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The Oil Palm (Elaeis guineensis,) in the East.

The thoughts of planters and capitalists have been turning for some time to *Elaeis guineensis,* the West African Oil-palm, as a new source of supply for oil, which as we see from the Market Reports is more and more in demand, at prices, which, high as they are, are not unlikely to soar much higher in future. An increased demand for seeds of *Elaeis* is an indication that the idea of establishing plantations of the palm is taking concrete shape in the minds of many, and this has induced the present writer, as far as his limited means of information allows him to visualise it, to work out for himself the problem of the future of *Elaeis* as a planting proposition on systematic lines.

With a view to establishing a nursery in the Economic Gardens, a look-out was kept for a bunch of fruit which had shown signs of approaching ripeness for some time. The tree, which bore it, is a well-grown palm measuring no more than 7 feet to the lowest row of branches, and with a girth, at one foot from the ground of 9 feet 10 inches, and 7 feet 2″ at five feet from the ground. These measurements include the protuberances due to stumps of decayed or cut leaves. No records are to be found of the date of its plantation, but a foreman-gardener who has been working for seven years in the gardens, remembers it as a seedling when he first came. This is the first head of fruit which the tree has yet produced and this fact allows us to compute its age as somewhere between 8 and 9 years, for the habit of *Elaeis guineensis* is at first, to bring forth male flowers only, the female flowers appearing a long time afterwards. Owing to the neglected state in which it had grown, all covered, as is the wont of *Elaeis guineensis* in similar conditions, with a heavy vegetation of ferns and other epiphytic plants, we may well allow a couple of year's delay in the appearance of the male flowers which one expects on a plantation, to come out in the fourth year, and also subsequently, in the appearance of the female flowers.

Neglect notwithstanding, the tree has, as already said, grown into a fine and vigorous specimen of its kind, with a profusion of leaves from 16 to 18 feet long, and an abundance of dead and living male flowers, the dead forming by their decay, masses of a humus-like material which fills the cavities between the trunk and the bases of the leaves. These rich humus-pockets probably explain the tendency of foreign plants to seek sustenance on *Elaeis guineensis*; the strangest of all these being seedlings of *Elaeis* itself, of which the writer found two with well developed roots and plumules embedded in the leaf-base cavities.

It will be understood that this, being the first bunch collected off the tree, it cannot in any way be an indication of the fruiting capacity of the tree, no more than the first bunch plucked off a coconut tree can be considered as an indication of its future crop capacity.

The arrangement of the leaves round the trunk of the palm is in groups of three as shown in the diagram.

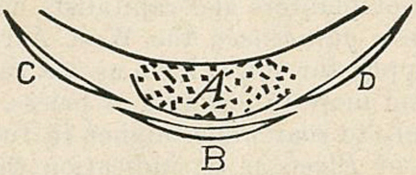


Diagram showing disposition of leaves and fruit bunch.

The bunch of fruit A is jammed between the trunk and the base of the leaf B, while the two leaves C and D also exert a pressure on the sides of the bunch. The pressure exercised by these three leaves against the bunch is very great, so much so that a large number of the fruit cannot develop beyond the embryonic stage and are absolutely wasted. Owing to this pressure, it is impossible to get at the bunches without first cutting the leaves as near as possible to their base. Now, the substance of the *Elaeis* leaf bases, is not, like that of coconut leaves, soft and yielding, it is woody and very tough, and it requires a sharp and heavy parang or a hatchet, or a chisel and mallet, to hack through it.

A point which also impresses itself very quickly on the coolie is the presence of spines at the lower end and on both sides of the stalks of the leaves (the midribs) : this makes it almost impossible for the hand of the coolie to get in touch with the bunch itself without getting hurt by the spines; and, lastly the fruit themselves are encased between spiny bracts, which put out of the question all possibility of picking them out individually by hand. It is thus seen that the fruit bunch is extremely well protected against human intrusion.

It was necessary to go into the above details to explain one of the difficulties, and not a mean one, that confronts the planter of *Elaeis*. For we may take it for granted that *Elaeis* will grow in these countries as well as in its African home, the superb specimens of the tree seen in Sumatra and in Malaya are a sure warrant of that. That it will yield as good returns and yields of oil may also be conceded. But to conclude from this, that the systematic plantation of *Elaeis* will be a "paying" proposition in Malaya or Sumatra is somewhat premature.

