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The Oil Palm in the East. II.

In the paper which appeared under the above title in the April number of the Gardens' Bulletin, several points of interest to the prospective planter of the oil-palm were touched upon, which it is now proposed to treat more fully.

Selection of Land. Most of the thick palm-forest of West Equatorial Africa is found in broad open valleys with gentle undulations, where the soil and the rainfall favour the palm, and along the level plains from the coast to the high bush. It becomes scarcer in hilly regions and it is seldom seen, except in widely scattered patches, at altitudes of more than one thousand feet. The palm-forest stops where the evergreen equatorial forest begins. *Elaeïs* is essentially a tree of the lowlands and it is even found in situations which are intermittently submerged in periods of floods—but yet it does not thrive in swampy or badly drained places where water stagnates. Briefly it is at its best on well drained flats of deep rich soil with plenty of atmospheric and soil moisture, and it will be apparent, if we keep in view the general configuration of the Malay Peninsula, that its range of profitable cultivation is not a very wide one—at least not if we compare it with that of Rubber which accommodates itself to a wide range of soil conditions and to greatly varying altitudes—or with that of the Coconut which thrives right down to the sea-board in almost pure sand, or along the course of tidal rivers in salt-impregnated soil.

The selection of land for the planting of *Elaeïs* will therefore have to be carefully thought out, the planter keeping well in view not only the suitability of the soil, but the configuration of the land and its easy accessibility by water or by road; also the necessity of a thorough but economic network of communications between all parts of the estate and the factory. Some of the sugar estates of Province Wellesley, long since transformed into rubber estates, with their canalisations, would probably well fulfill, in respect of communications, both internal and external, the requirements of an *Elaeïs* estate; this, of course, apart from considerations of soil.

However, one thing is now certain, viz: that the *Elaeïs* does grow well under congenial conditions in Malaya, and that it produces crops as heavy as those recorded from West Africa; and, although there is no room in Malaya for the vast stretches of Palm-forests as seen in Africa, it is quite possible that fairly large tracts of land could be found, suitable for its cultivation. One expert who knows the Congo well, and who is also well acquainted with Malaya is emphatic in his opinion that certain parts of the Peninsula offer ideal conditions, in point of soil and climate, for *Elaeïs*.

Nurseries. Once a suitable location is found for an estate, the initial work of opening up will not present any special difficulty to a practical planter: it entails the usual programme of felling, clearing, draining, road tracing, &c., &c., but when we come to the establishment of nurseries, the difficult problem of an adequate supply of seeds will have to be faced. Seeds could perhaps be obtained from Sumatra, East Coast, where, according to the latest information, 6,500 acres, planted with 290,000 *Elaeïs*-palms were in full bearing on the 30th June, 1919, producing 700,000 kilos of oil during the first half-year of 1919. If *Elaeïs* has proved the success which these pioneers hoped for, they may not be too eager to part with their seeds, except at very high prices. Failing such a source of supply, seeds would have to be procured from West Africa—a proceeding not without risks, in view of the diversity of races of *Elaeïs*, and their varying oil-yielding qualities. Still, the thing has been done before, with success in the case of these Atjeh plantations, and it could, no doubt, be done again.

It may be said, if all has gone well with the selection of the land, and if the difficulty of the seed-supply has been overcome, that the planter has four years of easy time ahead of him in which to lay out his estate to the best advantage. He can safely leave his seedlings in the nurseries for full twelve months, before transplanting. The writer has had occasion to transplant trees at least two and a half years old, most of which, after three months, had resumed their normal rate of growth.

Catch Crops. Here then is an opening for the planter to put down catch crops of food stuffs such as maize, sweet potatoes, groundnut, to the extent of his labour facilities, or for putting down a subsidiary crop of coffee or perhaps of cocoa, which is said to succeed particularly well in West Africa with the oil-palm, owing to the large amount of moisture which is stored in the latter's root-pad, and in the felt coating round its trunk, and which comes in as a reserve in times of drought.

Moreover, it may be observed here that the *Elaeïs* does not form the same far-spreading matted rooting which characterises the coconut and renders it so uncongenial a neighbour to other plants.

