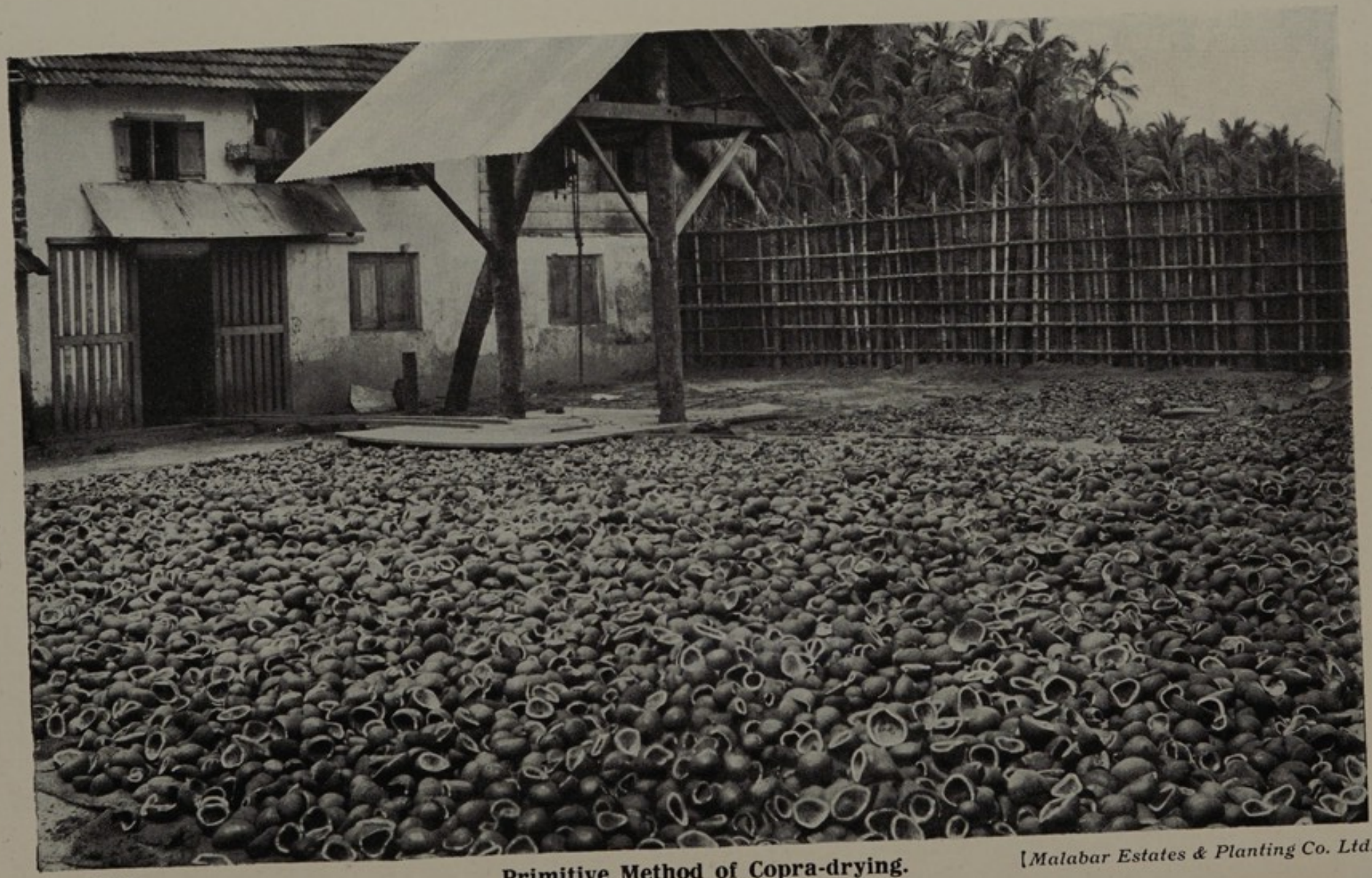
# Chapter XIII

## The Preparation of Copra

WHILE the coconut yields many products of substantial commercial value, as we have seen, copra is undoubtedly the most important of them all, not only by reason of its natural qualities, but also because there is, and has been for some time, such a persistent demand for it that the price has been steadily rising. This upward tendency appears likely to continue for some time to come, owing to those developments which are discussed in the opening chapter of this work.

This appreciation in price is strikingly demonstrated by the fact that while in 1909 the average quotation was only £15 per ton, in 1910 it rose to £20, and in 1911 to £30. The following table shows the quotations since that year:

| Description | End July, 1912 | End July, 1913 | End Sept. 1913 |
|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. |
| Malabar ... ... | 27 10 0 | 32 15 0 | 32 10 0 |
| Ceylon ... ... | 26 12 6 | 32 5 0 | 32 0 0 |
| Cebu ... ... | 24 10 0 | 31 0 0 | 31 5 0 |
| Java ... ... | 24 13 9 | 31 5 0 | 31 5 0 |
| South Seas ... | 24 2 6 | 30 17 6 | 31 5 0 |
| Straits ... ... | 24 10 0 | 31 15 0 | 31 5 0 |
| Manilla ... ... | 23 8 9 | 29 15 0 | 30 10 0 |



**Primitive Method of Copra-drying.** [*Malabar Estates & Planting Co. Ltd.*

As everybody knows, copra is the trade name given to the kernel of the coconut 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 coconut 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 in them poured out. The broken coconut 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 coconuts 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 from 6 to 20 per cent. of moisture, which induces 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 open place, and it dries naturally, while retaining its white colour. When dried, the copra is packed in gunny bags for shipment. The work of drying, collecting, and baling has long been almost entirely in the hands of

the Javanese, 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.

Mr. Herbert S. Walker, a Government expert, who has devoted special attention to coconut cultivation in the principal regions, notably the Philippine Islands, tells us that the time needed for drying copra by these respective methods is as follows:

| | Time. |
|---|---|
| Sun ... ... ... ... ... ... | 5 days |
| Grill (over bamboo) ... ... ... ... | 10 to 12 hours |
| Hot-air chamber ... ... ... ... | 3½ to 4 ,, |
| Rotary hot air ... ... ... ... ... | 2 to 3 ,, |

He points out that the disadvantages of grill drying are that the creosote and other substances carried in the smoke from the husks and shells permeate the entire mass of the copra meat, so that it becomes unfit for the important purposes served by the unsmoked article, notably in connection with the manufacture of nut butter, edible oils, etc. As a matter of fact, smoke-dried copra is only fit for making soap, candles, and other similar commodities. Fire drying, too, is always more or less uneven, some of the pieces being

scorched, while others are scarcely half-dried. These become mouldy, and frequently decay in transit.

The leading authorities all agree that, with the rapid development of the industry, it will soon become imperative to adopt some system of artificial drying in order to obviate the difficulties and drawbacks inherent to sun and fire drying. Already there are on the market several very efficient appliances for artificial drying, for which the inventors claim, as compared with the old systems, the following advantages:

The absolute smokeless quality of a well-finished copra.

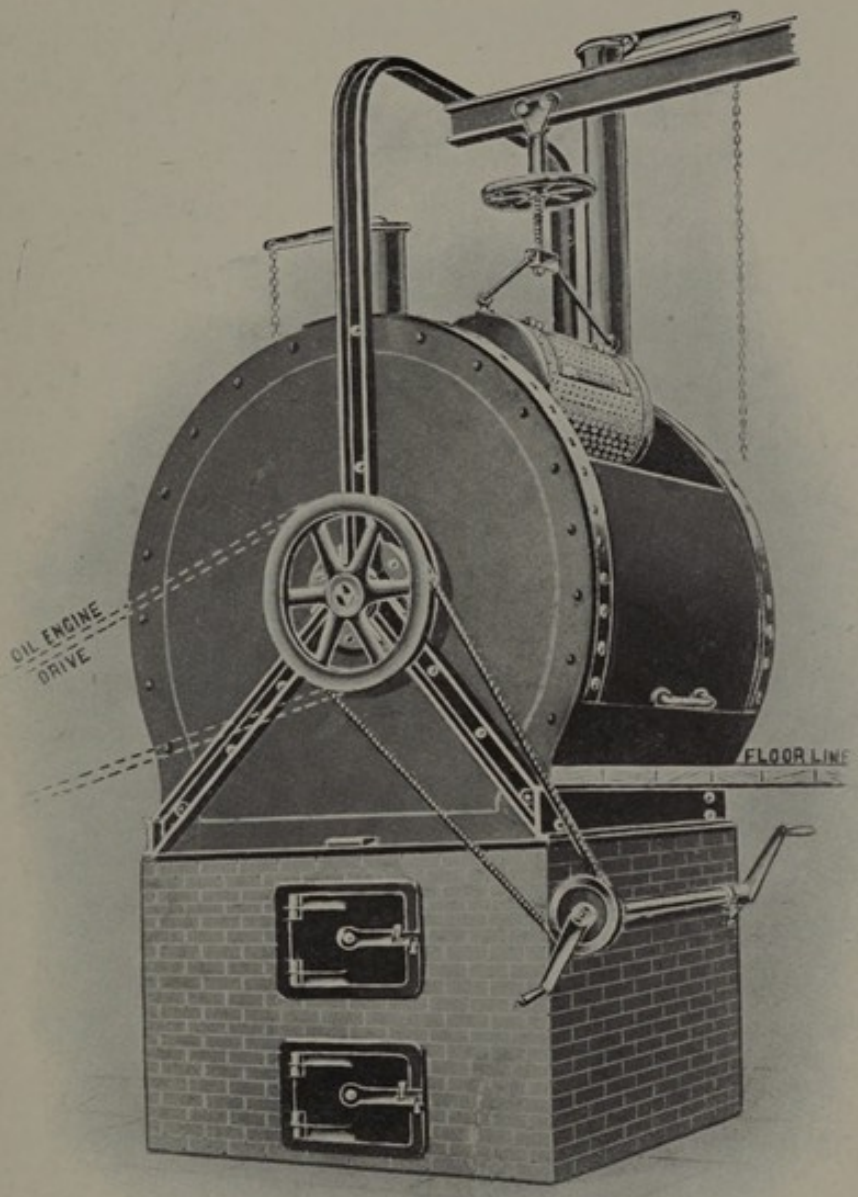
The limited time needed to turn out the completely dried product.

