NOTICE

ON THE

HEVEA BRASILIENSIS

IN COCHINCHINA

GENERAL GOVERNMENT OF INDOCHINA

AGRICULTURAL AND COMMERCIAL ADMINISTRATION

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SAIGON

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HEVEA BRASILIENSIS

As industry requires more and more a greater quantity of Indian rubber, it is time to think, not only to rely upon what Nature produces, but to try in planting various species of rubber trees. One of them that seems to render the highest benefit is the Hevea Brasiliensis.

Our pretension, in these quick studies is but to endeavour to give a summary cognizance in publishing a memento that will be useful to planters.

1°— Botanical description.

Hevea Brasiliensis is synonymous to *Siphonia Brasiliensis* which is also called Para and Hhévé rubber, on the borders of the Amazon river.

That tree grows at about seventy feet high, it belongs to Euphorbiacees family which includes a large number of species more or less white in latex Besides these, there are other hevea trees that give rubber, but nevertheless, it is from the latter that comes the largest part of the produce exported under the name of Para rubber.

Hevea Guyanensis or *Jatropha Elastica* or *Siphonia Elastica* or again *Siphonia Cahuchu* is very nearly the same as the preceeding one and for a long time it has been confounded with the latter. However the Hevea Brasiliensis has its leaves alternate, prolix foot stalk, composed of three full leaflets of twenty to sixty inches in length, elliptical lanceolate, sharp at both ends, filmy, green on the recto and darker on the verso with prominence ribs on both sides, whitish grey small specks can be seen on its inferior

face. The Hevea Guyanensis has its leaves prolix foot stalk composed of three leaflets from ten to twenty inches in length, oblong, oval, straiten at its base, bluntly sharp at its sommit, green on the recto and ash colour on the verso.

It is by the number of stamen that they recognize the Hevea Brasiliensis from the Hevea Guyanensis, there are ten in the first specie and only five in the second. The anthers are laying on the surface of a cylindrical column that terminates in an entirely small lump in the first case but devided into two lobes in the second. Those differences are interesting enough to be known for Hevea Guyanensis produces à great deal less latex, and its latex is inferior in quality. Hevea Brasiliensis produces more and of better quality.

What can help to identifie these two species, it is by the devergences of stamen and also in the division or not, of the calumn that carries anthers. Anyhow the same description has not always been given as regarding Hevea Brasiliensis. According to Mr M. G. VERNET this probably fact comes from adaption of trees by the middle. This hypothesis appears very plausible to us, as much that few trees offer marks from each other so unsettle. It is to planters to study well how to select good seeds from most of the trees and to try young plants vigourous trees proceed and in producing the largest and best quality of latex (1).

The fruit of the Hevea Brasiliensis is a capsule, oftener, with three shells (sometimes with four or five). Those shells open themselves when the fruit is ripe, during the hottest time of the day, in producing a startling report, then seeds and shells are projected to a certain distance. These seeds are like a small walnut in size, brown in colour with

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(1) *See M. Vernet, in the Journal tropical Agriculture,* N° 73 (31 st of July 1907).

light crankle rays and dark spots. They produce oil, that we shall speak of in this book which perhaps will offer a certain interest.

At last let us remark that latex tubes are in the liber near the generator layer, are anastomosed and not parallel M. VERNET believes it is Ficus elastica. This particularity is extremly important for the vessels are not all sectioned when they make an incision and these wounds can be healed during the draining even when the latex abonds through ducts still undamaged.

2°.— Introduction of hevea in Asia

Mr. H. A. WICKAM imported Hevea seeds from the borders of the Amazon river to Ceylan, and it is in 1876 that plants of Hevea have been sent from Kew to Ceylon and to Buitenzorg.

On 70.000 seeds (paid at the rate of 250 francs per one thousand) they succeeded in obtaining 4 per °/₀ germination, and in August the 12 th 1876 that thirty light cases of plants were exported to Ceylon of which 90 per °/₀ arrived in good conditions.

«According to M. MORANGE'S and M. JOSSELME'S statements the culture of Hevea Brasiliensis has been introduced in the Botanical garden of Saigon, in 1880 and they were of vigourous aspect, when 4 or 5 years after, they were cut down, on account of the new plan made to the garden».

« Doctor Spire mentions that in 1891 M. SELIGMANN, Inspector of Post and Telegraph brought some Hevea Brasiliensis plants from his voyage in Malay country, but no trace could be found of them a few years after».

« From the same author, Doctor Yersin, planted in 1895,400 trees at Suôi-Giao, near Nha-trang. But Doctor Yersin declares in a letter sent to the Agricultural Chamber of Cochinchina (published in the official report of March 1899 page 213) that he received his plants aged 18 months from the Botanical Garden of Saigon».

«That age coincides precisely with the time that seeds were given to be planted by M. RAOUL, a colonial chief chemist during his voyage in the East and in Malay country, to the Botanical garden of

Saigon in the second half year of 1897. M. VERNET confirms also that the first plants at Suoi-Giao comes from M. RAOUL.

« The meritorious distinction of introducing the Hevea Brasiliensis in Cochinchina comes to that renowed botanist.

« The parcels of 1800 young plants from Ceylon were fowarded by M. RAOUL to M. HAFFNER, Superintendent of the Botanical garden at Saigon, of which 200 were despatched to Nha-trang and 600 distributed to several planters, particularly to MM. CANAVAGGIO and JOSSELME, 1000 were planted in the Essais garden, at Ongiem, in 1898».

3°. — Utility and preparation of the product.

a). — *The latex.*

The juice of rubber is generaly white scentless, holding in suspension a great number of small globules (of $0^{m}/^{m}$ 0035) which are separated under the action of reactings or by heat, the lump where they are and constitute the rubber whilst the remaining liquid from forms the serum.

Pure rubber is a mixture of carbureted with hydrogen. This solid lump of rubber obtained by coagulation is not pure, there is more or less a proportion of resin, some azote substances, which they call Mucilaginous or albuminous and also salt of calcium when it is question of the Hevea ; and protoxyd of iron, when it is Africa rubber and some magnesia salt when it is treated as Ceara.

For rubber to be of good quality it must contain very little albuminoide substances this can only be found out by burning it. If at that moment there is a smell of burnt hair or corn the product is bad; but the product is good if this should not happen.

It is said also that the value of a specie of rubber is proportional to the hydrogen carbure of the rubber. However, it must not be forgotten that this product being employed in Industry is very much varied in its forms, such rubber which presents all the chemical qualities required will not do in a determined case, while, on the contrary it would be superior for some other application. The Industrial ex-

perience of a specimen of rubber is also useful, if not more, than the chemical analysis which can only give an indication.