At the base of the *Elaeïs* a pad of earth and roots forms, from which emerge successive generations of roots most of which do not live long, but their dead remains subsist and go to swell the

pad on which the tree stands. Those roots which live radiate in all directions to a distance from the tree. The writer has followed one, by digging with a fork, to a length of 32 feet from the base of the tree. Of a uniform thickness throughout of about one quarter of an inch, they run in an almost straight line through the earth, forming very few branches (only one short branch was observed in this case) and no hair-roots; but, at every three or four inches, single short feeders, from three to eight inches long, are seen emerging from the main-root and perpendicular to it; it requires a fairly strong pull to wrench these feeders out of the earth, and, in their *ensemble*, they must constitute a very powerful anchorage for the tree. The older portion of the main-roots, *i.e.* that portion nearest the tree, is woody and somewhat brittle, but it becomes soft and pliable in the newer parts; and under the brown epidermis which rubs off easily, it is found to be quite white and turgid. If the covering tube is slit longitudinally, continuous semi-transparent cord can be detached of the appearance and thickness of Chinese vermicelli: if squeezed, water oozes out of it. This shows that, given a free open soil with plenty of moisture in it, (which is the case for the tree under review) the *Elaeïs* can draw sustenance from a fairly wide area, and, under similar circumstances, wide-planting would be indicated. But, on the other hand, these main-roots are not numerous and they are easily interpenetrated by the roots of other trees, as was found in the present case, where two neighbouring trees, (one rubber, one coffee) were found sending their roots in all directions, above and below those of the *Elaeïs*. In another case, that of an *Elaeïs* over thirty feet high, growing in stiffish laterite soil, a root one inch thick, of a *champadak* tree (*Artocarpus polyphemia*), standing 20 feet away, was unearthed within five feet of the basal pad of the *Elaeïs*. Briefly, then, the root-system of the Elaeïs does not form a thick network, as the coconut does, and its interference with the neighbouring vegetation does not appear to be such as to inhibit the cultivation of plants foreign to it. Hence the interplanting of a subsidiary crop, (given proper spacing), which cannot be recommended, except at quite an early stage in the case of coconut, appears to the writer's mind, as a sensible and practicable proposition in the case of *Elaeïs*. The more so as during the period of waiting for the appearance of ripe bunches of fruit, the labour of upkeep will be reduced to keeping the weeds down (work which will be assisted by the subsidiary planting), to pruning off the lower leaves, and keeping the trunks clean. Moreover, as the *Elaeïs* grow older, their productiveness will decrease, whilst, the trees being taller, fruit bunches will cost more to collect. A subsidiary crop of coffee or cocoa may then prove a saving standbye.

The Crop. In or about the sixth year, or earlier, under favourable conditions, the first bunches of fruit may be expected and the serious work of the estate will then begin. Not that the harvesting will offer any great difficulties up to the ninth or tenth year, for the upward growth of the trees is slow up to that period, and if the

pruning of the leaves below the bunches has been attended to, the bunches will be easily accessible without climbing in most cases. But meanwhile two problems will have to be solved:

1. The transportation of the bunches to the mill, and, unless a clear grasp of the difficulties of the case has been taken at the inception of the estate, and its distribution planned accordingly, the labour involved will bear heavily on the concern.

2. The treatment of the fruit for extraction of the oil at the mill.

Touching the subject of oil-extracting machinery, the writer has already declared himself incompetent to pass an opinion on the relative merits of the appliances in use for treating the fruits of *Elaeïs* and what is written below must be taken only as the result of reflexions of a layman face to face with the elemental side of the problem as it presented itself in his own homely methods of extraction as previously described (Bulletin April 12th).

At the end of the latter Bulletin the writer expressed the view that the future of *Elaeïs* is bound up with, among other conditions:

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

An article of The Tropical Agriculturist of March 1920, affords an opportunity of amplifying that statement. The article is an extract of the Bulletin of the Imperial Institute, Vol. XVII, No. 2, which, itself, is a reproduction of a report of Mr. A. Bories, Inspector of Agriculture, French Equatorial Africa, published in the *"Bulletin des Matierès Grasses,"* No. 2, 1919. The gist of the report is given below, but as in the conversion of French weights into English, certain minor errors have crept into the account. Mr. Bories' figures are here reintroduced.