Better keeping qualities on board ship or in store.

Superior appearance when shipped.

Freedom from the mould, dirt, etc., which are usually found in the sun-dried product.

Messrs. Hamel Smith and Pape, with their practical experience, have each invented a special system of artificial copra drying, and the cost of such appliances is not prohibitive considering the results achieved. For instance, the rotary hot-air drying plant designed by Mr. Hamel Smith, and named after him, provides a total area of 11,000 square feet for the treatment of 80,000 lb. of wet copra per day, which, with an evaporation of




*Copyright*] [*"Tropical Life"*

**Modern Copra-Drying.**
**"Hamel Smith" Hot-Air Rotary Drying Machine.**

40 per cent., produces 48,000 lb. of the finished article ready for shipment. Coconut shells, husks, and other refuse available on all estates serve as fuel for this plant, and the motive power can be supplied by means of steam, gas or oil engine, by bullock or other animal, electric or windmill power, as the case may be. The complete equipment, including building, fans, heaters, packing, freight, transport, etc., costs between £2,500 and £3,000.

It is obviously impossible to state how many coconuts are required to make one ton of copra, for there can be no invariable standard number. We are frequently told that three nuts are required to make one pound of copra. But there are nuts *and* nuts, and it is quite impossible to lay down any hard-and-fast rule, seeing that their size and productivity must always vary, even when grown on the same tree. According to one authority, the coconuts must be calculated at the rate of 6,000 or 7,000 to the ton. On the other hand, Mr. William Wicherley, a Ceylon expert, assures us that only 4,000 are required to make a ton of copra. In West Africa the calculation is 4,000 well-selected nuts. In Papua about 6,000 are required; while in Samoa the number is 7,000, in Malabar 3,500 to 4,500. West Indians reckon 6,000 to 7,000, but copra is made only from their smallest coconuts; in the Philippines the figures are 4,000 to 5,000; in Malaya, 3,500 to 5,000; in

Panama, 4,000 to 5,000; and in East Africa, 7,000. *The Cult of the Coconut* says that 4,000 to 5,000 full-sized nuts produce about one ton of copra, which, in its turn, yields from 1,344 to 1,563 lb. of oil or fat, and from 672 lb. to 896 lb. of residue, which is manufactured into cattle food. The result of an expert German test showed that 4,448 ordinary or mixed nuts, or 3,703 selected nuts, were required to produce approximately the same result. Finally, the nuts of some specially favoured districts, such as San Blas, on the Atlantic side of Panama, and Gorgona, on the Pacific side, required only about 2,000 to the ton of copra.

## Chapter XIV

# The Sterilisation of Copra

HAVING produced a good marketable product the planter has next to consider the question of export. For many years this presented a very knotty problem on account of the deterioration suffered by the copra in transit, which at times reached such proportions that it became practically valueless before arrival at its destination. The expansion of the industry, however, provided an extensive field for scientific research, particularly in this branch, and in time a solution was found for the difficulty.

Many of the methods adopted for drying coconuts or, in other words, preparing copra, have been failures, because those who set out to solve the problem studied it from the point of view of the copra drier only, and without any inside knowledge of the difficulties which face the oil producer and refiner.

They were unaware of the fact that the two great difficulties which cause the heavy expense

in pressing and refining oil are the separation of the free fatty acid and the removal of any colour which may naturally exist or have been artificially produced in drying the raw material.

It stands to reason that any process which permits of the extraction of oil whereby its original clarity and colour are preserved would be of immense value to the oil refiner, as it would enable him to eliminate to a considerable extent plant for clarification and decolorisation. These two aims have in several methods been attained for all practical purposes, but the principal problem still awaiting solution is that of preparing, by one definite process, a special grade of copra in which the percentage of free fatty acid present shall be reduced to a minimum. To get a better view of the problem involved, it is only necessary to realise that if an oil after being extracted contains 10 per cent. of free fatty acid, which costs money to separate, and is then only worth, say, £35 per ton, the remaining 90 per cent. realising considerably higher values, the process which would give a *minimum* of free fatty acid, say, of half or one per cent. only, would possess the considerable advantage of bringing the cost of separation to a very low point, reducing the amount of low-grade oil *pro rata*, and increasing the quantity of higher grade oil, for which a better price could be obtained in like proportion. It is from this standpoint that

the latest research work has been undertaken, and the results now practically confirm the belief that by the scientific oxidisation of the copra the tendency towards rancidity is satisfactorily controlled, and the consequent percentage of free fatty acid can be confined within the narrowest limits.

In the preparation of copra for export it is generally recognised that it is most essential to dry the nut in such a manner that the product does not deteriorate from excessive heat while traversing tropical seas, and is also immune from the attacks of the copra worm, cockroaches and other vermin that invariably infest cargo steamers. Moreover, it is equally important that it should not be exposed to any danger of rancidity or "sweating" as a result of the conditions of transport.

Repeated attempts have been made to secure these results, and many different methods have been adopted, each embodying some particular feature which secured certain advantages. But in every case these processes had disadvantages of their own which were difficult to overcome, and consequently annulled their value.

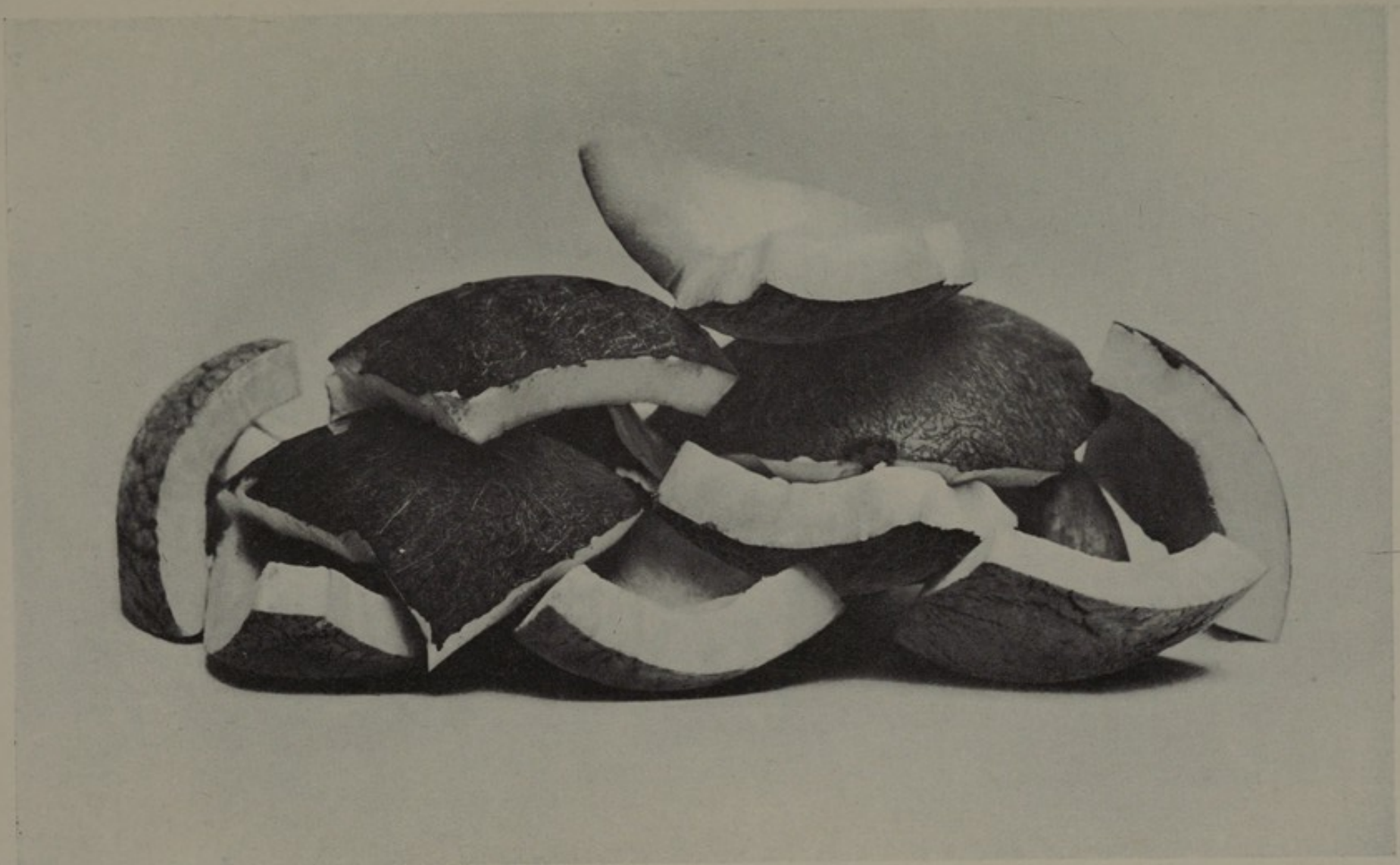
Experts consider, however, that there is one broad principle upon which every such process should be based; that is, the *sterilisation* of the green nut before or during the process of drying,

so that nothing remains which will, of itself, conduce towards, or expose the product to, the ravages of vermin, or injury from excessive heat. This is now affirmed by science, which asserts that sterilisation alone can ensure these results.

The first step in the process is to see that the natural fat in the nut is so preserved that there is no tendency towards oxidisation; or, in other words, rancidification.

There are in use several processes in which oxygen, one of the finest disinfectants, bleachers and preservatives known to science, is employed; the copra, or to be more exact, the oil contained in the copra, is brought into contact with just the necessary proportion of the gas to secure the desired result. Most of these processes have been, more or less, adaptations of the Mercer process, which was originally designed for the bleaching and sterilisation of cereals, particularly flour. It is so well known that no extended reference to the process is necessary at this point. Its principal feature is the injection of a charge of oxygen, accompanied by electrical treatment. Flour or other cereal products so treated are chemically bleached, sterilised and preserved, while the process itself results in the maturing of the product in less time than would be necessary under normal conditions.

The Hoffmann process for the sterilisation of



*Copyright]* **Dried White Flesh, commercially known as Copra.** *[Eastern Palm Estates, Ltd.*

fats is, in its way, merely a variation of the Mercer process, differing only in so far as the electrical charge is applied *direct* to the product under treatment. The obvious disadvantage of this is that the slightest error of judgment on the part of the operator applying the current leads to a considerable discoloration of the fats, consequently the copra, after being pressed, yields a discolored oil which has, in turn, to be refined through filters containing animal char, a process both difficult and costly, in order to restore its original colour.