This is evidently not the view of a contributor to the "*Bulletin de l' Association des Planteurs de Caoutchouc*" of November 1919 who writes, page 91, "It is to be observed that the cultivation of the palm (*Elaeis*) is appreciably easier than that of *Hevea,* for the fruit is obtained by mere picking, and the question does not arise, as it does in the case of *Hevea,* whether the yield is premature or too heavy."

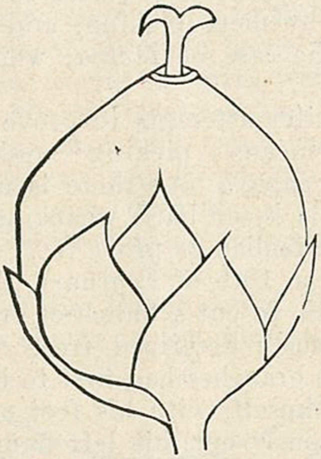
We think this writer attempts to prove too much. The word "cueillette" literally means "picking" and is applied to a gooseberry, an apple, or a papaya, but there is no picking the fruit of *Elaeis guineensis;* it is sheer hard whacking that does it and the following account is intended to prove it.

At 7.45 a.m. on the 10th of February, the present writer started work with one coolie to cut a bunch of fruit, at 8 feet from the ground on the previously described tree.

The spines on the branches had first to be pared with a parang, the man supporting himself, with his feet on the stumps of leaves which had been previously cut, his left hand holding on to a leaf above him, whilst the right hand was kept hacking with a parang at the leaf immediately below the bunch. At 8 o'clock exactly, the leaf fell, bringing down with it a lot of decayed matter, and at that moment, a great number of ants appeared, compelling the man to jump down. A ladder was sent for, and by 8.10 o'clock the man was able to resume his work by cutting the two leaves, one on the right, and the other on the left side of the bunch, and this took another seven minutes. Access to the bunch was now free, and after eight minutes more of hacking at the tough and thick peduncle, the bunch, severed at last from the tree, fell to the ground. It was then 8.25 o'clock, so that the actual time it took to bring the bunch down was from 7.45 to 8.25, *i.e.* (less 10 minutes of interruption) exactly half-an-hour.

At the store, the bunch was found to weigh 18 lbs., and with its 3 inches of peduncle, it measured 18 inches in length and it was about one foot in diameter. One side of it had only a few fully-developed fruit.

As far as the writer is aware, the only way to deal with the bunch is to lay it on its side and, with a sharp parang or an axe, to split it longitudinally in two halves, then laying each half on its flat side (the side just cut), to split it also in two. We thus have 4 quarters from which it is, comparatively, easy to dig out or pull out or wrench out by torsion, the fruit from the spiny bracts which hold them, a work which took 10 minutes to effect. The result was 206 fully-developed fruit, weighing altogether 7 lbs. In the bunch were also found a large number of misshapped and undeveloped fruit, the size and shape of a clove of garlic or even smaller, the result of incomplete fertilisation, or of compression in the bunch by the leaf at the axil of which the bunch is formed. Such fruit cannot be dealt with by any hand process which the writer can conceive. Whether they have any oil in them, and whether they can be dealt with mechanically, so as to pay costs by the extracted oil, he has no means of judging, but he is inclined to think not. Thirty-five fruits more, of half normal size were dug-out of the bunch and, when stripped of the calyx-leaves and their peduncle cut off, were found to weigh altogether 4 ozs.



Size and shape of fruit of "Elaeis" with calyx leaves and dry stigma on top—Weight 17 grammes.

The largest of the 206 fruit is here represented in shape and size, but they were mostly of less symetrical shape, with depressions on one side and a more conical apex.

Their colour was bright orange at the base shading abruptly into deep purple and almost black at the apex.

So far the labour employed on these 7 lbs. 4 ozs. of fruit had taken 45 minutes, but it should be borne in mind that it was performed under the writer's own supervision and in his presence, without the loss of one minute, and, secondly that the tree was a very low one, the fruit being only 8 feet from the ground.