On a "palmery" at Louna (Gabon) consisting of 30,000 palms which had been looked after and kept clean during a previous period of three years, 4 men and 4 women were told off to gather a crop of *Elaeïs* and bring it to its ultimate result, viz: clean oil.

The first day was spent in collecting and transporting the bunches to the house. The result was 120 bunches weighing each about 10 kilos = 1200 kilos = 2640 lbs. equivalent to 1700 pounds of fruit. The bunches being of full ripeness the picking of the fruit out of the bunches was easily performed in the course of the afternoon.

The second day was spent in making the oil, an operation which took altogether about five hours, consisting in 1st cooking the fruit, 1 hour 30 minutes: 2nd pounding, 30 minutes: 3rd depulping, sorting out the stones and re-heating the pulp, 1 hour 30 minutes: 4th extraction of the oil, 1 hour.

Cooking the fruit was done successively in three iron pans, each of a capacity of 22 gallons, each receiving about 190 pounds of fruit, with about 4 gallons of water. The whole was covered with banana leaves. When, after 1½ hours cooking over a brisk fire the fruits were sufficiently softened, they were shovelled into a mortar.

Pounding the fruit and sorting out the stones. The usual form of wooden pestle was used. The pounded mass is then laid on iron plates where the women do the picking out of the stones, the fibrous pulp being put in wooden buckets, which were in this case barrels sawn in two.

Re-heating the pulp. The pulp now cooled is re-heated by means of stones heated to a very high temperature, which are dropped and stirred in the mass of pulp.

Extraction of the oil. The pulp is ladled into sacks made of rotan with a slit on their sides by which the pulp is introduced. At both ends of the sacks are loops through which a pole is passed and by turning these in opposite directions, the torsion produced on the sacks forces the oil out.

The next day the oil is boiled over a slow fire, which causes the water to evaporate, while the scum formed on the surface by impurities is skimmed off.

The yield of oil was equivalent to 12% of the weight of fruit, to which should be added the yield in Kernels (omitted in Mr. Bories' report) say at the rate of 20% of the weight of the fruit.

Thus we get as the output of two days' work of 4 men and 4 women,

1700 lbs. of fruit = 204 lbs. of palm oil. . .
plus 340 lbs. of kernels.

This put into Malayan figures at a price of (see Bulletin des Planteurs de Caoutchouc December 1919).

Florin 0.40 per kilo of oil in Sumatra.
0.20 „ of kernels do.

is equivalent to *f* 0.18 and *f* 0.09 per pound and we obtain as final result,

204 lbs. of oil @ 0.18 = *f* 36.72
340 „ kernels 0.09 = 30.60

f 67.32 = @ 1.15 = $58.50
Straits Currency.

Thus 16 days (8 people for two days) of coolie labour have produced a value of $58.50, or one coolie day, costing, say one dollar, has brought in $2.65 of nett revenue, less cost of cultivation.

This figure would do credit to a crack rubber estate; the more so as we are dealing with a process which, although constituting a great progress on the old native method of fermenting the fruit in heaps, is still very crude and capable of great improvement, (with consequent increased yield of oil), without the aid of any very complicated machinery.

But can we accept the above account of work as representing a normal and regular daily output of a coolie-day?

Here we have a very high official inspecting a crack palm-stand of 30,000 trees, kept up to the topmost state of cultivation obtain-

able in the country. It is highly probable that the manager in charge will choose for trees to operate upon, those which bear the heaviest crop of well-ripened bunches and will, besides, put in charge of the work, his most proficient labourers. The manager of a crack rubber estate, placed in similar circumstances, would, in all probability, select a first-rate tapper to tap a few chosen trees among his best "milkers" leaving aside those that have run dry through Brown Bast or other disease. Thus, in all good faith, startling results could be shown, but they would not be, in any way, representative of the normal yield of all the trees on the Estate.

Be this as it may, the process described above deserves to fix our attention for other reasons. Crude as it is, there is found in it a train of thought which inclines one to think that it was not born in the brain of the natives of West Africa without suggestion from the white man.