Whatever it may be, here is a comparative table as to the analysis of different kinds of rubber (1).

DÉSIGNATION	IN THE RUBBER WASHED AND DRIED.					
	RESINS	OXYGEN	ALBUMEN	SUBSTANCE inorganic	PURE rubber	RESIDUE
Para fine	1.9%	2.2%	2.9%	1.1%	91.9%	8.1%
Para	2.0%	2.3%	4.1%	1.3%	90.3%	9.7%
Ceara	2.1%	2.4%	3.3%	4.5%	87.7%	12.3%
Rubber of Colombia	6.8%	6.8%	3.5%	1.0%	81.9%	18.1%
Rubber of Antilles	8.6%	7.2%	10.4%	3.2%	70.6%	29.4%
Rassai	6.4%	6.6%	7.4%	2.8%	76.8%	23.2%
Kassai	5.6%	5.4%	7.9%	2.1%	79.0%	21.0%
Congo superior	6.1%	5.6%	12.4%	3.2%	72.7%	27 3%
Madagascar	7.2%	5.8%	6.8%	1.2%	79 0%	21.0%
Batanga	12.4%	8.9%	12.7%	2.7%	63.3%	36.7%
Thimbles	9.1%	7.8%	8.4%	3.6%	71.1%	28.9%
Lopori	5.9%	5.7%	7.2%	1.8%	79.4%	20.6%
Mozambique	5.8%	5.8%	6.1%	1.9%	80.4%	19.6%
Bornéo I a	8 0%	5.9%	10.8%	2.2%	73 1%	26.9%
Bornéo III a	15.0%	9.0%	14.9%	3.8%	57.3%	42.7%

Mr SERRE, the French Consul, at Batavia gives (2) on the other part the following analysis for well dried Para produced by the Buket Rajah Rubber Co.

Rubber	95.37 %
Resins	3.02 %
Albuminoïde substances	1.24 %
Mineral substances	0.37 %

(1) We extract this from the "Pratical manuel of Rubber fabrication and products that come from" by MM. Adolphe Heil and Dr Wesch.

(2) *Journal of Tropical Agriculture*, n° 46, April 1905.

The little quantity of albumen contained in the fine Para can be verified: it is in it that can be found the smallest quantity whilst the pure rubber, that is to say the hydrogen carbures, is in considerable proportion.

By unorganic substance we mean salts of calcium, iron and magnesia of which we spoke just now.

The serum contains besides the coagulate mass, which is the rubber and its impurities, sweetish substances, organic and azote components and mineral substances.

The sweetish substances render certain latex eatable such as those of Hevea or Hancornia (1)

The organic azote substances are those which cause the putrification of certain rubbers by their fermenting so that a product badly prepared has the most desagreeable smell.

The proportion of these substances is 2, 3 % according to Mr Seeligman in the Braziliensis hevea latex, and it is greater when it is question of rubber produced by Manihot glaziovii. We have seen in Tonkin slabs of this product which although prepared with the greatest care, had still a nauseous smell. Only one manupilation could weaken the strength of the smell and this was attained in washing several times the slabs with « Marseilles soap ».

It must be observed however that in the serum of Ficus, salts of magnesia are always found while they do not exist in the serum of Hevea which contains salts of lime and potash.

M. Farauday analysed the latex (serum and globules) of the Brasiliensis hevea produced in Brazil and found that it contained.

Rubber	31. 7 %
Albuminoïde substances	1. 9 %
Coloured and bitter organic substance	7.13 %
Other products	2.90 %
Water	56.37 %

(1) The rubber and gutta percha plants by Henri Jumelle.

M. Bamber analysed latex from the Botanical garden of Peradeniya (Ceylan) with the following results :

Rubber	41. 3 %
Albumen calculated according to the quantity of azote	2. 8 %
Dust and sugar	0. 7 %
Water	55. 2 %

The comparison of these two analysis is of considerable interest, not only by showing the greater proportion of rubber contained in the latex of Ceylan, but specially in the fact that this rubber contains almost rubber and water.

The chemist declares that Mr Cibot is right when he says that the natural rubber is beaten out by the product of the cultivated hevea.

« In the course of 1903, says Mr Cibot (1) 20.000 kilos of rubber were exported from Ceylon and sold at a price sensibly higher than that of fine smoked Para.»

« It may be thought, that that price was an exceptional one and due to the fact that manufacturers desirous of trying this new rubber favoured the sellers with a good price. This is perhaps in some way true but in considering that this rubber dried before being despatched looses very little of its weight when stored and that it presented in form of thin and translucid slices thus revealing the cleanliness of the product which then only needs a slight crushing which are so many real advantages ; it is easy to understand that the over valued price of the cultivated Hevea rubber is but only justified. »

The analysis proves besides facts, which have been partly verified by the practice and which we consider as primordial :

« The latex gathered the 1st day at Buitenzorg, says the Dr P. van Romburgh (2) at the moment of the falling of the fruits had a specific weight of 0,966 at 26 and contained 48 % of rubber. In the dry weather at the falling of the leaves the quantity of rubber was even of 60 %. That explains sufficiently the great facility of the coagulation of the latex. This latex contained 0,25 % of azote and in admitting that the latter is only found under the form of

(1) *Journal of Tropical Agriculture*, no 43, jaanury 1905.

(2) The rubber and gutta percha plants cultivated in the Indies Dutch settlements.

albumen, the quantity of albumen is to be 1,6 %. In the dried coagulated rubber, the azote was to be 0,44 % (équivalent to 1,6 % of albumen).

In the following tappings the quantity of azote contained in the latex decreases while the percentage of water is always increasing. For instance in the latex of another tree, Mr Tromp de Haas found after 5 tappings done within 15 days the following respective quantities of azote 0,364 — 0,369 — 0,341 — 0,278 and 0,273 % ;

That is to say that during the dry season and even during the warmest hours of the day the latex which is gathered contains less water and more rubber. At first this appears to be advantage but we do not believe it. In fact the substance being more diluted becomes coagulated almost instantly and a great many *scraps* and *sernamby*, are obtained in small quantities of rubber, coagulated at the factory. Besides, if the proportion of water increases, the azote diminishes, and therefore it results that with a concentred liquid subsequent putrification is liable to be more considerable.

To confirm these suppositions there is still much analysis to be done on latex obtained at different hours of the day and the results may perhaps prove that it is necessary to water the Hevea. It is not here that we have to try and find the reason of the opinion which prevailed for a long time that the Hevea trees should be planted in low and damp ground. Does the water in any way influences the growth of the tree? We are of a different opinion because at Ongiem we always noticed that the yield was increasing when dew was abundant. When the rubber is of good quality, in thin transparent slices, it is of a yellowish white or of a yellowish brown in thicker slices.