Further still, no time was put down for transport which is a larger question than appears at first sight. Dealing with coconuts, the crop of nuts can be hurled towards the transporting cart or wagon, by successive throws of 20 to 30 yards at a time, or more if the ground is a sloping one, and the job of loading is an easy one and quickly done, but with the hedgehog-like bunches of *Elaeis*, each bunch must be handled by hand, and gingerly at that, for they refuse to roll of their own accord, and the unloading at the store must proceed in the same way. Taken altogether, climbing up the tree, hacking through the leaves and the peduncle, getting down again, and carrying the bunches to the cart, the writer is of opinion that the coolie cannot, in a nine hours' day, visit more than 9 trees, and assuming a crop of two bunches per tree, his day's work is summed up by 18 bunches, which means that, at a daily wage of 75 cents, each bunch brought to the factory and split ready for treatment, will cost over 4 cents. Moreover, the work is so hard, so unpleasant that it is very doubtful if our ordinary class of coolie will stand it. It is pretty certain that coolies accustomed to the comparatively leisurely work of rubber or coconut estates will not look at it, and unless extra wages are paid it will be difficult to recruit the class of men required.

It is quite possible that in West Africa the natives, being expert climbers, give a greater output of work; yet Dudgeon tells us in "Agricultural and Forest Products of British West Africa" that it takes 8 minutes for a native to chop off a bunch.

The leaves are often, and should always be, cut long before the harvest, so as to favour the expansion of the bunch by reducing the compression exerted by the leaves. But what is more significant is "that the number of skilled palm-tree climbers is said to be decreasing in many districts and a very large proportion of the annual yield of fruit remains unharvested" (page 93). This does not say much for the attractions of *Elaeis* climbing as a profession.

The bunch which the writer is dealing with in this paper comes, as already stated, from a young tree and does not therefore, give quite a fair idea of the crop obtainable from the *Elaeis* palm, for as in the case of Coconut the full-bearing capacity of the tree is only reached when it has attained complete maturity. In his monograph, "The Oil Palm and its Varieties" J. H. J. Farquhar says, page 20:

"On the average, 5 bunches of fruit are produced per palm per annum; but it is common to find trees yielding many more. The average weight of a bunch is 31 lbs. made up of fruits 20 lb. and stalks, bracts, and calyx leaves which are worthless 11 lbs. The average number of fruit in a bunch is 1600 of which 600 or 38% are fully developed, 200 or 12% are imperfectly developed, and 800 or 50% are not developed."

The 20 lbs. of the fruit is made up as under (page 23)

the palm-oil extracted by native methods weighs	1.5 lbs.	20 lbs.
the kernels	4.0 lbs.	
the refuse, fibre and shells	14.5 lbs.	

5% of the weight of a whole bunch of palm-fruit may be considered oil, and at 5 bunches per tree this would mean 7½ lbs. of palm-oil yearly per tree.

One imperial gallon of cold palm-oil weighs 8½ lbs., accurately. The writer's own findings are:

One bunch ("maiden crop") weighs	18 lbs.
The bunch contained 206 fresh fruit perfectly developed weighing	7 lbs.

25 fruits, whole, after the calyx leaves and the peduncles had been cut off weighed	13.50 ozs.	
25 pericarps	5.75 ozs.	13.50 ozs.
25 fruits divested of their pericarps ..	7.75 ozs.	
25 pericarps gave of pericarp-oil (Palm-oil)	1.625 ozs.	

We need not attach any importance to the differences of weights of the bunches, as shown between the above two sets of figures: the bunch cut down in this case, being a "maiden" crop would be expected to weigh less than one cut from a mature tree: but when we come to compare the weights of the fruits and the results in oil, the differences are wide. For instance, at the rate of 206 fruits to 7 lbs., it would require only 588 fruits to make up the 20 lbs. weight of 800 West African fruit (600 perfect and 200 imperfect). And the divergence in the outputs of oil is remarkable, but Farquhar's figure of 1.50 lbs. of oil to one bunch of fruit, applies to native methods.