Another process is the Bechter, which has proved in many respects satisfactory and up to date, giving in practice perhaps the best results. But this process is, in its turn, only an improvement on the Hoffmann system, already described. Both these methods of dealing with the raw material—the coconut—present serious disadvantages, being based upon the assumption that nuts from all parts of the world and gathered at different seasons of the year are identical in chemical composition—an assumption which has no foundation in fact. For it stands to reason that a nut harvested in the rainy season must, of necessity, be of different chemical composition to one gathered in the middle of the dry season. Consequently, if no provision be made for this variation, and if all nuts are treated alike, irrespective of their origin and

condition, material differences must necessarily arise in the finished product.

As the result of many years' observation and experience in the drying of copra, an improved method has been discovered whereby a simple test is applied to the nuts as received—a test which instantly determines the percentages of oil and moisture they contain. Guided by this information, which indicates precisely the treatment that each parcel of nuts should receive, the inventor claims that he can produce a grade of copra that remains uniform and constant, quite irrespective of the geographical origin of the nuts or the condition in which they have been delivered.

Indeed, by the adoption of this process, it should be possible to produce a copra which could be shipped from its point of origin without necessitating the opening of the nut. While this might constitute no advantage from the commercial standpoint, owing to the increased cargo space required to ship the coconut in its entirety, this possibility does possess an intrinsic value, inasmuch as the copra so produced would be completely sterilised and absolutely milk-white throughout. It would never suffer from the attacks of vermin on board ship, it would be impervious to both heat and cold, and there would be no possibility of rancidification.

For commercial purposes, however, the ordinary

course of splitting the nut is usually followed, and while the resultant copra may not be quite so white, the saving in freight and in the cost of drying more than compensates for the slight discoloration.

This new method is mainly an elaboration of the last-named processes, the additional feature being that the green nuts are submitted to a test before being dried. The subsequent manipulation is then adjusted to the particular condition of the parcel of nuts undergoing treatment. The advantages of this system are :

1. The copra becomes absolutely antiseptic, or germ-proof.

2. The treatment ensures that no ship's vermin will attack it, rancidity is out of the question, and "sweating" in the ship's hold an impossibility.

3. The oil expressed from the copra is of such quality and colour that the ultimate process of refining occupies the minimum of time, and can be carried out at a lower cost than that for any other oil.

4. The necessity for decolorisation through filters containing expensive animal char becomes entirely obviated.

We have had no opportunity of verifying these claims, but we understand that samples of the treated copra have been submitted to the most stringent analysis by competent and independent

authorities, the results showing that the copra does become germ-proof, and that the oil from such copra is of a superior quality to that obtained from the product not so treated. The process is likely to be exploited, principally throughout the whole of East Africa, where coconut cultivation is conducted on a very extensive scale, and there appears to be no reason why it should not be successfully introduced into other coconut-growing regions.

## Chapter XV

# The Coconut Oil and Desiccated Coconut Industries

AS we have already seen, copra commands special consideration among coconut products by virtue of the oil which it contains, this oil forming the basis of several important industries which are destined to develop enormously. Yet not many years have elapsed since the demand for coconut oil was quite limited, and the supply was more than sufficient to meet the market requirements. At that time it was principally utilised in the manufacture of toilet soaps, candles, and so on; it was not considered suitable for edible purposes owing to the fact that no means existed for deleting the coconut flavour from the oil, and because it quickly turned rancid. Efforts were constantly being made to discover some practical and cheap method of deodorisation and purification, and finally these were successful. For instance, one French firm of engineers invented a vacuum plant for performing these essential opera-

tions, a discovery which largely assisted in revolutionising the coconut industry by enabling the oil to be utilised in the manufacture of food products. By their process coconut oil is freed from its flavour and acidity, and thus rendered less liable to rancidity. Numerous other inventions have since been made with the same object, the author of one of the best of them asserting "that by its use every trace of colour, taste or smell is removed from the oil," and its general adoption in Europe would appear to support this claim.

In former times coconut oil was extracted from the copra by natives, who employed extremely primitive methods. In Ceylon, for instance, the principal applicance was the *chekku*, a native oil mill made of iron, wood or stone, of which there are still about 2,000 in use among the Cingalese. On the other hand there are both in Ceylon and in Malabar a number of extensive steam oil mills for the scientific expression of oil on the spot. The *chekku* is described in Ferguson's Manual as a large mortar, firmly fixed in the ground, and a corresponding pestle, wrought by a lever, with which a pair of bullocks travel round in a circle. In some countries camels are employed for this purpose. The action of the pestle, when the machine is at work, is a double one of grinding and pressing; the copra is thrust down in front of the pestle at the opening between the pestle and the

mouth of the chamber. In passing over it the pestle forces it upwards again, and the work of the operator is to return all that is thrown out on the table, and to break up and turn the cake from time to time. Copra for *chekku* pressing must be absolutely dry, and is all the better for being put in hot. A "turn" of copra is 42 lb., and should the apparatus be in perfect order and the copra perfectly dry, the result will be 28 lb. of oil and 14 lb. of poonac, or cattle-food cake; thus 45 lb. of copra should yield 3 gallons of oil.

In the Philippines the pieces of dried copra are held by hand against a rapidly revolving half-spherical knife blade, which scrapes and shaves the copra down to a fine degree of comminution. The resultant mass is then macerated in a little hand press, and the milky juice which flows therefrom is collected in receivers placed below. This is then drawn off into boilers and cooked until the clear oil concentrates upon the surface. It is then skimmed and filtered through a cloth, after which it is ready for the market. Obviously this process, while effective, is very wasteful, as it leaves quite 10 per cent. of the oil in the residue.

"By another crude, wasteful method long adopted in the Philippines," we are told, "the kernel of the nut is rasped out of its shell and loaded into old boats, which are elevated on posts. When putrefaction supervenes, the oil percolates

through the crevices in the boats to vessels placed underneath, after which the pulp is pressed for the remainder. The process is a tedious one, occupying months, and the product—a dark brown, viscid product—is worth less than half the market value of the superior oil.

"With the development of the industry, however, more up-to-date efficient methods have been evolved, the modern oil mills established in Malabar, Ceylon, and other centres being splendidly equipped with special decorticating, rasping, hydraulic crushing, steam boiling and filtrating machines, and also with facilities for converting the residue into cattle-food cake. The disintegration of the pulp is effected by toothed iron discs, against which the kernels are placed by the operators. The shredded nut is then allowed to undergo partial decomposition in flat pans, after which it is subjected to moderate pressure; the resulting liquor is caught in vessels and, after standing for a few hours, the supernatant oil is skimmed off the top. This oil is then treated in iron pans until all the water has evaporated. Then, in order to facilitate its cooling, and prevent its deepening in colour, two pailfuls of cold, water-free oil are poured in, and the fire quickly withdrawn. Next the compressed shreds are once more exposed to air, and put under more powerful pressure, and after these operations have been repeated the material is suspended in sacks

between vertical boards and alternately squeezed and shaken up. The oil that runs from the sacks is free from water and very clear."

A fully-equipped, up-to-date factory, possessing crushing mills and desiccating machines, can, says an expert, be erected for about £7,000, and a well-organised copra company can make such an installation a very profitable proposition.

A considerable portion of the oil produced is obtained by this process of powerful pressure. When warm, the yield is greater, but when cold the oil is of finer quality and better colour; therefore oil intended for edible purposes is invariably cold-pressed, but for other purposes the process is effected by heat. Everything, of course, depends upon the object in view. Sometimes oil and feeding cake are required; at others oil and fertiliser. "When a cattle cake is desired, then the oil is perhaps more safely obtained by expression; but if the residue is only required as a fertiliser, or would become a waste product, then more satisfactory results are obtained by means of a solvent." The sole material difference in the two methods lies in the yield of oil obtained; the expression process secures only a proportion of the oil, the balance remaining in the cake. By the extraction process practically all the oil is recovered, and the cake retains none.

Where the oil is required in a colourless condition, as for toilet and perfumery purposes, a 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 reboiled 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, as 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 solid as cocosin, or cocostearin, which is a somewhat complex constituent containing several fatty acids. When the oil is fresh the flavour and odour 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.

*Copyright*] **Husk from which Coir is manufactured.** [*Eastern Palm Estates, Ltd.*

The market price of coconut oil at the time of writing (end-October) varies from £50 to £55 per ton, according to its place of origin and quality.

For many years Cochin (Malabar Coast) oil commanded about 35 per cent. more than the Ceylon product, and still maintains a certain superiority in price. This is due to the exceptional whiteness and other special qualities of the Cochin copra as compared with that of Ceylon. While the south-west monsoon rains from the end of May to August are very heavy in the Cochin district, the latter enjoys a larger number of dry months than Ceylon, and it is in those dry months that the coconuts are dried in the sun. This produces a whiter and finer copra than the average of Ceylon, and therefore accounts for the superiority of Cochin oil. Generally speaking, Cochin *coconuts* are not better than the Ceylon variety; the advantage is rather one of climate and of the greater care exercised in the preparation of the copra. From a close study of this question, we have acquired the conviction that the Cingalee is not so cleanly or intelligent as the native of Southern India, notably in Malabar and Cochin, who takes a pride in his work and is more painstaking. So indolent is the native of Ceylon that coconut planters have to import a good deal of labour from other regions. Another important

factor is that while Cochin copra is sun-dried, the Ceylon product is mainly smoked, which accounts for its bad colour. The reasons for the superiority of Cochin oil may therefore be summarised as follows :

(*a*) Climatic conditions permitting of rapid sun-drying.

(*b*) Selection of thoroughly well-matured nuts of a dark brown colour, *dry on the tree*, before gathering.

(*c*) Prompt treatment after gathering.

(*d*) Greater cleanliness and industry of the Malabar Indian, as compared with the workers of Ceylon.

(*e*) Elimination of all inferior nuts.