When it is well washed, well dried and without bubbles of air, than it has a specific weight which changes from 0,925 to 0,967. At normal temperature it is elastic and flexible but its properties diminish when the temperature lowers, it takes up amply when the temperature becomes normal.

It is a bad conductor of heat and electricity (that is why

it is employed as isolant) but by the rubbing and pressure it stores up electricity, so well, that it is used sometimes to replace the glass plates of electric machines. When it is slightly warmed it becomes soft and can be soldered it transforms in a doughy substance with the heat, which makes it malleable, and it is that substance which renders it precious for the fabrication of articles in rubber. Little by little, after some time, the mass cools and the rubber becomes elastic. When it is warmed very much it becomes soft and sticky, even after it is cold.

The alkalis — and acids extended on rubber does not harm it, but it is not the same case when the latter is in a concentrated state :

The sulphuric acid carbonizes it.

The azotic acid colours it to an intense yellow, dissolves and decomposes it, when warmed.

The water is absorbed by the rubber which becomes white, after an assimilation of a certain quantity of liquid.

It puffs out in the concentrated ammoniac.

It dissolves in the sulphuret of carbon, benzole, ether, chlorid of carbon, turpentine etc..

When the rubber is rich in azote and when the albuminoïde substances have not been extracted from the mass (on account of the milkish juice left in the interior) a fermentation occurs and forms it stick like glue. This reaction happens so rapidly in the product when it is exposed to the rays of the sun: so it occurs when the rubber is to be conserved; it is absolutely necessary to have it in dark and well aired warehouses suspended apart from one another to prevent getting heated.

b). — *Obtainment of latex.*

Methods and Instruments.

The latex vessel is not in the bark but upon it, buried in the liberien parenchyme near the generator bed of the

cells. It is in the vicinity of the generating bed which renders the operation of the tapping very delicate, because as soon as it is tapped deeply, the course is injured and the tree is then incapable to recover from its wounds which are made by the constitution of different instruments. On the other part when the instrument does not enter deep enough the latex vessel is not sectioned and the milkish juice does not run out. Then it is easily judged that in these conditions, the aim of all the inventors of machineries for tapping is to adapt an instrument with a notch stopper that would prevent the difficulties mentioned above from going in too deep, although, in letting it penetrate up to the contact of the generating bed. To solve the problem it is almost insoluble in this way, that the thickness of the liberating bed and the bark changes not only in the age of stock but also in its individual characters. Such trees will have a thick appeareance, some others of the same age will present a thin parenchyme. This operation on the above is made at a certain height according to its thickness: the instrument with a notch stopper should be regulated at each degree for tapping a single tree.

What ever it may be, if successively a revue was passed over all the tools employed it will be noticed that the effort of the inventors are pushed as far as to give a fulcrum to the workman so that in tapping he will be master of his incision.

Indeed, we are at present away off the Machadino » which Mr Cibot describes (1), but the instrument of perfection has not yet been made and the hability of the tapper is still a great job says M. Cibot :

« The *Machadino* is a small hatchet of 8 to 9 centimeters in length and which the blade does not exceed 3 to 4 centimeters. It is never very sharp in order not to injure the wood at the moment when the cut is given which will join the latex of the bark. It is adapted to an handle in wood of 40 to 50 centimeters ajusted with a socket and chips of wood or nails. »

(1) *Journal of Agricultnre tropical, paper*, nº 18 December 1902.

Mr Parkin, who was charged in 1898 to study at the Botanical Gardens of Ceylon, the best proceedings of tapping, praises the use of a carpenter's chisel having 25 to 35 m/m in thickness and at 3 m/m from the blade.

A cut in the form of a V is made by the chisel, and bellow is placed a cup in which the latex is gathered. These cuts are made with the chisel by driving it into the tree with the help of a mallet.

Without changing the way of making incision, the tool is transformed afterwards and in 1903 M. F. J. Holloway at Kepitigalla (Matale district Ceylon) used a triangular gouge with up spout.

« Thank to the evidant sharp with which the incision is absolutly sure, said the author (1), the tree is very little damaged. In practice, both hands are used indifferently to touch the handle from the wood. In placing the inferior part of the angle from the summit to the beginning of the wound the gouge is drawned from the top downwards, repeating the same operation twice or three times in the incision made, but in taking care not to damage the wood ».

We must say that similar tools are used at Ong-Yèm, and in spite of improved tools we have not yet seen any that may be as useful as the one mentioned. Unfortunately, it has no notch stopper and it is the pratice alone that teaches how deep the gouge can go in; the pratice teaches also the way how to hold the instrument in giving it the obliquity required in order that lateral trenches should present an inclined brim according to the surface of the trunk.

Whatever it can be said, if we continue to enumerate the tools used with the most success we see that for a time scissors were used also and by forcing an impression in striking on the instrument it has a cut in the form of V. Then a knife with very short blade has been fabricated. The blade is regulated with a screw in order to cut as deep as it can be.

(1) India Rubber World, March 1903.

In the same course of ideas Mr R. J Block made a tool called the regulated chisel.

« It is formed (1) by a chisel, on the blade of which is adapted a movable piece which can be screwed tight in order to regulate the deepness of the incision in accordance with the thickness of the bark. The instrument is constructed in such a way that the cut leads from bottom to top and this prevents the stoppage in case of rain. A wood mallet is used for driving the chisel into the bark ».

With the new methods of tapping, the instruments are also altered. This is why for spiral tappings certain knives created sensation for some time at Ceylon.

The description given by M. F. M. (2) is the following :

« The first is a sort of tracer in which there is a regulated point and two blades tracing two parallel lines on the bark : the second is the knife itself ; it serves to reapest the upper part of the cut and is fitted also with two blades so that it may be used in any way. It must be noticed especially that there is a flexible blade which limits the deepness of the cut and obliges the workman to respect the cambium. The last stool is very peculiar : it is called « pricker » and is a kind of rowel which moves by pricking instead of gashing.

« The rowel is on one side of the tool while on the other side is a triangular guide which determines the deepness of the pricking ; the deepness can be altered in changing the guide. The use of the rowel is not indispensable, but it offers the following advantage : the new cut of the bark is alternated with the pricking thus allowing to strip but only 25 m/m of the bark per month. In cutting daily the bark with a knife, it is very hard to strip off less than 50 m/m of the bark per month, that is to say that a year's tapping is sufficient to join two consecutive spirals while the use of a rowel enables to recede that limit of a year.

« We gave a description of these tools because they appeared to be of interest, but it must be reckoned that tools of a new model are to be seen daily in Ceylon and straits Settlements which are generally suitable for the work they have been made for.