As stated above, from the pericarps of 25 fruits the writer obtained 1.625 ozs. of oil. This was done in the following way. After freeing the fruit of their calyces and peduncles, the pericarps were sliced off with a sharp knife, cut up small, and passed through a special mincer which ground them to a fine paste. Boiling water was then poured, in small quantities, into the mincer, and the watery paste was allowed to escape by a tap at the bottom of the mincer into a pan which was put on the fire and boiled for 1½ hours, the mash being stirred the while, until the oil began to show itself on the edges, when it was dribbled from time to time into a cup. Boiling was continued, small quantities of water being added at times, until no more oil was seen to separate from the sediment which was put by until next morning when only a few drops of congealed oil had exuded. Perhaps a little more oil might have been obtained by pressing the sediment, but this was not done.

At first the oil is of a dark-brown orange colour, very clear, but the next day a very small quantity of sediment had formed at the bottom. In the early mornings it is congealed in the bottle and it takes the colour of anchovy sauce. The odour when fresh is pleasant, but eggs fried in it, came to the table with a deep orange film, suggestive of varnish or floor polish—and the flavour, to a palate accustomed to fresh coconut oil or gingelly-oil, was not quite pleasant. Yet, according to the *"Bulletin des Matières Grasses" No. 4, 1919, page 135,* palm-oil is one of the most advantageous materials for the manufacturing of margarine, when freed of its fatty acids.

The yield of 1.625 ozs. of pericarp-oil (palm-oil) from 25 fruits, means that, from 600 perfect fruits in an average bunch (we leave aside the 200 imperfect fruits), the resultant oil would be 2.43 lbs. per bunch, whereas the West African native, as shown above, obtains only 1.50 lbs. per bunch.

If we work out the above averages of outputs for an estate under systematic cultivation of *Elaeis guineensis* of say, one thousand acres, we should arrive at the following figures respectively:—

1,000 acres planted 27 × 27 feet = 50,000 trees.

50,000 trees giving 5 bunches each annually would give 250,000 bunches.

The *"Bulletin Economique et Financier du Journal d'Agriculture Tropicale"* of November, 1919 gives the following quotations.

Palm-oil Liverpool 10th November Congo £75 Lagos £83 per ton.

Palm Kernels London 10 November £38 to £38.10 per ton.

Therefore 250,000 bunches at 1.50 lbs. of oil = 375,000 lbs. Palm-oil at £80 per ton = £13,392.

250,000 bunches at 2.43 lbs. of oil = 607,500 lbs. Palm-oil at £80 per ton = £21,250.

Messrs. B. J. Eaton and F. G. Spring (Agricultural Bulletin F. M. S., Sept. and October, 1918) assuming a yield of 4,500 lbs. of fruit per acre, estimate the yield of palm-oil at 800 lbs. per acre; this would result in a yearly crop on 1,000 acres of 800,000 lbs. which, at £80 per ton, would give a gross return of £28,571. The discrepancies between the above figures show, if nothing else, the great need for further close investigations of the subject.

Palm Kernel Oil.

It may be useful to remind the reader that the above figures relate to *palm oil,* i.e. the oil extracted from the outside oily coat of the fruit. When this coat, or pericarp, has been taken off, there remains the nut, the Kernel of which has also a large oil content; this oil goes under the name of "palm-kernel oil."

The fruit of *Elaeis* is very much like the Coconut in structure, and the name "Klapa Kechil" given it by Javanese and Malays, is, botany apart, quite apt; for we have in both:

1st. The pericarp which instead of being of corky material, as in the Coconut, consists of a fleshy coat about $\frac{1}{8}$ inch in thickness in which are embedded, as strands of steel in reinforced concrete, straight and almost parallel fibres which converge towards the apex of the fruit. This coat, or pericarp contains of oil (extracted by solvents) 32.86% of the weight of the pericarp (C. W. R. Ralston).

2nd. A shell of the same stone-like hardness as that found in the Coconut—but harder in the *Elaeis* fruit; thickness, $\frac{1}{8}$ to $\frac{1}{4}$ inch.

3rd. A kernel of white "meat," filled with "water" in the Coconut, but full, *i.e.* without cavity, in the *Elaeis.* This "meat" has a bluish tint and is much harder than that of the Coconut.

It contains of oil (extracted by solvents) 43.96% of the weight of the kernel (C. W. R. Ralston).

The writer has found the weight of 25 kernels, divested of their shell, to be 2.12 ozs.