On the other hand, it is necessary to point out that Ceylon nuts cannot be much inferior to those of Cochin, seeing that large quantities of copra have been shipped from Ceylon to Cochin for the purpose of extracting oil, which it is reasonable to assume is sometimes, if not always, placed on the market as Cochin oil. This refers more particularly to the copra produced by European planters in Ceylon, who take greater pains to secure a good, clean product than does the average native grower. Finally, it is certain that the system that has been gradually built up in Ceylon, whereby various

grades of copra are all crushed together, does not encourage the grower to attain a high standard of excellence.

The range of uses to which coconut oil may be put is extremely wide, quite apart from its steady consumption as an important constituent of toilet soaps, night lights, candles, etc. To-day its principal outlet is in the manufacture of nut butter and nut lard, of which enormous quantities are being consumed in Europe and America. Attempts are also being made to introduce it as a salad oil, to supersede that composed of cotton seed oil; as a substitute for cod liver oil, in cases of phthisis. It is also used by bakers, restaurateurs, caterers, vegetarian specialists and lubricating oil manufacturers. As the basis of cosmetics and for medical purposes it is largely used, while the purified and deodorised oil is sold under a number of fancy names for a whole host of purposes.

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 fertiliser. In the East this residue is known as poonac, and the cake made from it possesses four valuable qualities, which are: Firstly, 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 colour and flavour are improved.

From *The Cult of the Coconut* we reproduce the following striking table showing the comparative values of the various cattle food cakes now on the market, by which the superiority of poonac is clearly demonstrated:

| Food | Fats | Carbo-hydrates | Albumin-oids | Water |
|---|---|---|---|---|
| Coconut cake ... | 11·2 | 47·4 | 18·2 | 9·4 |
| Palm-nut cake ... | 9·5 | 55·4 | 16·1 | 10·5 |
| Linseed cake ... ... | 8·9 | 27·5 | 24·8 | 12·2 |
| Sunflower cake ... | 7·6 | 24·7 | 31·3 | 10·3 |
| Rape cake ... ... | 7·7 | 23·8 | 25·3 | 11·3 |
| Common cotton cake | 5·5 | 14·9 | 17·5 | 11·3 |

A few years ago British farmers, true to their conservative instincts and traditions, declined to utilise this new and cheaper cattle food cake, although it was clearly demonstrated to them that it was rich in oil, albuminoids, and carbo-hydrates, and consequently offered special advantages, its food nutrients being easily digested, and there being no waste.

At the same time Continental and Colonial farmers were freely recognising its superiority, and adopting it as the finest and cheapest food for cattle and poultry. In Australia it was found invaluable for maintaining the milk supply at profitable levels during periods when pasturage was

scarce and dear. Poultry also thrived on it, and experiments proved that the laying powers of hens were materially increased by its use.

But from special inquiries we have made it appears that British farmers are now realising the value of poonac as a cattle food, and that the consumption is increasing with surprising rapidity. To-day the market price of pure coconut cake is about £7 per ton, and there is no doubt that, as the consumption increases, the quotation will advance, until the coconut product commands higher prices than any similar cattle food cake.

The following table shows the volume and the value of both refined and unrefined coconut oil imported into the United Kingdom during recent years :

| Year | Cwts. | Value |
|---|---|---|
| | | £ |
| 1906 ... ... ... | 538,036 | 803,417 |
| 1909 ... ... ... | 679,493 | 1,067,941 |
| 1910 ... ... ... | 1,039,905 | 2,150,365 |
| 1912 ... ... ... | 1,233,189 | 2,530,482 |

These figures afford a striking illustration of the growth and importance of this industry, and suggest a closer inquiry into the values and proportions obtained from each source of supply.

These are set out in detail in the following official table, which deals with the year 1912:

| From | Refined. | | Unrefined. | |
|---|---|---|---|---|
| | Cwt. | £ | Cwt. | £ |
| Ceylon ... ... | 4,332 | 8,841 | 171,049 | 328,151 |
| India ... ... ... | 367 | 798 | 25,894 | 53,400 |
| Australia ... ... | — | — | 86,595 | 164,482 |
| Total British ... | 4,699 | 9,639 | 283,775 | 546,522 |
| France... ... ... | 270,345 | 587,543 | 8,903 | 17,524 |
| Germany ... ... | 218,978 | 490,001 | 306,788 | 580,123 |
| Belgium ... ... | 57,940 | 124,511 | 22,448 | 40,011 |
| Denmark ... ... | 48,212 | 112,870 | 7,418 | 14,111 |
| Other Foreign ... | 1,583 | 3,391 | 2,100 | 4,236 |
| Total Foreign ... | 597,058 | 1,318,316 | 347,657 | 656,005 |
| TOTAL ... | 601,757 | 1,327,955 | 631,432 | 1,202,527 |

One of the most interesting features of the coconut industry, and one that is most generally understood in this country, is the substantial and growing popularity of the desiccated nut as employed in the making of confectionery, biscuits and other edibles.

For desiccating purposes only well-matured nuts are selected, unripe, unsound and over-ripe fruit alike being unsuitable. The nuts selected must be allowed to mature in heaps for about three weeks before they are fit for treatment. The process of desiccation is commenced by men who open or shell the nuts, this being done by means of small hatchets or by small circular saws, many experts preferring the former method. The nuts must be broken in order to drain off the milk, for whenever this

remains in the kernels they are liable to turn yellow. Native choppers from long practice become very expert in their work, though at first their wrists swell in a painful manner, which continues until the muscles become accustomed to the strain of the work. When the choppers have completed their task the nuts are passed on to women, who pare or shave off all the red rind, leaving only the pure white kernels. For this purpose, we are told by the Hon. J. Ferguson, in his Coconut Manual, the women use an ordinary carpenter's spokeshave, which has to be constantly sharpened.

Having been carefully washed, the nuts are transferred to the disintegrating machine, and ground to a pulp. This is then removed in trollies to the desiccators, often known as siroccos, where it is dried at a temperature of 160 degrees. From this machine the product emerges quite hot; after being cooled down, it is sorted by sifters or by hand sieves into three grades—fine, medium, coarse—and, although still warm, is immediately packed. In Ceylon, whence practically all of our desiccated coconut is imported, ordinary tea chests, lead and paper lined, are used for this purpose, about 130 lb. net being the quantity packed in each case. The parings, rich in oil, are afterwards dried in the sun and sold to the oil-crushing firms. Other grades of desiccated coconut are sold, including chips and strips, which are cut by special machinery, a great

deal of this work being done in England, by or for firms who utilise large quantities of this product. As regards yield, three good-sized nuts will give 1 lb. of desiccated coconut, which is sold to the public at from 7d. to 9d. per lb., according to quality.

Ceylon produces practically all the desiccated coconut consumed in Europe, the United States, and other regions; the annual production aggregated in 1911, 32,604,546 lb.; in 1912, 31,295,813 lb. Of these quantities the United Kingdom imported in 1911, 15,905,804 lb.; in 1912, 12,670,710 lb., the reduction in production during the latter year being mainly due to the drought.

## Chapter XVI

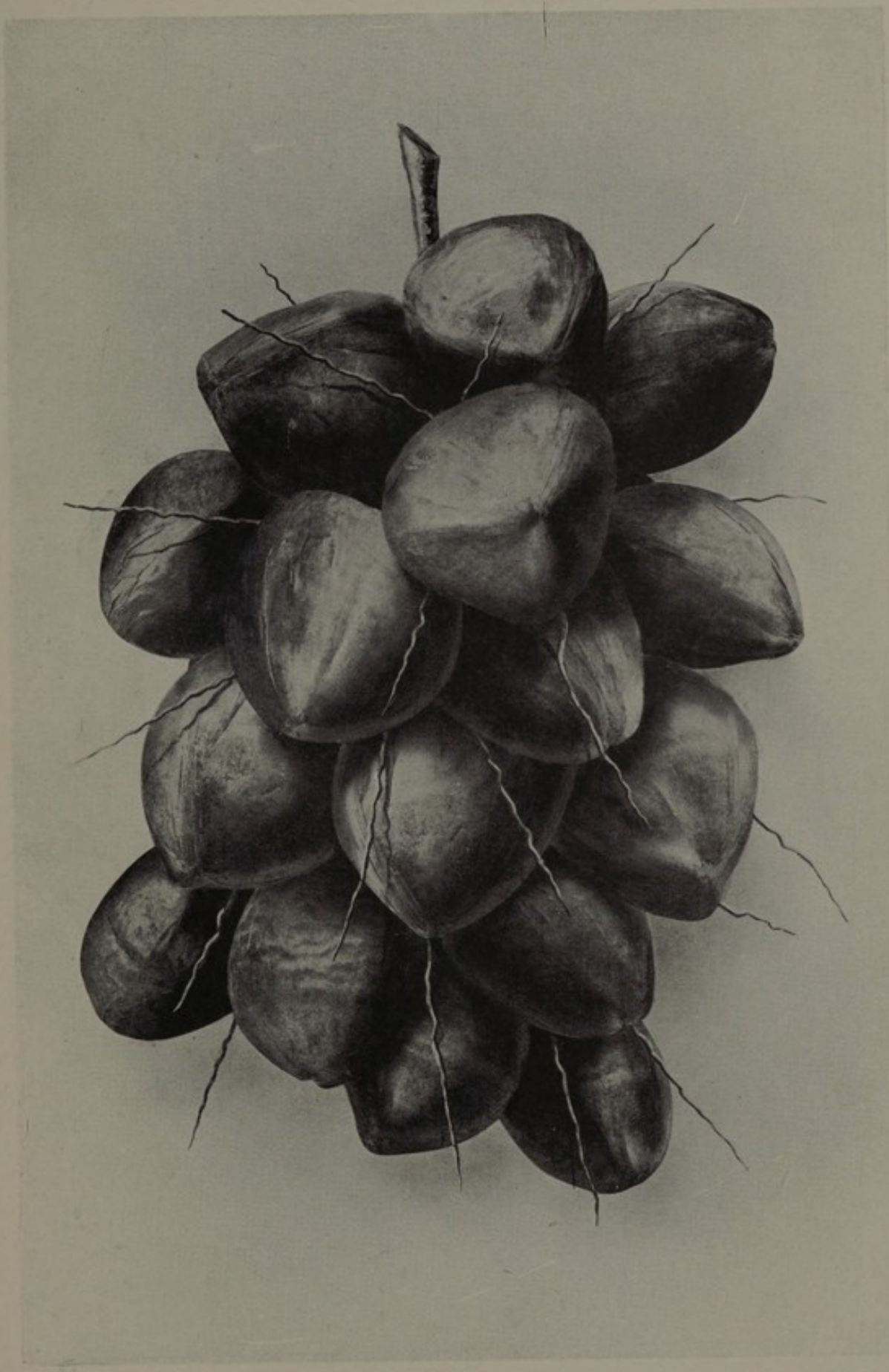
# Marketing Coconuts and Copra

WHEN the coconut is ripe for harvesting the crop is usually sold "on the tree" or "on the ground." In the latter case the planters generally advertise the fact that they have so many thousands of nuts for sale, say, of the second or third picking. These are left complete in their husks and placed conveniently for their subsequent removal by the purchaser. They are then sold by the thousand, the price obtained, of course, varying according to size and quality. Quite early on the day appointed for the sale the dealers foregather, inspect the nuts and buy parcels to suit their requirements, it being the usual custom to remove the lots purchased within two or three days. Very frequently the grower will undertake to have the nuts husked for his buyers, charging them about 1s. per 1,000, providing the labour and taking the husks in part payment.