« In the 2nd Edition of his book entitled Para Rubber, in which the introduction is dated the 11th of May 1906, M. Herbert Wright of the Botanical Gardens of Ceylon, describes : — we take the figure according to the index 16 taping tools, 10 of which are special ones patented by their inventors as per list below : Bowman Mothway, Brown and Co, Collet, Dixon, Eastern Produce and Estates Co, Golledge, Holloway, Macadam, Mackenzie, Macadam-Miller ; at last half a dozen of models connecting with artisan's tools »

(1) *Journal of Tropical Agriculture*, no 39, September 1904.
(2) *Journal of Tropical Agriculture*, no 61, July 1906.

It is absolutely certain that it will be tiresome and of no interest whatever to give a description of all the tools, which have been praised each by turn and then disdained.

The following advertisement published by a british firm for the tool of the latest creation will show the desires of those who make use of those tools. It is easy to see that the latest fashion of tool is said to be far better than all the previous ones.

A few reasons for which this knife is excellent (the knife in question is the « Scorpion ».

1° The reopening of the running trench can not be done by attacking the cambium, if the initial incision or the latest one have been done correctly.

2° The strips of bark which is taken off, is of an uniform thickness whether worked on the right or on the left. It does the incisions in perfect parallel lines and it can strip off 18 shavings on the bark of 0m 025 in height.

3° It leads always to the same deepness made for the first incision without going less or more inward.

4° With it the work is done more rapidly than with all the other knives. A skilful workman can cut 9m,15 in an hour's time on trees separated from one another by a space of 7m,6 0 and bearing each tapping trenches measuring in all 0m,61. It is very easy to handle it and to learn to use it with great ease.

5° It is not of a complicated mechanism, and does not bear any parts fitting one into the other, that is why it is immediately rid of all the remainings of bark and therefore cannot be obstructed.

6° It only requires a little sharpening which can be done without touching at any thing.

7° The blade (which cuts right and left) can be changed when worn out and another one put in its place within less than a minute's time.

8° As the blade is replaceable and that the support as well as the handle are of little value, if they are worn out or spoiled it is by its duration the cheapest of all the good knives for tapping which are to be found in the market and by its rapid work it overpays its value in a season.

It is therefore not necessary to insist upon saying what are the qualities to be looked for in an instrument intended for tapping, since the seller says that it possesses all of them.

Let us see now the different methods of tapping. They will be nearly as numerous and various as the knives which are employed for that use. However, it seems to be good to mistrust complicated proceeding for it is only by the rational study of the tree that the best method can be obtained. This has been studied by a clever botanical professor of Strasburg, the Dr Hans Fitting. This is an abstract of his remarks (1). The experiments were made at the Botanical Gardens of Buitenzorg on young plants of hevea, which were put at this disposal. In every method of tapping, says he, the tree sustains a prejudice. In fact, on one part the radicle system draws from the soil the water and salts which are required for the vegetable constitution. On the other hand the leaves furnish all the parts of the plant, the roots included with the indispensable materials for its living and growth. Therefore it is essential that a current should be able to run between the roots and the leaves to distribute to the latter water and food taken from the soil, while an inverse current circulates easily carring away the substances, which are transformed in the leaves, in the different vegetable constituents.

It is the trunk which carries these substances for it is composed of vessels, which are principally in the wood, for what concerns vessels used as channels for the liquid

(1) The above appeared in the supplement of Tropenflanzer of February 1909 and were translated and inserted in the Bulletin of the Association of Plantors of Rubber N° of April 1909.

going upward and in the bark for what concerns vessels used as channels for the liquid running downward. But these channels are placed vertically and parrallel to the trunk so that if the substances are made to follow an oblique line, it is immediately ascertained that there is an evident slackening in their course.

Besides these channels the trunk contains in its different parts stores of nutritive reserve. These stores are connected with transversal channels which also serve to withdraw the elements in store in case of need.

If a tree is tapped right round the trunk, by making a deep circular wound connecting with the bark and the liber, it is noticed that above the cut circle all the marrow, wood, liber and bark stores are full of organic substances.

While on the contrary the portion situated under the incision (trunk and roots) can only be provided with food by appealing to the accumulated substances kept in store in that portion for the leaves are unable to provide any more nutrition.

The resistance and the vitality of the tree will then depend.

1st from the naturc by exchange of substances between the trunk and the radicle system.

2nd from the quantity of substances in stock.

3rd from the quantity of organic substances which can run down to the foot of the tree by uninterrupted channels.

4th by the rapidity with which the wounds yield in order to connect the interrupted channels.

It must not be forgotten that if the nutritive substances are lacking, the production of latex will diminish accordingly in quantity as well as in quality.

The immediate pratical tuition which can be given of these experiments seem to be the following:

1st to give to the tree the possibility of communicating from upwards to downwards.

2nd Act in such a way that the appeal made to the substances in store, appeal resulting from the wounds made to the tree in tapping, be reduced to the minium. According to these considerations our opinion is to condemn the methods of tapping in complete spirals and prefer the proceeding which will leave the greatest part of the trunk indemn, that is to say in the present case, to half a fish-bone which only requires a cut of a quarter of the surface.

Let us therefore see the different ways of proceeding and we shall say which are in our opinion the advantages and the inconveniences of each of them. these premices being admitted.

The oldest proceeding in date is certainly the one employed in Amazonia and here is how M. Cibot (1) describes it.

«The native Seringuero commences his work before the rising of the sun and often towards 4 a.m. at the light of a torch made with the remains of rubber gathered along the Hevea trunks and rapped in a band of cloth, old shirt or trowser worn out; sometimes at the trembling light of a « lamparin »

It is during the fresh. hours of the morning that the latex flows in abundance towards 9 or 10 o' clock as the heat of the day coagulates the latex on the border of the cut made by the « Machadino and stops the flowing.

«The first day, the seringuero taps at the highest point he can reach with his Machadino and cuts in slanting the edgetool vertically of 45°, in a special trice instead of penetrating in the alburnum he succeeds in turning the blade and sends off a small rectangular portion of the bark so that the drops of latex will gather at the inferior corner of the cut and from there it will drop into the «tichela» cup placed beneath.

The number of gashes made on each tree depends on its dimensions; the horizontal distance adopted between each strock is about 40 c/m, so that a tree of 80 c/m in circumference (25c/m in diameter) can bear two gashes and will have two «tichelas» and so on. in increasing a gash per 40 c/m in circumference.

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(1) *Journal of Tropical Agriculture*, nº 18, December 1902.