The writer has no personal acquaintance with this oil, nor, except from drawings, of the machinery in use for its extraction, but, as in the generality of cases, the extraction does not take place on the Estate itself the kernels being exported to Europe, it will be sufficient to take their market value, which in London is £38 per ton.

On the above basis of 25 nuts weighing 2.12 ozs. we should have from a 1,000 acre estate (250,000 bunches of 600 fruit) 357 tons of kernels at £38 per ton or £13,566.

Messrs. Eaton and Spring estimate a yield of ¼ ton of palm kernels per acre which is equivalent for 1,000 acres to 250 tons i.e. at £38 per ton, £9,400.

On this reckoning, taking only the figures relating to these countries, we have here two figures of the estimated gross revenue of a 1,000 acre Estate of *Elaeis* as under:—

	The writer's		*Messrs. Eaton and Spring*
Palm-oil	£21,250	.. ..	£28,571
Kernels	£13,566	.. ..	£ 9,400
Total Gross Revenue of 1,000 acres:	£34,816	.. ..	£37,971

Conclusion and Suggestions.

We have in these Countries two products of the soil which have great attractions for capitalists, namely Rubber and Coconuts, both safe industries, both paying handsomely, both easy of performance without strain of labour.

In considering Coconut, in particular, planters are accustomed to think in terms of copra only, and at the present time, with the staple at $30 per picul and 10 piculs of it, more or less, per acre, produced at small cost, and with a minimum of labour, there is really not much wrong with the coconut industry, from the money making point of view. Yet planters might make more of it and benefit their land, by the return of the "poonac," if they turned their copra into oil, as they do in the Philippines, but as it is, the industry flourishes exceedingly.

Now there are not a few people who think that there is room also in these countries for the cultivation of *Elaeis guineensis.* Perhaps that is so, but that will only be in places where the population is dense, and the recruiting of labour, men and women, assured at all times; for labour will be an all important factor, more important perhaps than machinery. So far we have only mentioned the difficulties which beset the coolies at the work of the gathering of the fruit, but it is not only the hardness of the work one has to look to, when dealing with *Elaeis,* it is also the great number of hands required to do it.

Whereas, for instance, on a coconut Estate, four coolies doing nothing else, will suffice to bring down the crop of 200 acres in one month, the same number of men will barely suffice to bring down a crop of 30 acres of *Elaeis* in the same time.

The same conditions apply to the labour at the factory. Whereas the manipulation of copra is of the simplest, requiring practically no machinery, the fruit of *Elaeis* is about as intractable a staple as can be conceived, requiring most elaborate machinery for the mere depericarping of the fruit, before extraction of the oil.

To satisfy himself on this point and find out where the difficulty lies, the writer effected the depericarping of 25 fresh fruit.

With a very sharp knife, he worked continuously for 43½ minutes, slicing off the oily coating and the result was 5 ozs. of pericarp. It will be noticed that on a former occasion, when making oil, the writer obtained $5\frac{3}{4}$ ounces of pericarp; this time, however, working against time, he probably did not scrape the nuts as carefully, and hence the loss of weight.

If we follow up this result, we find that a day of 9 hours should give an output of 62 ozs. or say, allowing for time wasted by the coolie $2\frac{1}{2}$ lbs. of pericarp, yielding about 12 ozs. of palm-oil, worth about 6 pence. A daily task of $2\frac{1}{2}$ lbs. of pericarp could not therefore be paid more than 4 pence, leaving 2 pence for cost of extraction of the oil freight and profit; plainly an impossibility, except where the very cheapest female and child labour can be drawn upon.

In this connection, a well known authority, Auguste Chevalier, (Bulletin des Matières Grasses de l' Institut Colonial de Marseille, No. 4, 1919) makes the following statement:

"A native of West Africa, working 300 days, produces yearly only 390 kilos of almonds, while another, treating the pericarps, obtains yearly 657 kilos of oil: the daily production of almonds not exceeding 1.300 kilos and that of oil 2.190 kilos."

2.190 kilos per day for two persons or say 1.100 kilos for one person, is more than treble what the writer himself obtained of oil; this is probably due to previous softening of the pericarps by fermenting in heaps, a native practice.