In the course of a general discussion of this question of marketing with a London merchant,

whose practical experience of the coconut industry ranges over thirty years, we gathered that the methods of native planters in this respect are both casual and irregular; in fact, they are very much on all fours with their general system of cultivation, which, as we have already pointed out, is hopelessly inefficient. Their views on the subject may be gauged by the contention of one chief who recently asserted with the greatest emphasis that coconut trees never required watering, even in the driest weather, because there was water already inside the nut! Naturally, accounts and bookkeeping are practically unknown to them, and they anathematise everything that savours of science as a device direct from the evil one. In such circumstances it is impossible for them to show anything approaching an adequate result, and they are frequently obliged to fall back upon the moneylender—usually a Chinaman in the Middle East—who advances cash for their immediate requirements in return for a mortgage on the trees, with the inevitable upshot: when they sell the crop they find themselves between the devil and the deep sea, in the shape of the moneylender on the one hand, and the middleman, who takes advantage of the situation to drive a hard bargain, on the other. If they emerge with anything like a fair profit for themselves they may be classed as very fortunate.

It must be remembered that, so far, the majority



*Copyright*] **Cluster of Nuts.** [*Eastern Palm Estates, Ltd.*

of plantations are under native control, but the time is fast approaching when this important industry will come more and more under the ægis of European capitalists and companies, who will work them on scientific lines under expert supervision, the increased cost of which will be amply recouped by the additional acreage opened up and the saving effected by efficient, honest management. In this way estates, formerly cultivated on the casual, native plan, will be developed out of all knowledge. It is quite certain that not until this change takes place can these valuable coconut properties be made to yield their maximum results in revenue and profits.

A considerable proportion of the nuts and copra exported is first handled by small dealers, who collect it from growers who have anything from 50 to 1,000 trees to cultivate. A recent author thus describes the methods of collection of the coconuts from the natives: "The small husbandman of the Moluccas and other Dutch East Indian Islands has, as a rule, a couple of dozen coconut trees to his name. Perhaps through marriage or inheritance the family he is head and patriarch of has brought more into the store, and then the family is well off. The surplus of the nuts is made into copra, bartered away at his own door or taken with the lot of a neighbour to the nearest trade depot. There is a gradual piling

up: first comes the tiny native prahu with a Chinaman or Arab as owner. They go from house to house, as it were, and collect their little cargo of twenty to a hundred bags of copra. These tongkangs take the produce to the nearest port where the coasting steamer calls, from whence the buyer collects and consigns the bulked lot, which he has purchased from many native vessels, to the big emporium at Singapore, Batavia, or other large centres, and from these ports sail the ocean leviathans with the cargoes of many coasters swallowed up in their enormous maws. This manifold intertrading method of handling the copra will probably never change in thousands of little inlets and creeks, and nooks and corners, throughout the South Seas, where even, with the most carefully-organised service, the big steamers can scarcely ever go."

The copra collected in this manner is smoke-dried, and is usually of a grade that is only fit for soap-making and other similar purposes.

The nuts are sold entire, in their husks or husked, as the case may be, the larger proportion being used to make copra. Most of the coconuts and copra imported into Europe and America are shipped from the Dutch East Indies, Manilla and Cebu, the Straits and Singapore, Ceylon and Malabar, the principal ports of arrival being, in their order of importance, Marseilles, London, Liverpool, New York, Hamburg, Rotterdam and Antwerp. The West Indian

growers ship most of their coconuts direct to New York, where prices range so high that it pays the planters to favour that market instead of making copra or oil. Moreover, there is a big local consumption among the 200,000 Indian coolies now in Trinidad and British Guiana. Sydney is the recognised centre for the collection against shipment to Europe of the South Seas copra. Within recent years a world-famed British soap-making firm has effected a considerable saving by extracting oil and coconut butter in Australia and shipping these products instead of the crude copra, which is a much more expensive freight. The natural supplies of coconuts in the South Seas were always extensive, but they have been greatly increased by planting, partly under native and partly under European and American auspices. Whether the oil and the coconut butter extractions, with the subsequent preparation of the by-products, are carried out at some Australian centre or whether the copra be shipped to European ports and there treated is, as an expert points out, quite immaterial from the coconut planter's standpoint. His principal preoccupation is the continuance of a steadily expanding market for cocoanuts and their various products, and this is practically assured for many years to come.

So far as London is concerned the coconuts themselves are handled by fruit brokers, who are

mainly established in the neighbourhood of the Monument and in Eastcheap. They supply the merchants who exploit the "three shies a penny" industry, which is far more important than most people realise, millions of nuts being distributed throughout the kingdom for sporting purposes. Most of these are imported from Ceylon, West Africa and the West Indies. The present price per 1,000 for Ceylon-grown nuts is between £6 and £6 10s. At the important Whitsuntide costermongers' market in London the nuts are classed as "large milky," "middles," "smalls," "milky growers," and "chats," the last-mentioned being the smallest and thinnest. One of the peculiarities of the coconut trade is that it has always remained under the control of a small number of dealers, owing to the fact that it is a somewhat difficult business to understand, its movements being influenced by factors that would baffle those who have not acquired, by long practice, the necessary knowledge. The nuts sometimes arrive in England in a dry condition, a defect that is revealed by shaking them close to the ear. Indeed, many experts can ascertain the state of the inside of the nut merely by knocking them together, while others tap the nuts with a large silver ring worn for the purpose. Milkiness is one of the essential features of a really fine nut, its lovers regarding the liquid as a rare and refreshing beverage, an

opinion which would be further confirmed if they knew how delicious it is when the milk is drunk from a nut freshly gathered in its tropical home. Natives will climb a 90-ft. tree with surprising nimbleness to secure this pleasure for a traveller who is anxious to slake his thirst.

The greater portion of the copra arriving in London is sold at the Commercial Sale Rooms in Mincing Lane, for immediate or forward delivery. Copra has now become such a valuable commodity, for which there is such a free market, that it is possible to buy and sell it in Mincing Lane as easily as first-class stocks and shares are sold on the Stock Exchange. France is the greatest consumer of copra in the world, the trade being mainly centred at Marseilles, to which port the commodity is shipped direct, a considerable percentage emanating from the Middle East. Germany, England, America, Holland, Belgium follow in order of importance. The average freight for the product from the producing centres to European ports is about £2 per ton. Generally speaking, consumers prefer to import copra and express their own oil, finding that they secure a finer, cleaner product by this method than that extracted on the plantations. This is the case with the big multiple-shop provision companies, which make a speciality of coconut butter, as we have already seen.

The coconut industry commands some of the

finest business ability in the City, and, with the rising price of copra and the expanding demand for coconut products, a period of prolonged prosperity may be confidently anticipated.

## Chapter XVII

# Foreign Coconut Enterprise

IF any further confirmation of the profitable possibilities of the coconut industry were needed, it would be promptly furnished by the anxiety displayed among the financiers and merchants of Germany and other countries to participate in its development. Already the coconut world owes much to the work of foreign pioneers, who have shown no lack of enterprise and determination in their endeavour; and, as we all know, Germany has of recent years on every possible occasion annexed or sought to annex tropical territories yielding among other products coconuts. Typical of their alertness in this direction was their eagerness to annex New Guinea when the British Government declined to allow Australia to annex that territory on the ground that "there was no danger from German expansion in the Pacific."

It would be interesting to know what the statesman who was responsible for that remarkable

utterance thinks now of his judgment on the point. Within a year of that declaration Germany hoisted her flag over about half the unannexed part of that vast island, which comprises some 312,000 square miles—the Dutch holding 151,789, the British 90,540, and the Germans 70,000 square miles. Not only here but in Samoa, the Carolines, New Hebrides, the Bismarck group, etc., the Germans have been conspicuously active in the cultivation of coconuts, usually in preference to most other products, they having found them the most profitable and the easiest of all to cultivate. Moreover, in their own colony of East Africa they are developing similar activity, and the entire German policy in this connection is based upon the very practical desire to save the immense sums which their own consumption of coconut oil now compels them to spend abroad.