« It happens sometimes that there are some magnificent centenary heveas with straight trunks of 15 meters height up to the first ramification and which measuring 5 meters in circumference, can bear 12 ranges of gashes and 12 tichelas; but these trees are very rare, the average circumference of the trees being between 1m20 to 1m60. The number of «tichelas» distributed in the « Estrada » is from 4 50 to 500 which at the rate of 140 to 160 trees by estrada gives to each tree about three tichelas.

« *Phenomena of the habitat*. — It is remarked that the quantity of latex which flows from the notch, is almost insignificant during the three first days; it seems to be the usual fact in the regimen of latex circulation. One would think that the tapping operates in the same manner as a seton, in drawing the latex downwards and preventing it to flow up towards the branches.

« *Succession and duration of tappings*. — For the two first days « the seringuero » does not put any tichelas because the quantity of latex is too insignificant.

« On the second day, he does a second series of notches exactly at 5 centimetres below those done on the previous day, with his machadino, keeping always the same verticals. On the following days, he continues until he has reached the base of the trunk.

« Two days before completing the work of one of these vertical rows, the workman begins another one, side by side of that which he is finishing, he gives a knock with his « Machadino » at the same height and of 5 cm on the right of the first, in order to provide for a second vertical series of latex ducts.

« Tapping begins at two and half mètres height from the ground, therefore, on a vertical row there can be forty five notches so that at the end of a year of one hundred and eighty days there can be as many vertical four rows of notches as there are tichelas put daily.

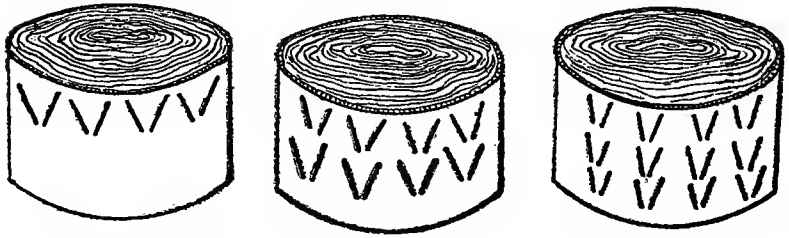
« In the second year, four other vertical rows of notches are made near those of the first year.

« During the third and fourth years notches are intercalated in the spaces left in the rows of the two first years and after these four consecutive years of work, the tree will remain untouched for five or six years to heal the wounds in order that new bark may reach its normal thickness.

M. Cibot, in his interesting writing says it is necessary to give five or six years rest to the trees after four consecutive years of product. This opinion does not astonish us, first, because a good number of verticale notches have been made all along the tree and as long as the wounds are not

healed the nutritive parts exist only in the undamaged vessels to which the living of the plant is due. Therefore this method should be dispensed with because it wants a considerable and too long effort from the organized part.

As it requires a great dexterity of the hand on the part of the workman to take off a piece of bark and liber with an hackle knife without damaging the cambium, the proceeding has been modified but not the principle. In 1903, triangular gouges were used at Ceylon, which we spoke of to tap in a form of V at the bas (\/) below which tichelas were placed. These tappings of eleven centimetres about, in lenght with an opening of eight centimetres or more at its superior part, were made in rows separated of eight centimetres from each other and all over the circumference of the tree.



1 ts day 2 nd day 3 rd day

On the first and subsequent days new series of notches one underneath the other were made daily.

They succeeded to have twenty rows of notches all around the trunk up to 1m,83 from the ground. Five tappings can be operated on a tree of 0m,35 diameter. Whatever the produce might be, one can easily make out the result coming from a such exhaustible treatment.

Little by little, it came to the mind to reopen the cut done previously and according Mr. H. C. Dinet's (1) description here is how the proceeding was used at Soobang (Java) in 1903 :

(1) *Agricultural Bulletin of the Straits and Federated Malay States*, Vol 2 ind February 1904.

« The system adopted is to do vertical incisions of 20 centimetres separated by lateral incisions of 10 centimetres in lenght on one side. A year after, lateral incisions are done on the other side of the vertical trench. In the third year, it is between the incisions made on the first side, and in the fourth year incisions were made between that those of the second year (Probably the trench is kept open during four years a way that cannot fail to be prejudiciable to the tree) The trenches are reopened in cutting off a slice of the bark at the inferior part every other day. This operation is done ten times, what brings the number of days labour to twenty and according to skilfulness a workman is able to tap from six to ten trees during this same time. The reopening of notches could not be made more than ten times at Boebang but at Buitenzorg they have been able to do it fifteen times and the result has been better than with ten. It is after the sixth reopening that latex is more in abundance. »

Very likely it is the method that Mr Cibot speaks of when he says : (1)

« I am not partisan of that system which causes very broad wounds to the tree that are not only very long to heal but dangerous to its living.

« The method to tap with fish bone and the reopening of notches renewed ten times leave ducts that will be healed only after twelve months. Besides this observation, we see when notches have been reopened fifteen times instead of ten, four or five centimetres remained unhealed after a year.

« That system of tapping in long and oblique canals with a fish bone, according to my own idea, is doubly harmful, firstly, because oblique incisions, cut the laticifere vessels in half the circumference of the tree, completely stopping, on this face, the nutritive circulation of the sap. Secondly in regard of wounds of that breadth of 8 to 10 centimetres, heal very sloly, the sap-wood remains exposed a lengthy of time to worm insect's attacks and to moistur These injuries are frequently fatal to hevea whose wood is very tender ».

According our opinion there were but inexperienced beginner who prevented to attain for the first time to perfection, but a good system has been found.

For all that, in 1904 at Suoi-Giao, near Nha-Trang, experiments were proceeding with incisions in V and one wants to know if there were interest to revive or not superior and inferior on both borders of the wound see Mr Vernet (2).

(1) *Journal of Tropical Agriculture*, No 84, January 1904.
(2) *Economical Bulletin of Indochina*, No 44, (New series).

« *Shaving the inferior lip.* At the time to revive some notches, it was useful to know if in the right of interest, both lips or one only incisions should be made on.

« On the same trees, at the same height from the ground, two cuts in V not closed were operated on one side, the two lips of the wound have been revived and on the other side one lip only. The work has been done alternately during five consecutive days.

« In performing the same experiment on the same tree, individual differences attenuate considerably.

« The essay has been carried on twenty heveas.