Taking as a daily task 1.100 kilos or 2 lbs. 7 ozs. of palm-oil per coolie per day, of a value (at £80 per ton) of 20 pence, it would perhaps be possible to pay a daily wage of 1/- sterling, leaving 8 pence for cost of extraction, oil containers, freight and profit. But the number of hands employed would be such as to render the operation impossible for an estate with a large production of fruit.

However, these figures may stand for the time being. Meanwhile the question naturally presents itself: what about machinery?

The writer is unacquainted with the various depericarping, depulping, grinding, and nut-cracking machines, which have for some time made their appearance on the market. Some of them, we are told, are made more to sell, than for anything else; others, having been working for some years, have proved their efficiency. But the writer has not seen any of them and his opinion would, at best, be only that of a layman: he must therefore borrow light from other, better informed sources.

Two such sources of information are now before him:

The Agricultural Bulletin F. M. S. for September and October, 1918, and the "Etude sur l'Exploitation industrielle du Palmier à huile," by Mr. Houard Director of Agriculture, Dahomey. The report is dated 1919.

On page 509 of the "Bulletin" reference is made to a German process installed in the Cameroons before the War. A summary description (to which the reader is referred for want of space) is given of the machinery and its mode of action.

Now if we dissect the process into its several changes from start to finish we shall find that the crop has to go through the following manipulations:

1° Cutting the bunches open to get at the fruit.
2° Removing the fruit from the divided bunch.
3° Transporting the fruit to the boiler.
4° Boiling the fruit for 1 hour.
5° Transfer of heated material, (by mechanical means presumably) to a number of mortars worked mechanically.
6° The stamping of fruit in the mortars.
7° The stamped-mass is steam-heated.
8° The nuts (for the sorting of which from the pericarp pulp some device must exist), are separated from the pericarps.
9° The transfer of the mass of pericarps to the hydraulic presses.
10° The extraction and reception of the oil from the presses.
11° The conveying of the oil to the sand filters.
12° The pumping into puncheons.
13° The disposal of the fibrous residue from the presses.
14° The separated nuts are transported to a barbecue or a drying-shed to dry.
15° The dried nuts are conveyed to the nut-cracking machines.
16° The nuts are cracked in a centrifugal cracker.
17° Kernels and broken shells fall in a tank below, filled with brine, in which the shells sink, and the floating kernels are collected.
18° The kernels, taken up from the brine, are put to dry.
19° The nuts are put in bags.

The total pre-war cost of such machinery is given as £3,500. The quantities treated 10 tons of fruit per day of 10 hours. The yield 16% of palm-oil 10% of kernels.

Accepting these data as exact, it would require to keep the mill at work for 300 working days of 9 hours to treat 2,700 tons of fruit. We base our calculations on a 9 hours day instead of 10 hours, as more in conformity with estates in Malaya.

If we reckon on a production of 5 bunches per tree per year, each bunch with 20 lbs. of fruit, and adopt the very generally accepted figure of 1½ lb. of palm-oil per bunch with 4 lbs. of kernels divested of shell, we shall come to a final result of:—

1 tree = 5 bunches = 100 lbs. of fruit = 7½ lbs. of palm-oil + 20 lbs. of kernels, and for one acre of 50 trees an annual return of

250 bunches = 5,000 lbs. of fruit = 375 lbs. of palm-oil + 1,000 lbs. of kernels. To produce 2,700 tons of fruit it will therefore require 1,200 acres of palms in bearing.

The whole production of 1,200 acres will be: 2,700 tons of fruit = (453,750 lbs.) 202 tons of oil + 536 tons of kernels.

202 tons of oil at £80 = £16,160
536 tons of kernels at £38 = £20,368 total £36,528.

It is perhaps a little bold, with such fragmentary information as we possess, to attempt to build an estimate of the total cost of an installation of this kind and of the expenditure incurred in running it. For that, it is necessary to visualise it as a whole, with its accessory and component parts and surroundings: but Mr. Houard's report (pages 198-199)) will supply us with several useful figures, which, however, have had to be altered to Straits Currency and to estate conditions in Malaya, where salaries and wages are on a higher scale.