On the other hand, other countries are equally impressed by the possibilities of the coconut industry. In Chapter XVIII. we refer to the important part taken in the development of the nut butter industry by leading French firms, especially in Marseilles, which city imports vast quantities of copra for manufacturing purposes. Indeed, to-day France imports more copra than any individual country in Europe. Not only are the French largely interested as manufacturers, but in certain French colonies, notably Madagascar and

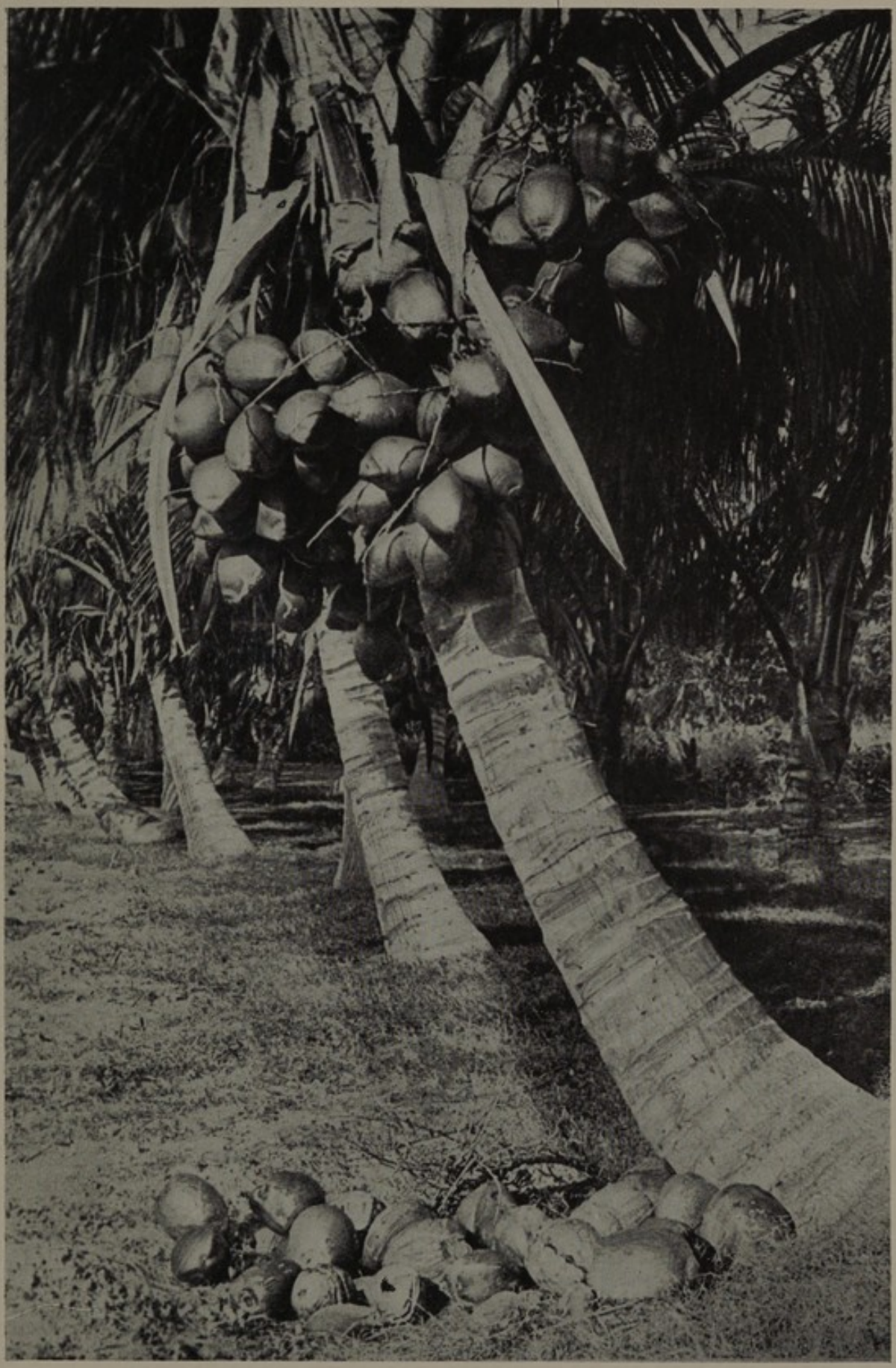
Cochin China, there is ample scope for coconut cultivation, and such possibilities are now attracting greater attention than ever. In Cochin China about 70,000 acres are now under coconuts, and further extensions are constantly being made.

In recent years the Dutch have been particularly active in the development of the copra industry, some of the world's largest manufacturers of nut butter being located in Holland, while several important Dutch merchant firms are interested in the financing and exploitation of cocoanut areas in Java, Sumatra, Macassar, and the Moluccas, where they have some of the finest coconut-growing areas. The Moluccas, especially, are now yielding excellent crops of coconuts, and cultivation on a more extensive scale is being undertaken there by responsible firms. Macassar is another region favourable to coconut cultivation, which has hitherto been conducted by natives in haphazard fashion. But the Dutch are now awakening to the profitability of more intensive cultivation, and exploitation on the European system is likely to be undertaken in the near future.

The Chinese not only rank among the world's principal consumers of the coconut and its products, but they have long been prominent in the financing of native owners of coconut estates in Malaya and other Mid-Eastern regions. Another significant sign of the times is that wealthy Chinese

merchants are now embarking on the cultivation of the coconut and the acquisition of large areas suitable for this profitable branch of tropical agriculture. Quite recently we heard from Mr. Abraham Sol, a former Resident Provincial Governor of the East Indies, who is now in the Middle East, that certain Chinese merchants have started planting in Sumatra some 4,000,000 trees. Other properties are being acquired in various parts of the Middle East by Chinese capitalists convinced that this industry has a brilliant future.

The Americans, owing to the scarcity of animal fats referred to in Chapter I., are now turning their special attention to the coconut, and their consumption aggregates about 50,000,000 nuts per annum, quite apart from the copra imported, which amounted, in 1912, to 46,370,732 lb., valued at $3,851,279. They also have an immense area of territory which produces the coconut. Florida and Cuba yield a fair quantity; the Philippines, their largest overseas possession, is one of the most prolific coconut-growing regions in the world, and most of that island's production is exported to America. The New York merchants also import immense quantities of coconuts from Brazil, Panama, and also the West Indies, the prices obtainable by the coconut planters of Trinidad, Jamaica, and other West Indian centres being so high that the greater part of their nuts



*Copyright]* **Trees in Full Bearing.** *[Underwood & Underwood.*

are exported to New York in the husk or in the shell.

Only those nuts that will pass through a ring $3\frac{3}{4}$ inches in diameter are used for copra. It is more than probable that the shortage of animal fats will compel the Americans to import more coconuts from Brazil, Venezuela, and other producing countries than they have hitherto done.

From this brief survey of foreign activity it will be seen that the demand for the coconut and its products and also for coconut-growing areas is now practically world-wide.

Always practical and methodical, the painstaking Germans have organised a Colonial Economic Committee, which has set itself to solve the problem of "How to enable the German colonies to become producers of the larger proportion of the raw material that is required for home industries." And, in furtherance of this purpose, they have collected and collated a vast mass of facts and figures which have incidentally enabled them to solve many difficulties in connection with the coconut oil and allied industries, especially by the provision of the most effective system of crushing and expressing oil products. We believe that it is generally recognised that the Haake machine for shelling the nuts is one of the best now in use. Moreover, German chemists have been active in the development of new products from the

coconut, convinced that other and more profitable uses can be found for it. This has led to an immense increase in their trade in the produce of the coconut and palm oil. Within a period of two years their imports under this head increased from about £4,200,000 to £9,300,000, and further expansion is anticipated as their plantations develop in various regions.

Confirmation of this progress is furnished by the author of *The Cult of the Coconut*, who, after carefully studying the reports of German researches and experiments with the coconut and other tropical produce, states that he was astonished at the extraordinary detail in which they have been studying the question ; the care and patience with which they have carried out observations and the lucid manner in which they have marshalled their facts and presented them to their compatriots.

We ourselves have also had occasion to note the thoroughness with which the Germans have now embarked in this industry and by what means they have been able to organise a system of statistics which enables those interested in the coconut industry to realise the progress made. It is much to be regretted that similar statistics are not available in this country. A step in the right direction has, however, been made by the Board of Trade, which recently announced that, owing to

the growing importance of the copra industry, the quantities imported would in future be separately quoted.

This has been brought about by the success already achieved in the exports of coconut, copra, etc., from various British possessions, particularly from Malabar, Ceylon and Malaya, which has served to emphasise the immense value of the industry, a value that must increase tenfold when the estates are transferred from native to European control. Signs are not wanting that the British investor is also waking up to the importance of this industry. As in the case of rubber, we possess many of the finest coconut-growing territories, and there is no doubt that a vast impetus will be recorded in their development during the next few years.

This question of German enterprise is not one to be lightly dismissed, for the majority of students of industrial development consider, and not without some reason, that but for the saving grace of our aptitude in the matter of colonisation and the fact that we already possess vast territories in the tropics, we should probably be outstripped in this industry by our Teutonic neighbours. Undoubtedly it is a fact that Germany was persistently and scientifically striving to get to the heart of this particular subject while other nations, including our own, were merely dallying on the fringe of it.

There is now, however, no lack of initiative and enterprise on the part of Britishers, and already there are pioneer companies in the field which bid fair to lead the world in the successful development of this industry.

## Chapter XVIII

# The Nut Butter Industry

IN dealing generally with the development of the coconut industry in the preceding chapters, great emphasis has been laid upon the value of coconut products as an efficient substitute for animal fats in the preparation of food for human consumption. One would wish for a better word than "substitute" in this connection. The term suggests a makeshift, or stopgap, and coconut products are neither the one nor the other. In purity, food value, and in all other respects they are equivalent to the animal fats they have replaced. For instance, nut butter, which is now consumed in enormous quantities, is in every way, save in market value alone, absolutely equal to the product of the best dairies, and the leading scientists and hygienists in every country where it is used have, after exhaustive analyses, paid the highest tribute to its excellence. That its popularity is increasing daily, among the rich no less than among the poor, is quite obvious from the

ever-increasing quantities consumed, which prove beyond doubt that the prejudice which formerly existed against all butter substitutes has practically disappeared.

Nothing has been more remarkable in modern commerce than the sudden development of the nut butter industry, which was almost non-existent a few years ago. It has now attained such huge proportions that one firm alone is using over 550 tons of coconut products every week in the manufacture of this article.

It must not be thought that substitutes for butter originated from coconut products, for long before their value was recognised margarines and other substitutes were largely produced from neutral lard and oleo extracted from animal fat. According to a recent writer, the credit for inventing the first substitute belongs to a French chemist named Mège Mouriés, the suggestion having come from Napoleon III., who was anxious to procure a cheap and wholesome substitute for butter for the use of the poorer classes in Paris who could not afford to purchase dairy produce. This was about the year 1870, and the substitute in question was made almost entirely from beef suet. The Mège Mouriés process had a certain vogue, but was finally abandoned owing to the expense of the principal constituents, it being calculated in 1885 that 150,000 head of cattle produced only 3,000 tons

of "butterine." It was not until the introduction of coconut fats that the manufacture of butter substitutes became a recognised industry. Some doubt exists as to who was first in the field with nut butter, but it was recently stated on official authority that Messrs. Rocca, Tassey & de Roux, of Marseilles, were the first to place upon the market, under the name of "Vegetaline," a coconut butter, the basis of which was an edible fat extracted from copra oil. The remarkable success achieved by this firm, according to the author of *The Cult of the Coconut*, is demonstrated by the growth of their output, for, while they started by manufacturing about 25 tons of this nut butter per month, their Marseilles, Hamburg, Geneva, and Milan factories now turn out quite 36,500 tons per annum, of which they export 11,000 tons to the United Kingdom; and the question of further extending their capacity may come under consideration. Marseilles has always been, and still remains, a very important centre of this industry, its total output of nut butter alone now aggregating 75,000 tons per annum.