The latex has been gathered and mesured from both sides of the tree. The results are the following: The latex produced from each tree conformably to places that have been revived at there bases only (B), or in both high and low places (B + H), are set side by side from one same tapping. Other figures follow according to trees met with :

DATES	B + H	B	B + H	B	B + H	B	B + H	B	B + H	B	B + H	B	B + H	B	B + H	B	B + H	B	B + H	B	B + H	B
3rd of Dec. 1904.....	8	6	8	7	21	11	5	9	11	6	17	16	5	4	18	15	8	10	7	3
	5	6	6	10	4	4	27	30	2	2	10	9	6	1	11	5	5	3	6	3
6th of Dec. 1904.....	8	6	19	14	8	3	10	6	12	5	9	7	25	17	9	5	18	12	9	9
	12	17	5	5	4	3	26	24	3	5	9	6	10	9	10	8	15	9	4	4
7th of Dec. 1904.....	1	2	10	5	14	5	5	4	3	3	5	6	9	7	12	11	7	9	19	12
	10	6	17	14	6	6	12	10	10	7	11	10	26	22	11	6	17	16	16	10
8th of Dec. 1904.....	33	17	6	4	30	21	7	8	4	3	12	10	7	8	11	14	16	8	4	7
	9	5	4	2	18	9	15	10	6	3	12	7	15	10	22	17	12	7	19	12
9th of Dec. 1904.....	5	5	10	6	11	10	3	4	28	19	10	11	19	14	12	9	18	7	14	20
	3	3	14	7	5	5	18	12	9	6	10	7	18	17	22	18	15	10	9	6

« The total of latex obtained from the whole (B + H) and B tappings we see that 100 revived wounds upon the two lips have given 1153 c/mc of latex 100 revived wounds upon the inferiour lip alone have given 872 c/mc.

« If I had revived the wounds twice upon the inferior lip alone, that is to say if I had caused an equal damage to that made on reviving twice ou both lips, I could have obtained $872 \times 2 = 1744$ c/mc instead of 1153 whence a profit of 591 c/mc of latex or 235 of rubber at an average of 40% of latex ».

It was inevitable that having done short incisions joining by one duct gatherer they succeeded to extend these laterale trenches as far as to take the surface of.

For that, two central collective channels were made and to the latter were joined spires which were cut, some on

the left side and others round the right side of the tree. A modification of that system consisted in tracing an entire spiral round the tree. Here is how M. F. M. describes the method (1).

« The tapping commences at 1 meter 20 from the ground for trees having 0 m 45 in circumference measured at 1 meter from the ground and at 1 met 80 for older trees. It then follows a descending spiral in a slant of 25° to 45° the spiral being the more in a slant as the tree is younger. The bark must be taken off according to the band traced on the tree and only as far as the cambium, for the tools are made in order not to injure it in the least.

« Two spirals are thus made on the young trees and three on the older ones at a distance of about 0 m 30. As it happens that the borders of the cut are opened every day and that 25 millimeters of bark are cut off every month, it results that the tapping being only done once in two months the strip of bark taken off yearly is of 150 millimeters that is to say it will take two years for one of the spirals to meet another and during that time the bark can be tapped again!

« This method has among many other advantages that of requiring a small number of cups. While in Holloway's method (gashes in the form of V.) for instance one cup is required for each gash, in this system, one cup only is required for each spiral, that is to tay, 3 in the most per tree; it is true that the cups are bigger, but the advantage is still great.

We have already explained why this method appears to us fatal, and it is much more on account of the instrument employed for that purpose which is called the pricker. We have experienced that when the liber is not taken off regularly, it is difficult to reform its constitution and it is a mistake of Vernet's method which we are now going to study. Here is how the author describes it: (2)

« At Suoi-giao we first commence by making a helicoidale collector-trench with a symmetrical gouge and to this collector trench which is on a slant of about 60° is fixed a small metallic spout. Then with a special knife, the tapping is done at every 15 centimeters of the upper lip of the trench and in a perpendicular way to its direction ; these tappings lead completely through the bark and the liber up to the wood, thus cutting the laticiferes the contents of which gather in the deep trench made and then drop into the cup. The next

(1) *Journal of Tropical Agriculture*, n° 61, July 1906

(2) The rubber and the gutta percha, n° 72, February 1910.

day new tappings are made above the precedent ones and so on during 12 days, in order to leave between each group of cuts a space of 5 centimeters in minimum which has to be left untouched. And then at 5 centimeters above the precedent one, a new collector-trench is traced and which is tapped during 12 days, but in order to alternate the precedent frec spaces and so on. This disposition is destined to make use of the lateral anastomosis which allow the flowing of the latex from the upper part of the trunk. The height of the collector-trench differs with the age of the trees ; it is of 1 meter for trees of 7 years and 2 meters for those of 10 years.

« In such conditions the Hevea trees can be treated according to their height from 140 to 180 days per year up to the age of ten.»

We have experienced this method at Ongiêm and we did not obtain the results we expected. The reasons of the unresult are as follows :

1° It happens very often that the latex runs out of the hélicoïdal gathering trench.

2° The running surface of the latex being very considerable, a great part of the latex coagulates in the trench and loses its value by becoming what is called « sernamby ».

3° When the latex does not flow down along the trunk it runs into an old trench and as the latter does not lead to the cup, the latex of course falls on the ground.

4° Actually there is a tendency to wash the trees in order to diminish the quantity of sernamby ; with Vernet's method this is rendered impossible, as the water invariably rushes out instead of running in the trench.

5° The reconstitution of the tree is defective and at that moment it presents a puffed up bark which comes off by bits and renders the subsequent operations very difficult.

6° As the spiral injures the whole tree, the vessels of the bark have no way of continuance and the descent of the nutritive elements from the leaves towards the trunk and the roots is obstructed. It results that the tree is forced to appeal continually to its stores and by that it suffers. Is it on account of that activity diminished that the latex changes its colour and becomes often violet? We are ignorant of it,

but this colour appears frequently in produce of trees which are treated accordingly to this method.

We give a description on its originality, a process in which the central collector channel does not exist. The author names it the « Chain Gamna » and describes it as follows.

« All methods of tapping rubber trees are, one may say, combinations or variations of the oblique incision and probably the two most popular methods in use in Malaya at present are the V and the herring-bone. It is objected however to the former that so many cups are required. The latter is frequently to be seen deprecated on account of the central channel which is a mere conductor of latex, being unproductive in it self and wasteful. It is said also that it lessens the tension of the bark and therefore tends to minimise the output of rubber. If such is so with the full herring-bone, how much more proportionately is the vertical channal uneconomical in the case of the half-herring-bone ! »

« Examining recently a series of trees tapped by the latter method it appeared to me that if the length and position of the conducting channel were somewhat altered it could he made both productive of latex and thus less wasteful of bark while, besides, the natural tension would probably remain unaffected ».