To begin with, the machinery, which is put at £3,500, pre-war cost, would now cost more than double and we can, without risk of surcharging put it down at £7,000 *i.e.* at $8.54 .. .. $59,780

Building of factory and engine house	12,000
Water Supply—pumps and reservoir (Water must be in abundance and constantly available)	1,500
Wagonets and rails for transport of fruit in the mill—also of fibrous and shell refuse	2,500
Drying sheds or barbecues	1,200
Store house	2,000
Tanks for brine with elevators	1,000
Spare pieces of machinery	2,000
Sand-filters and tanks to clarify the oil	2,000
Repair shop and tools	2,000
Offices	2,000
Manager's house	5,000
Chief Engineer's house	5,000
Clerks' and fitters' house	2,500
Coolie house	1,200
Total Cost of Installation	$101,680

Repairs and depreciation (20%) will amount to $20,336. We have now to work out the cost of running the mill on the assumption that 2,700 tons of fruit are treated per year.

Fortunately Mr. Houard's Report supplies us, under the heading "*Daily expenditure of a mill treating on an average 10 tons of fruit per day,*" with a full schedule of the labour and staff employed, which is given below unaltered, except for the wages which are brought to Malayan standards.

LABOUR:		*Yearly*
1 Receiving clerk paid daily	$2.00	$ 730
6 Coolies	.60	1,314
2 Men attending steriliser	.60	438
3 Men cooking the oil	.60	657
8 Men tending the presser	.70	2,044
2 Men tending the filters	.60	438
2 Men filling the casks	.60	438
4 Men tending the depulping machine	.60	876
4 Men tending the drying and the nut-cracking machines	.60	876
2 Engineers	3.00	2,190
2 Stokers	2.00	1,460
1 Fitter	4.00	1,460
1 Mason	2.00	730
1 Carpenter	3.00	1,095
Carried Forward ..		$14,746

	Brought Forward	..	$14,746
2 Coopers	.. ..	3.00	2,190
1 Black smith	.. ..	3.00	1,095
1 Frappeur? (man who sounds the casks?)	..	.60	219
2 Bookkeeper	.. ..	..	2,400
1 European manager	.. ..	..	5,400
1 Chief Engineer	.. ..	..	5,400
Fuel .. .. 50 francs per day			
Lubricant .. 3.			
Sundry .. 6.50			
	= *f* 59.50 = $20	..	7,300
Yearly Salaries Wages, etc. Total		..	$38,750

The mill requires a number of puncheons as oil containers, and of bags for the kernels.

Liverpool puncheons are 1 meter high and 1.30 meters at their broadest part; their weight 281 pounds; their content 205 Imperial gallons of oil, weighing about 1,590 lbs.

The puncheons are sent out from Europe, packed in pieces ready cut, with bands, bungs, and bottoms, and put up at the mill. Their cost at the mill was in pre-war days £1.19 made up as follows:

Manufacturer's sale price in Europe	..	£1.6.0
Freight	.. ..	8.0
Landing at the Coast and transport	..	2.0
Cooperage (putting them together)	..	3.0
		£1.19.0

The present price would be, say double = £3.18.

As the mill has a nett production of 202 tons of oil to deal with, it will require 285 puncheons costing at £3.18 each, £1,111 converted at £8.54 = $9,488.

Kernels. Where loading facilities exist, the kernels are shipped in bulk—but where boats have to be used to the steamer, bags have to be used, which contain 1 hundredweight of kernels and would cost at present say $0.75 apiece. The output of the mill being 536 tons of kernels it would require:

10,720 bags costing	$8,040
Transport to the Coast and loading:	
285 puncheons oil at $4.00 .. .. .. }	$6,500
10,720 bags kernels at $0.50 .. .. .. }	
Insurance, freight, storage, Commission. Shortage *i.e.* 50% on $83,213	$41,600

So far the yearly expenditure of the mill would be as under:

Depreciation repairs, etc.	$20,336
Wages and salaries	38,750
Puncheons and bags	17,528
Transport to Coast and loading ..	6,500
Insurance, freight, etc.	41,600
	$124,714

The produce sold in Europe, as shown above, would realise £36,528 or $311,950.

The 1,200 acre estate has therefore a credit balance of $187,236 to defray its expenses of cultivation, of harvesting, of transport to the mill, etc. *i.e.* $156 per acre.

The margin available for dividend will be a small one and might even be to the debit side of Profit and Loss Account.