The most convenient way of separating the pulp from the stones, that which offers the line of least resistance to the native, is the fermentation process, which, if carried on long enough, causes thorough disintegration but causes also a considerable increase in the degree of acidity, which in oils so obtained, often amounts to 25 and even 30%, whereas the oils obtained by the above method are said to contain no more than 10 to 12% of free fatty acids. By carrying the process right through without interruption from the gathering of the bunch to the expression of the oil—by submitting the fruit at once to a steaming process in a small quantity of water, these natives suppress, or greatly check the formation of ferments—in fact their process is akin to a veritable sterilisation.

The same aim is furthered by using hot stones instead of water to increase the fluidity of the oil in the pulp, besides which the after operation of expelling, by evaporation, a great mass of water is dispensed with.

We can therefore trace, in the process, a set purpose of checking fermentation, which was probably initiated by Europeans in the beginning.

But, although the extracting process may be considered as satisfactory, so far as it goes, from the point of view of the degree of acidity, there is yet ample room for improvement in the man handling of the crop, by, as previously suggested, "a judicious blending of native methods with mechanical devices."

It may not be possible to attain the rapidity of action of the Trevor system, which, it is claimed by the inventor, can extract the oil within thirty minutes of the arrival of the fruit at the factory, but yet much time might be saved on the sequel of operations previously described.

For instance, it took 8 people one half-hour, *i.e.* 4 hours to pound the fruit in mortars, an operation which a hand-contrivance

in the nature of a disc coffee-pulper with a revolving rasping surface, could probably effect in much less time, and with less labour as the material would be worked by gravitation through hoppers.

Again, coils of heated steam in autoclave pans would advantageously take the place of hot stones to heat the pulp and would do it in half the time.

Lastly, a handscrew-press or a hydraulic press would be a sure improvement on the twisting of the rotan-bag.

It is therefore quite possible, even while following the lines of native methods, to reckon on an increased production of oil which would bring the output to a figure not very far behind the 16% which is the actual percentage claimed for modern mechanical appliances.

Conclusion. A question was hinted at, towards the end of our previous paper which was put to the writer, somewhat in the following way:

"Given the existence in West Africa of large stands of "*Elaeïs,* growing in its own native habitat and largely in the "bearing stage—exploitable at once at the cost of clearing the "undergrowth and cleaning the trees—would not capitalists, fol- "lowing the lines of least resistance, be more readily attracted to "such a proposition than to one entailing the heavy toil and "expense, and the long wait for results, implied by the opening up "of jungle land, in a country like Malaya, which has the further "disadvantage of greater distances from the home markets?"

The situation here presented, has, to some extent, a parallel in the "*Estradas*" of *Hevea* in its natural habitat on the Amazone, where the "*Seringuero*" collects the latex and coagulates it on the spot. We know, however, that this method of production cannot hold its own, either in the matter of economy or of quality and purity, against the product of cultivated rubber.

But would not the case be materially altered, if, instead of isolated trees or colonies of trees widely scattered in the forest, the *Hevea* trees were found in pure, unmixed stands over extensive tracts of forest, necessitating only the erection of a factory on the spot to transform the latex into clean, pure sheet, or crêpe rubber? In a word, viewing the *Elaeïs* as it presents itself in many parts of West Africa, in large pure stands of forest, is it not conceivably possible that it would be readily exploitable in an economic way by a factory on the spot?

Not knowing the country, the present writer is unable to view the question in all its bearings, yet certain points force themselves on the mind which tend to show that the process may not be so simple nor so inexpensive as appears at first sight.

To begin with, these extensive stands of *Elaeïs,* or the right to exploit them, belong, presumably, to somebody, to neighbouring villages or communities or to their chiefs, from whom they would

have to be acquired, and, in that case, we should soon see the "option" hunter appear on the scene and it is not usual with him to give anything for nothing.

In the second place, these stands, or "*Palmeries,*" (shall we call them?) would have to fulfill certain essential conditions, which are so varied that it seems impossible that they should be met in their entirety, in a state of nature.

A suitable spot must be found for the factory with abundance of water near by. The factory must be accessible by light railways or by canals (cattle draught cannot be used in West-Africa owing to the tse-tse-fly) to all parts of the estate, as the carriage of the bunches to the factory is inconceivable in any other way.