Fig. 1

« I therefore sketched out the following pattern (Fig. I the dotted line representing the original vertical channel) of a modified half-herring-bone — I should like to say improved, but from lack of opportunity to test it cannot yet do so-which, if we desire to stick to

the alphabet for tapping nomenclature, instead of a Roman V occuping the tree at intervals, might be described as a colum of Greek Ys ascending the trunk-ascending because tapping must be done from base upwards».

« A very symmetrical pattern that would probably heal rapidly is also obtained by reversing each alternate Y ».

« Having gone so far it was of course obvious that the alteration should be carried to its logical conclusion and thus Fig. 2 was obtained ».

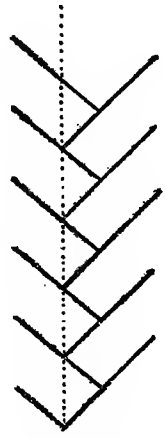


Fig. 2

« The basis of the method is itself a very simple pattern, productive throughout all its length. This is a continuous regular zig-zag, but I am not aware that it has been experimented with in this form for the orthodox zig-zag seems to be two oblique cuts joined by a vertical, and so useless, channel.The advantage of the full pattern however is that the flow from the lateral projections at once forms a leading stream which is joined by the descending latex from each step above as tapped, and so obviates any likelihood of delay or overflow at the angles ».

« I fancy that the pattern will be found very productive and of value when it is required to obtain a large amount of rubber per tree. The proportion of scrap will probably be small owing to the strong flow of latex throughout, the fluid from above helping to wash down that below and thus differing from the ordinary herring-bone where the latex in the lateral cuts soon begins to coagulate».

We are far from sharing the optimism of the author of this method for the following reason:

1° When the cut is open again by taking away a chip, the operation being done either on top or at bottom, the trenches freshly traced join with the old ones with the result of an irregular flowing of the latex which then flows in trenches not leading to the cup.

2° the tapping being first done at the bottom, the latex will have time to coagulate at the lower part before the latex of the upper strata flows down.

3° the washing of the trenches will be rendered difficult, if not impossible.

In ending this slight study regarding tappings, we cannot do better than giving a part of the report of the Director of the Botanical Gardens of Singapore, during the year 1909 (1):

« Throughout the East all plantation rubber is obtained by some method of excising the bark whereas in Brazil the process is one of incisions. This latter method has been fully tried in this Garden and discontinued for the reason of low bark recovery of the incised wounds, combined with the poor return of latex-although in Brazil it is claimed that amount of rubber is higher per tree. This is very doubtful and probably refers to the average of old trees compared with young trees in the East. From one of the oldest and largest tree in the Singapore Garden 1245 ozs. of latex were obtained in three periods of tapping during 1909 resulting in 26 lbs. of rubber. (This tree was actually excised on 80 days only for one year), a much larger return than could be obtained by incisions and only a small area of bark operated on».

V.— Shaped method.

« So far as we know there is not any difference of opinion as what part of the tree should be tapped. It should be the trunk of the tree from the base to a height of 5 ft. In our own experiments we find that the dry weight of a biscuit of rubber is most from nearest the base, there is naturally a larger yield of latex from the single or double herring-bone excisions-being 4-5 or 8-10 excisions against 2 basal excisions-but the dry weight is slightly less from the same

(1) *Agricultural Bulletin of the Straits and Federated Malay States*, n° 7, July 1910.

quantity of latex while from the upper branches the dry weight is considerably less and-with young trees-the exudation of latex soon ceases ».

« It is no doubt due to the fact of the richest latex being nearest the base of the tree that the V-shaped method obtains so many votaries. Where the full V is practised half of the girth of a tree is operated on or excised and the objection to this method lies in the interval of rest between completion of the first half of the area of bark and commencement of the second half. If the second half is followed on immediately the tree is only able to partially fulfil all its functions, if is really stagnated and weakened and this should be avoided, a half V would only return a scanty yield of latex, the half-herring bone would therefore be an improvement as this amounts to 4 or 5 half Vs».

Herring-Bone Method.

« The double herring-bone method-something like 4 or 5 pairs of full Vs-has proved too expensive in bard excision and the single herring-bone method-a vertical channel with 4 or 5 half Vs, or oblique excisions at an angle of 45″ about l'apart-is now adopted. This we think the most practical method, both as regards yield of latex or economy of bark and provided the excising of bark is carefully done, i. e., the excisions are uniform and not too deep, improvement would appear to lie in the direction in which the latex is collected rather than by the method of tapping. To retard the rapid coagulation of latex on a practical basis is a problem which does not admit of an easy solution.

Basal excisions.

« Two excisions representing about one half or slightly more of the girth of the tree. The first excision is opened a few inches from the ground upwards at an angle of about 35° and the second excision on the opposite side of the tree is opened in a downward direction or reversed angle thus leaving the maximum space on the opposite sides of the tree betwen the excisions. As compared with the methods already cited there are two collecting cups against one, while the yield of latex is naturally less being two excisions only. It is however a method to be recommended for young trees for the following reasons: —quick bark recovery near the base, no distortion of bark; strongest latex; it can be followed by the single herring-bone without detriment whilst the trees have been increasing in girth.

« It should be pointed out that on both occasions of the basal tappings there was no water in the collecting cups as the latex was required for curing by smoke. Compared with the half herring-bone

tapping the latter was more added water and both basal tappings minus water and the further loss, at least measurable loss, of clotted latex which always occours (with young trees) unless the latex drips in a small portion of water ».

We shall complete this study of tappings when we shall see what the trees of Hevea will produce.

It is at this chapter that the lecturer will see for what refers to the period of tapping, at what height it has to be done, the usual phenomenon the hours of tapping etc..

The produce being gathered it must be cleaned of its impurities, first it has to be filtered and then the coagulation, has to be done away with. We have to go through a revue of different coagulation proceedings.

Before talking of methods of fumed acided coagulation, it appears interesting to us to describe the proceeding employed at Ceylon, at the estate of Keptigalla by Mr F. J. Holloway, and in which no coagulation is to be found, the air did every thing in this matter.

« The latex (1) sent to the factory in a liquid state, mixed with water, which is necessary for the course of time, it is strained through a fine wire gauze. For exemple a milk cullender tin pans of about 55m/m in depth and having 20c/m on the side and it is left to rest till the next morning. This lapse of time must be sufficient for the rubber to coagulate spontaneously and without the use of chimical substance. The slice of rubber is then taken out and placed on a table and the water squeezed out, it is first done by pressing it slowly with the hand then a roller in wood is passed over it from end to end. At last a sheet of rubber of 15m/m in thickness is obtained and left to dry in the air on bamboo hurdles or rattan beams made in the way of a chair but of less spaced.