The aim of this paper is not, as might be inferred, to make a case against the cultivation of *Elaeis*. The question is too large a one to be approached with prejudice, for there is little doubt that, placed under favourable conditions, the oil yield of *Elaeis* is so great that it puts the palm at the head of all oil-yielding plants of the world.

The question, in fact, is full of interest and it deserves to be probed in a much fuller way than is done in this paper.

The pioneers of Rubber planting were, for a long time, pulled this way and that, in their first steps in the, then, new industry. Some, on expert advice planted *Ficus elastica* others *Ceara,* and a good deal of money was sunk in putting these in the ground—and more money went in cutting them down afterwards. On the whole, however, the birth of the rubber was not a painful one, and the child has grown into a hefty boy. But blunders will cost more in the case of *Elaeis*: bad selection of land, wrong selection of seed, will kill it.

The writer has just received, and has now before him, photos taken in West Africa and, amongst them, are two bunches of *Elaeis* collected in the District of Lusango (Congo). One, standing on a table, must be, judging from the height of the man holding it, at least two feet high and nearly as broad,—a perfect mass of fruit, but its weight is not given. The second one is probably as big, but there being no standard to judge by, it cannot be estimated; its weight, however, is given as 62.750 kilos or 136 pounds!

Now, if the usual computations hold good in this case, that is, that the fruit weighs $\frac{2}{3}$ of the weight of the bunch, we have 88 lbs. of fruit, of which the oil-yield as obtained by machinery *i.e.* 16%, would amount to 14 lbs., and, as a conservative estimate would put the yearly crop of bunches at 5, we should have from one tree, 70 lbs. of oil and from one acre of 50 trees—3,500 lbs. of oil worth £125 in London. If besides, we reckon the weight of kernels at 20% of the weight of the fruit, we should get a crop of 88 lbs. for 5 bunches = 4,400 lbs. of kernels per acre worth £74. That is to say, the gross return of one acre would amount to £199.

There seems no reason why, under careful systematic cultivation, and under suitable conditions of soil and rainfall, which these countries afford, such bunches should not be obtained; then, of course, the whole aspect of *Elaeis* planting would change provided the labour is at hand.

Trees are not uncommonly seen in Malaya with 8 or 10 bunches; the writer has seen one in Sumatra with 12 bunches which would all be ready for cutting within twelve months. But the question is governed also by the yield of oil and of kernels. As shown by the analyses made by the Imperial Institute, some varieties like the "Au Suk Ku" yield as much as 83% of pericarp and 48% of oil, while others, like the "Udin" show only 25% of pericarp and 16.5% of oil.

The following points also invite consideration, firstly the fact that *Elaeis* grows in pure natural stands on the West Coast of Africa and secondly, that there it is only fourteen days from the European markets.

The whole problem of the future of *Elaeis* is, in fact, bound up with:—

1°. Selection of suitable varieties yielding thick fleshy pericarps with heavy oil content and heavy kernels with preference for short-stemmed trees which greatly reduce the cost of cropping, (as is the case with the dwarf coconut) and for those which mature their fruit at well defined periods.

2°. Selection of land, preferably flat land, with water transport both within the estate and to the coast; irrigation where dry seasons are prolonged; ~~plowing~~ ploughing between the rows of trees; heavy pruning of the lower leaves especially those that encircle the bunches; search for beetles; using the "poonac" for manure.

3°. Easing of the work of cropping, which certainly admits of much improvement. The adoption of light folding-ladders allowing the coolie to use both his hands; of powerful hand shears or tree-pruners to cut through the peduncle of the fruit.

4°. A judicious use of native methods of "depericarping," blended with mechanical devices of well authenticated efficiency.

5°. A settled population from which to draw labour.

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(*To be continued.*)

References.

"Le Palmier a huile" Paul Hubert.

"Bulletin des Matières Grasses de l'Institut Colonial de Marseille," 1919. Nos. 4 and 5.

"Agricultural Bulletin F. M.. S." September-October, 1918.

Dudgeon. "Agricultural and Forest Products of W. Africa."

J. H. J. Farquhar "The Oil Palm and its Varieties."

"Bulletin Commercial et Financier du Journal d'Agriculture Tropicale," November, 1919.

"Bulletin de l'Association des Planteurs de Caoutchouc," November, 1919.