These railways or canals, to serve their purpose effectually, cannot be made to twist their way round about irregular lines of trees; they must be laid symmetrically and at short intervals, between well defined rows of trees—which can only exist on an estate conceived and developed on a systematic plan.

If, on the other hand, as was the case presented in our first paper in the Gardens' Bulletin for April, it is proposed to erect a plant to treat 9 tons of fruit daily, we shall have to acquire a far larger tract of "*palmeries*" than the 1200 acres which the scheme implies, for it is not possible to suppose that these natural stands, partly planted, and largely propagated from fallen seeds, will be, all over, in the same stage of growth. Some parts may be too young, some too old to pay for collection, others, growing in less favoured spots, will yield smaller bunches. The stand, in a word, will not offer that uniformity and stability of production which one can reckon with on a systematically planted estate. Hence, if the daily supply of 9 tons of fruit is to be kept up, and the factory is to be kept working full time, the cropping area will have to be largely in excess of the 1200 acres assumed to be sufficient to feed the factory. Hence, also, increase of means of communication, increase of railway mileage, of wagonets, and lastly increase of labour—labour, the stumbling-block of the cultivation of the oil-palm in West Africa and perhaps elsewhere. Further, if we suppose that the owner of the oil-factory relies for his supplies of fruit on deliveries from the neighbouring villages, by purchase of the fruit instead of employing his own labour, it is fairly certain that, contract or no contract, his supplies will be, to say the least, erratic; and it is well to note here, that under penalty of increasing the free-acid content of the oil the fruit must be treated fresh.

Another aspect of the question here presents itself. So far, very little of the oil exported from W. Africa is extracted mechanically; the whole of it, practically, is made by the natives themselves by their own methods it is a familiar industry in which women and children contribute their quota. But when it comes to mechanical treatment of the fresh fruit at the mill, the whole character of the industry is altered. The work is mainly plain coolie work, confined to climbing up the palms after the fashion

A Native of Congo climbing up an Elaeis.
After a photograph taken in the Lusango District (Congo).

shown in the accompanying woodcut; to chopping off the bunches, and carrying them whole to the factory. That is to say carrying also a mass of useless matter, 100 kilos of bunches containing only from 50 to 60 kilos of fruit, equivalent to a quantity of (16%) 8 to 9 kilos of oil and 12 kilos of kernels.

That the work is irksome, we have shown, that the climbers dislike it, is a known fact. We are therefore not surprised to read that climbers are getting more scarce every year, and that the gaps thus made in the available labour of the country cannot be filled by imported labour, for they cannot climb.

Turn which way we like, we find these two initial difficulties confronting us, viz: the climbing, and the collecting of the nuts, not to mention their transportation to the factory—and that in a greatly aggravated degree, in the case of the exploitation of the West African *"Palmeries"* owing to the uncared-for state of the trees—to their dispartly of growth and the absence of ways of communication with the factory. So great are these difficulties that writing from Porto-Novo in 1919, a correspondent of the *Bulletin des Matierès Grasses* No. 5, gives it as his opinion that only trees which can conveniently be reached with a ladder should be kept standing, all older trees which require climbing being cut down.

It would be an idle waste of the reader's time to labour further this question of "Wild versus Cultivated *Elaeïs*" and we should have left it untouched, had it not been put to us with some insistence.

The following words taken from the *Bulletin des Matierès Grasses* No. 4 throw more light on the subject than we could ever hope to do.

"For a long time, the possibility of the successful establish-
"ment of an industrial exploitation (of the oil-palm) in West
"Africa has simply been denied. Even now, the majority of the
"heads of the great Commercial Firms, and of their Agents are
"convinced that any undertaking of that description is doomed to
"assured failure, for the reason that the times have not yet come
"when it will be possible to find the necessary labour among the
"native population."

And the commentator, himself an advocate of *industrial exploitation* clinches the matter with the following remark:

" The success of the mills erected in Senegal for the decortic-
" ation of arachides (ground nut) demonstrates how erroneous that opinion is."

Seeing, that, of all oil-seeds, ground nut is about the easiest to cultivate, to transport and to decorticate—all things which the *Elaeïs* is not—this argument fails to convince.