On the other hand, it is only fair to place on record that an English firm is said to have produced coconut butter as a marketable article of diet several years before the above-named firm started operations, although the latter can, we believe, fairly claim that they were the first to

invent improved processes of refining, which resulted in the elimination of the free fatty acids.

When the Mège Mouriés process was abandoned numerous experiments were tried in the effort to discover a satisfactory and profitable substitute for butter, and the trade drifted into such a discreditable position, owing to the dubious and inferior brands placed on the market—margarines composed of nondescript vegetable and animal fats and mysterious greases—that the Government considered it necessary to interfere, and the Margarine Act of 1887 was passed. It is essential to note that this Act had no reference whatever to butter manufactured from the coconut, seeing that the latter had not at that time been introduced. Thus it came to pass that nut butter, despite its absolute purity, dietetic value, and other superlative qualities, was placed on the same restrictive level as those dubious products which had necessitated the passing of the Margarine Act for the protection of the public health. But it is satisfactory to note that this unfair legislative restriction is likely to be removed at an early date, there being a Bill now before Parliament designed to achieve this object by placing nut butter in a class by itself. That it should be definitely and clearly distinguished from products based upon animal greases, American cotton seed oil, etc., is but just to manufacturer, merchant, and con-

sumer alike. Real "margarines" should be labelled as such, but nut butter is a totally different product, and, in the interests of the public, the two should be placed in their proper categories, under distinct names.

The special qualities of nut butter may be summarised as follows :

1. *Absolute purity*—freedom from microbic contamination and atmospheric fermentation.

2. Extremely *rapid digestibility*, combined with complete assimilation.

3. Richness in soluble fatty bodies and in carbon. It is, as one eminent analyst points out, from the standpoint of nourishing powers and as an agent of calorification, *the* alimentary fat *par excellence.*

4. Suitability as a reserve food, being immune from alteration due to atmospheric influences.

5. Susceptibility to *sterilisation*, a quality not shared by animal fats.

It is doubtful whether those not actually engaged in the coconut and copra industries realise what developments have taken place in this direction during the past five years, especially in this country. So exceptional are the profits now being made by the leading manufacturers of nut butter, etc., that they are all extremely reticent regarding their immense outputs of these popular commodities. We are informed that the Continent

consumes 25 lb. of nut butter per head per annum, while in England the quantity is 5 lb. per head per annum.

In many quarters it is considered that this industry is still in its infancy, and that within five or six years the general public will have practically discarded dairy butter in favour of nut butter, owing to the latter's superior quality and cheapness. Another outstanding feature is the extent to which the product is being manufactured in Great Britain, imports of nut butter having declined some 35 per cent. in three years. During the same period there has also been a significant decrease in the imports of dairy butter into the United Kingdom from Denmark and Sweden, as well as from New South Wales, Victoria, Canada, and other British colonies. From the various States of the Australian Commonwealth, for instance, the exports of butter, as shown by the official returns, fell from £4,637,362 in 1911 to £3,343,240 in 1912.

The process of manufacture of nut butter, as recently described by a leading daily journal, is extremely interesting, involving considerable scientific and technical skill and the employment of complicated and costly machinery. The principal constituents are coconut oil and milk. Every day nearly four trainloads of milk are dispatched from the West of England to the London factory of one big company, which alone disposes of about

*Copyright*] **Wild Coconut Palms (New Guinea).** [*R. W. Cater.*

550 tons of nut butter per day. From the immense churns, which are all bright and spotless, being cleansed and brushed by machinery, the milk is pumped to the top floor, passed over coolers containing brine, and thence conducted to numerous refrigerating tanks, each having a capacity of over 1,500 gallons. It is then Pasteurised, and has imparted to it just the necessary degree of sourness and acidity which facilitates the process of butter-making. This is accomplished by a process of mixing and preparation in a series of colossal cradles in which an army of infants could be rocked.

The coconuts are gathered, split, and treated, in the manner described in a preceding chapter, on the plantations, the product being shipped to England. Landed from the steamer, it is promptly conveyed to the top floor of an immense six-storey building, where it is handled by expert workmen, who reduce it to small dimensions with wonderful rapidity, the result being a vast quantity of pure, white-flaked substance. This, passing through shoots to the floor below, is melted in huge tanks, which are kept constantly stirred. The milk is then added, and blends with the coconut oil, the mixture being slightly varied in order to secure the different grades of quality. One of the most attractive features of the process is its spotless cleanliness, every stage being consummated

mechanically, so that none of the ingredients are touched by hand, a point which has gone far to inspire the confidence of all medical and hygienic specialists who have witnessed the operations.

Still retaining its liquid form, the combined milk and coconut mixture is transferred to colossal revolving drums, having a diameter of about 6 ft., which are kept at freezing-point by interior refrigeration. This cooling process is the special property of the company in question, and nothing could be more fascinating than the spectacle of the room below, where on all sides one sees descending immense flakes of the product in a crystallised form, resembling, as much as anything, a vast accumulation of frozen primroses. At this stage the product, not being sufficiently solid, is transferred to other revolving drums, and undergoes still another process, on issuing from which it is ready for blending. By passing over three sets of rollers it is subjected to further pressure, a suspicion of salt being added at the first set. The product is then brought to the desired consistency by passing through two special mixers. Owing to the system of manufacture and the minute care bestowed at every stage of the process, this nut butter will keep much longer than the finest dairy butter, retaining all its qualities for quite a month, if necessary. But, as a matter of fact, the manufacture is so closely regulated to the consumption

that one company renews all its supplies of nut butter to its hundreds of branches every three days. Quite bewildering is the rapidity of manufacture, thanks to the perfection to which both machinery and staff have been brought by constant experiment and practice. Milk and coconut, entering the factory at noon, can be transformed into the finished product, packed, and dispatched about four o'clock. The company is particularly proud of its packing machinery, which is a marvel of rapidity and precision, working with almost human intelligence. A case for packing 56 lb. of the product is constructed by one machine, which drives twenty nails in two or three seconds, another machine printing and attaching the label, and so on.

This company has its own water supply, which is drawn from over forty artesian wells sunk below the chalk. Its machine-room is among the finest to be seen in the country, one superb pair of engines being of 900 H.P.

It is scarcely necessary to add that at every stage the product is carefully watched and subjected to the most stringent scientific tests. The operations being continuous, night and day, two brigades of chemists follow every process in connection with the raw materials and the finished product. One of the finest departments is the laboratory, with its imposing array of scientific instruments and appliances necessary for the testing

of the various ingredients, on whose purity and palatability must necessarily rest not only the health of the company's vast *clientèle*, but also the material prosperity of the whole enterprise. Competition is superkeen, but not keener than the buying instincts of the British public.

## Chapter XIX

# Coconuts as an Investment

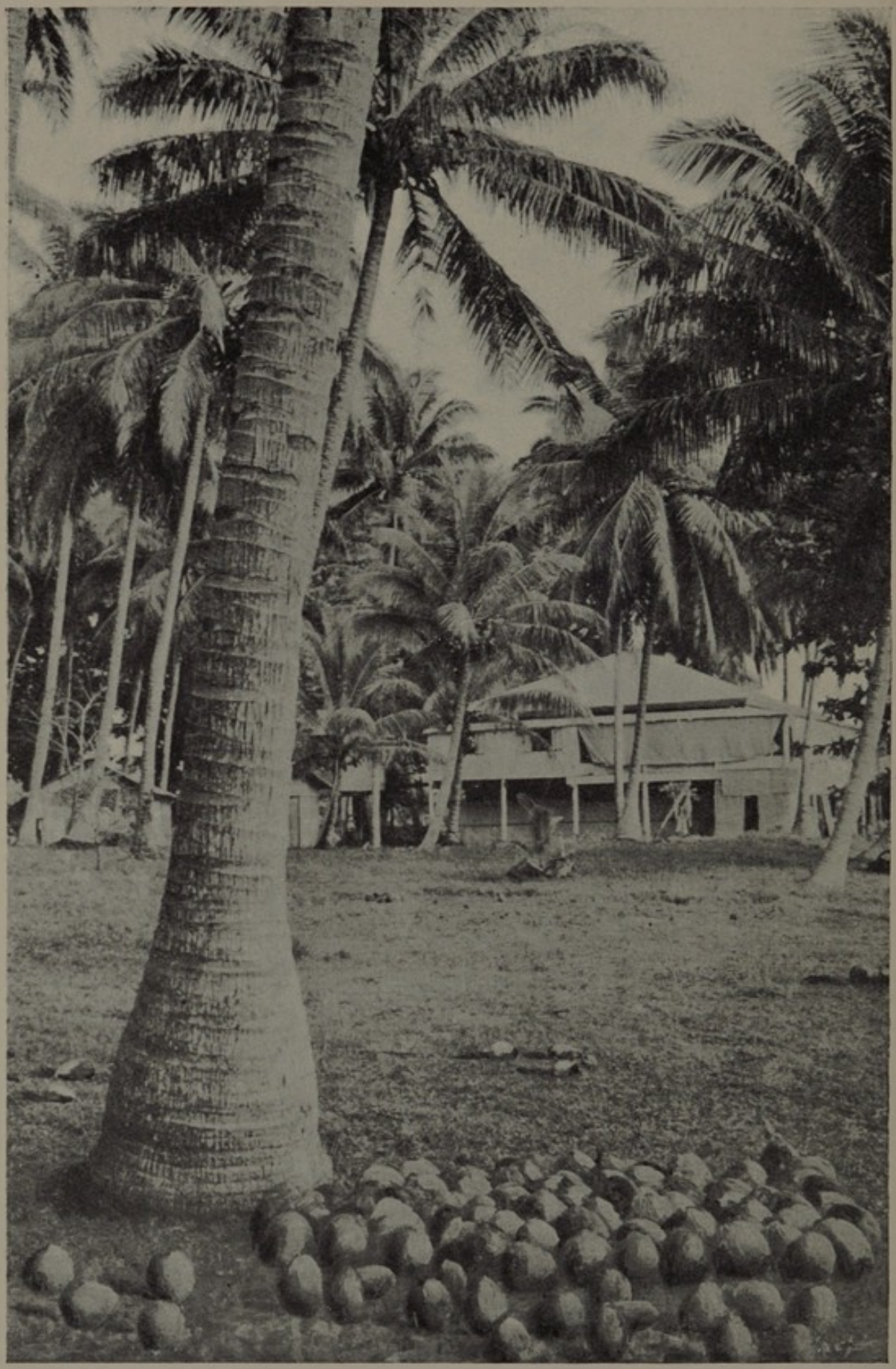
THE due consideration of the coconut industry from an investment point of view has been deferred, though, as a matter of fact, it has been clearly inferred throughout the foregoing chapters, for this reason: it is quite impossible to accurately gauge the investment possibilities of anything until one knows something, however fragmentary, of its history, sphere and future scope. The past and present value of the coconut as a commercial asset has been explained to the best of our ability in the preceding pages, its future possibilities have been pointed out, and our duty now is to indicate more clearly its significance to the investor. This point, too, is not without its Imperial aspect, inasmuch as the investor plays just as important a part in the development of a new industry as any active worker engaged in it, whether he be the producer, shipper, merchant, or the actual utiliser of its product. The industry that lacks financial support lacks its very life blood and