The present paper was ready for the press when the writer received the " *Bulletin des Matierès Grasses* 1919, No. 6 " with Mr. van Pelt's report of his mission of investigation in West Africa, which deals most fully with the question of the industrial exploitation of the Palm-forest as it stands. He sees no possible future in it and the reasons he gives are so cogent that they are unanswerable.

According to Mr. van Pelt, a careful valuation will show that, taking a block of palm-forest, not more than 25 trees to the hectare are immediately exploitable: that their output may be computed at 5 bunches weighing 10 kilos each, and yielding altogether 25 kilos of fruit per year *i.e.* for 25 trees, 625 kilos.

Here then, we have from the pen of a highly competent and unprejudiced observer an estimate of the capabilities of a palm-stand in its natural state given as 550 pounds of fruit to the acre per year, which, treated at the oil-mill, will give at the rate of (16 to 20%) say 18%—100 pounds of oil of a value (£80 per ton in London) of 71 shillings!

If we carry these figures to their logical end, we reach terms of pure impossibilities. For instance, to obtain 2700 tons of fruit, we shall require not 1200 acres which we found in our previous paper (April Bulletin) were necessary to keep a mill supplied with fruit for 300 working days at 9 tons per day; we shall require 11,000 acres, each acre containing 10 trees with 5 bunches that is to say 110,000 trees and 550,000 bunches. If, as Mr. van Pelt does, we estimate the capacity of a climber at 20 bunches a day *i.e.* 6,000 bunches a year, we shall require 100 climbers to do nothing else but chopping off the bunches apart from the collecting and transporting to the mill, which in itself, will require a very large number of hands.

As will be seen from the above digression Mr. van Pelt's cogent remarks completely confirm the present writer's views of the impossibility of an economic exploitation of the *natural* stands of oil-palms. If *Elaeïs* is destined to find a home in Malaya, as a cultivated product, it will have nothing to fear from its wild congener of West Africa—it will rather be the other way round, as the past history of Rubber shows.

Before finally closing these notes, the writer would call the attention of his readers to an interesting group of photographs of *Elaëis* grown in Sumatra, given by the Bulletin de l'Association des Planteur de Caoutchouc of Februay 1920. One tree, 4 years old showing a number of large bunches, hanging about 3 feet above ground, offers an object-lesson to the future planter of *Elaeïs*: the

branches below the bunches having been cut, the bunches instead of being compressed between the trunk and the leaves, hang outwardly, which allows them to expand and to receive on all sides the action of the sun, insuring thereby uniform ripening of the fruit—one of the problems of the cultivation of *Elaeïs*.

A remark in the previous paper, Gardens' Bulletin Vol. II, No. 7, p. 222 needs amending. An acre is put down as containing 50 trees planted 27 feet by 27 feet. *Elaeïs* should in no case be planted less than 30′ x 30′ which would give 48 trees to the acre. Its spread of leaves commands that span, and closer planting would be the surest means of encouraging growth upward, in response to the call of the sun, which all close-planted trees have to obey, at the expense of the proper expansion of their trunks. Above all things to be avoided in the *Elaeïs* are a long stem and a high crown.

After the above had been written the *Bulletin des Matierès Grasses* 1920 No. 1 came to hand with a very interesting notice written by Mr. Fauconnier, the well known planter of Rantau Ranjong (Selangor) with facts and figures which are of importance to the prospective planter of *Elaeïs* in Malaya.

His investigations show that: :

1. *Elaeïs* yields larger bunches in Malaya than in Africa, weights being recorded of 62 kilos.
2. The fruits of the Malayan *Elaeïs* are richer in oil, as much as 30% of Palm-oil being obtainable.
3. *Elaeïs* begins fruiting at 3 years and attains maturity at 5 years.

The yields obtained from 100 kilos of fruit bunches are 15 kilos of palm-oil, 12 to 15 kilos of kernels.

And the final conclusions are:

One acre planted with 40 trees = 6,000 kilos of bunches = 800 kilos of palm-oil plus 800 kilos palm-kernels.

Mr. Fauconnier's experience entitles these figures to our full acceptance. There only remains the question of the working costs and of the efficacity of present day machinery to obtain in practice, the output of oil as found to exist in the fruit of the Malayan *Elaeïs*.

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E. Mathieu.