must sooner or later die of inanition. On the other hand, it is quite out of the question to expect investors to interest themselves in any industry, however beneficial to the community, if it is financially unsound and shows no prospect of adequate security and profit.

What, then, is the promise of this particular industry to those who assist its development with their capital? The direct answer to this question has been provided, in words already quoted in the opening chapter of this work, by Sir William Lever, who says: "*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.*" We make no apology for repeating this sentence, which conveys the considered judgment of one who is highly qualified to speak on the subject. This should go far to remove any misgivings that may still be entertained as to the future of coconut cultivation.

Sir William goes on to say: "*Given reasonable precautions and care there is very little risk of failure in coconut planting . . . and a large amount of capital is not required. . . . There are millions of acres of waste land in tropical countries waiting to be developed, and all that is wanted is a little help from the authorities to convert waste tropical possessions into veritable gold mines, producing wealth beyond the dreams of avarice.*"

This is no mere pen picture of the possibilities of



*Copyright*] **Lever Bros'. Store,** [*Underwood & Underwood.*
**Island of Gavotu (Solomon Islands).**

the situation ; it is a deliberate forecast based upon a clear understanding of every feature connected with the industry. Sir William Lever has practically demonstrated his conviction by arranging for the planting of several millions of coconut trees in the vast territory that his company has just undertaken to develop in the Belgian Congo. His estimate of the cost of acquiring a rich plantation and bringing it up to the point of production is from £10 to £12 per acre, including every expense except the planter's own labour and interest on the capital sum invested, so that, at the present price of coconuts—which, be it remembered, is distinctly on the up grade—the net *income* derivable from each acre in full bearing is over £10 per annum. Therefore even a comparatively small estate must, unless grossly mismanaged, produce a large income.

Every competent authority endorses the view of this shrewd industrial magnate that, particularly at this juncture, capitalists, both large and small, can find an exceedingly profitable field for the employment of money in this industry. It is necessary, however, to take full advantage of the present position if the best investment results are to accrue.

The ingrained conservatism of our race is a characteristic of which most of us are proud, though we freely admit that it occasionally stands in our way ; it may be that here as elsewhere the

conservatism of the British investor will prove an obstacle to prompt action, but one thing is certain : those who from over-caution or misconception of the facts hold back until there is a boom, will find themselves excluded from the circle of far-seeing investors who will deservedly reap the greatest financial benefit from the expansion of the industry. It must be remembered that, with the exception of a very few companies recently organised, coconut cultivation even to this day remains almost wholly in the hands of native planters, who are often financed by Chinese traders. The former, as we have already explained, adopt the crudest, most antiquated and wasteful methods of propagation, yet even in these disadvantageous circumstances fortunes have been made by many who have been shrewd enough to realise the value of the coconut. What, then, must be the reward of those who acquire a financial interest in the industry at this juncture ? There is every opportunity at the moment of dealing with the native planter on lines similar to those adopted a few years ago by British experts in dealing with native rubber planters. Then, as everybody knows, small and scattered ownership was replaced by the formation of vast estates, antiquated plants and inefficient methods were swept away and scientific methods of cultivation, the most up-to-date machinery and organisation substituted in their stead, with the result that

the industry was placed upon a permanent and profitable basis, such as it never could have attained under the old *régime*, the first to derive substantial benefit from the change being the native himself. Colossal profits were returned to those who, to use an expressive Stock Exchange simile, "got in on the ground floor," and then came the boom. Thousands who had neglected their real opportunities rushed headlong into the market hoping they were not too late to secure a share of the spoils; anything and everything in the shape of a rubber share was bought regardless of individual worth, and prices rocketted upwards in a fashion that still further dazzled the procrastinators. When the boom was at its height anything that bore the name of rubber was good enough for the public, and all sorts of propositions that in normal circumstances would never have seen the light of day were brought forward for the edification of the investor, who eventually found that he had burned his fingers rather badly. Then followed the inevitable reaction and heavy losses were incurred all round before the market receded to its normal level. That, of course, is what happens in every boom, and it is by no means improbable that history will repeat itself in the case of coconuts. As we have said, the position to-day is very similar to that which preceded the development of the rubber industry, and huge profits will undoubtedly be the

reward of those who acquire interests early in sound propositions. It is not within our province to institute a comparison between the investment merits of rubber, or any other commodity, and coconuts, but the facts fully justify us in saying that, both economically and financially, the latter to-day presents a prospect that *has seldom been equalled and never surpassed in the history of commerce.*

Owing to the imperfect manner in which British official statistics of this industry have been compiled complete details are not available, but it has been estimated by experts that the total value of the coconut and oil palm together aggregated in 1912 over £70,000,000. The world's gold output in the same year came to £100,000,000, and rubber accounted for £50,000,000. Both gold and rubber are outside the scope of the present discussion, and we merely quote these figures in order to convey some idea of the relative importance of each commodity to the other.

Finally, at the risk of being thought redundant, we venture to recapitulate the salient points which should enable the investor to form his own judgment as to the future of this great industry. These are :

1. The demand for the coconut is now enormous, and is daily increasing by leaps and bounds.

2. Over-production, as we have previously

explained, is physically impossible for several generations to come, if at all.

3. The produce is easily marketed in a regular, open and businesslike manner.

4. The dividend-earning capacity of the capital invested must inevitably expand as the demand increases, because (*a*) prices will naturally rise in proportion, (*b*) the producing capacity of the estates must progressively increase as the trees mature, and (*c*) because of the improved methods of cultivation and exploitation that will be introduced by properly organised and equipped planting companies.

5. Most of the best plantations being located on the seashore transport and shipment are rendered both easy and cheap.

6. Labour is never likely to prove a disturbing factor, there being an abundance of workers.

7. There is no possibility of the keenest competition among utilisers of the products materially affecting the prices obtained by planters, whose profits, therefore, will remain unaltered.

8. The most favoured coconut-growing regions, notably Malabar, West Indies and West Africa, are under British control, so that their development can be organised under the safeguards and guarantees of British law and custom. This is a point of vital importance to the investor, who has far too often seen the safety of his capital imperilled by

foreign repudiation, maladministration, or such ruinous disorder as that fomented in Mexico during the recent revolution.

At no moment in recent history has such an opportunity for investment occurred, when the increasing needs of civilisation, combined with the inventive genius of man, are expediting the development of vast sources of tropical wealth which have hitherto been neglected or only superficially cultivated by natives. To-day the coconut industry presents illimitable possibilities for the profitable employment of capital, but it only needs the advent of the boom to put an entirely different complexion upon its monetary aspect, and already, as we have previously pointed out, there are indications of activity in this direction in the highest financial circles. The present investment opportunity cannot possibly extend beyond a limited period, for the very simple reason that every commodity under the sun is worth precisely what it fetches in the open market; therefore shares in sound pioneer companies, which may be obtained to-day at reasonable prices by moderate investors may be quite beyond their reach when booming markets begin to tell their tale. It must be remembered, too, that such companies owe their existence to the enterprise and foresight of their founders, who, being first in the field, were able to secure the best estates in the most favoured localities at bed-rock

prices; properties which, in a year or two's time, may be multiplied in value tenfold. But it is quite unnecessary to labour these points after all that has been said upon them; there will always be investors who are guided by their judgment and ability to accurately foresee the trend of affairs, just as there will always be those who habitually defer action until every opportunity has slipped from their grasp.

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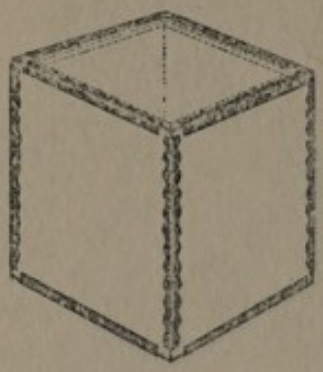

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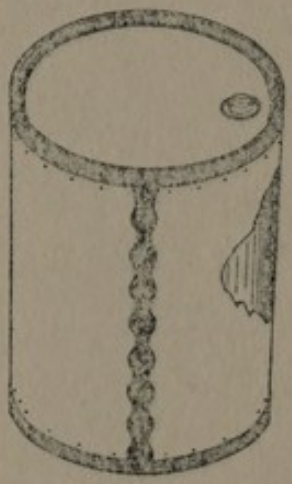

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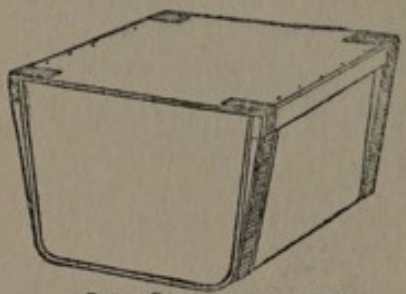

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