« The drying on the hedges lasts 4 or 5 days, it is finished when the sheets ot rubber are placed on wires attached in a room, a man is specially employed to wipe off any trace of moisture with a cloth ».

« It takes nearly 2 months for the rubber to dry properly and must be cleared of all the white moisture points. As long as these points appear, it is sign of humidity and the desiccation must be continued.

(1) *Journal of Tropical Agriculture*, September 1903, nº 27.

« When the proper degree of dryness is obtained the sheets of rubber are ready to be packed off. They are put in cases of 0m50 per side and about 0m22 in height, ordinarily each of the cases has 22 kilos 600 of rubber.

« The secret of the great value realized by our rubber consists :

« 1° In the filtering of the latex, which clears away all the impurities.»

« 2° In the thiness of the sheets which allows the buyer to see that the stuff is exempted of all impurities, sand, etc.»

« The rubber of the origin Para is sold in the market in big blocs and can contain a certain quantity of impurities without being noticed.»

These preliminary precaution of purification have always been followed in our experiments at Ongiem station and we have been successful. That is why we insist in advising the use of it. Here is the way how we proceed. The latex once gathered in the cups (which contained water with 1 $^0/_{00}$ formal) it is taken to the preparation room in recipients where it is given after being measured, all the juice proceeding from the same category of trees. These recipients (in form of milk tins) are emptied in vats and the latex is beaten up slowly so that it can be presented in a uniform mass an then passed through a fine stitch sifter.

The coagulate (acetic acid) is then added and the mixture is made together and the liquid is well agitated. The produst is after put in porcelain basins (photograph bassins) the froth which forms on the surface is taken off; by the help of leaves, with great care because it has been noticed that when it is removed without care, round circles form of a displeasant aspect in the mass of the coagulated rubber leaf.

The formol which is placed in the cups has the effect to delay the coagulation too rapid of the latex and to allow it to remain liquid till it is manipulated.

The cups are washed and the water containing latex in suspension is also placed with the coagulate substance in the porcelain basin.

At last the coagulated rubber in the same cups will be gathered to increase the mass of scraps. There is an element which is not to be forgotten : there is no small benefit; in having the recipients, the cups and the basins cleaned ,but the quantity of rubber gathered pays amply the overwork done.

In Amazonia, the proceeding employed for the coagulation is smoked purposes. This method with more or less modifications, which seems preferable and it is the reason why we are going develop hto the subject.

« The smoky room, says Mr Cibot (1) to whom they must have recourse when it is question of what happens in the patry of Para, is a small palm-leaves hut slut by its three sides in order that the wind could not come and drive in the smoke that must ride vertically from the chimney of the stove (buyon) in order to well wrap the mould (pala) on which the latex is smoked.

The seringuero lights some dry dead-wood and as soon as his fire is taken, he surrounds and covers it with some palm nuts of one of those specie known in the country under the name of « motacu » chonta, cusi ou maja" of which very hard envelop is burnt away and sets off a thick smoke mixed with soot vapours. For want of palm-nuts, they employ shell-nuts from Brazil (almendras) or at last shivers of all kinds of hard and green wood : tatjibo blanco », « almendro » « tami » palo amarillo », etc »....

« When the smoke begins to rise in big flocks, the seringuero covers the fire with the buyon that he finishes to fill up above with the combustible, and he blows the fire in fanning the small hole at the base of the stove, or moderates in stopping the door with a potsherd of terra cotta. »

« The white and creamy latex, is spilt in a large tinned-iron basin (« cazuela, » batea ») and, with the hand the work-man collects at the surface of the liquid, the leaves, the twigs and other impurities fallen in the tin during the Gathering of the morning. The basin is put down a little inclined on the seringuero side and not to near the stove, for the too sharp heat which gets rid from this sometimes after could communicate to the basin, cause the spontaneous coagulation of the latex and produce a cake of a less value of the dungy planchu. »

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(1) *Journal of Tropical Agriculture*, nº 20, February 1903.

« That cake of spontaneous coagulation which offers the appearance of curdled milk including cells full of water, acquires in a few days a nauseous and sui generis smell which is never produced with the dungy rubber, that gives to think that the smoke, by its sterilizing effects destroys some ferment staid in the latex. in same time that it coagulates the globules of the Rubber. »

« In order to make a « plancha » the workman sits on a stool before the stove and the basin, takes a flat mould having the shape of a paddle « pala » and with a small calabask, waters the surface of the shovel; after lays it above the smoke which gets out from the chimney-stove, returns it and in a few seconds the latex is coagulated in a thin membrane of rubber covering the paddle. This done the workman carries back the mould, pressed upon his knee, above the basin, waters it with fresh latex that he makes to coagulate by the same proceeding and goes on so till all latex used, taking care as soon as he sees, leaves impureties or coal-cinder which sometimes are sticked to the surface of the plancha, to take them off.

« In the course of the transformation of the latex in rubber, they notice a loss of weigh of 7 %, however, the loss of weight differs lightly according the latex is gathered in dry season or in rainy season, in the first case it is a little thicker.

« We already said that the latex loses 7 % at the smoking, but it loses much more afterwards by draining or dripping and evoporation.

« During our sojourn at Rio Beni, we have effected a gread number of weighing, in order to account for the course of rubber-desiccation, since the coagulation till the shipment, here is for instance a typic case: the rubber having been weighed the first day after being smoked, on the second day they state a loss of 15 % in proportion to the fisrt day weight, the third day there is 21 % of lost, and the fourth day, 28 %, either nearly 33 % loss on the weight of the latex gathered.

« The dessication does not stop there, and I estimate that Hevea's latex gives upon an average only 50 % of his weight in dry trade rubber, imported in Europe ».

« The dessication is faster in the thin « planchas » representing only the produce of two or three days gathering, than in the stout « bolachas » which will be bye and hye in question, and where the dampness, rolled up in the numerous course of superposed rubber, evaporates very slowly ; they find sometimes in the inside sacks of water which empty when they cut the bolocha ».

« The smoking of 10 litres latex, giving 9 k. 300 of fresh rubber, lasts one hour and a half — The smoking ended, the mould is pla-

ced under the shade in order to let the plancha drip and harden, and on the next day they un nutie it from the mould in cleaving it with a knife, on the opposite side of the mould handle and in knocking the extremity of this one against the ground ».

« Just now we have pointed out that they smoke two or three days on the same plancha, but as soon as it attains the weight of 15 at 20 kilos handling becomes very laborious ».

« If they want to make large « bolachas » balls, they use, then of a strong stick very straight of 1m80 long and 5cm at 6cm diameter. About the middle, they water with latex a length of 25cm they make to coagulate and, watering and coagulating new beds one upon others, they can superpose, every day the latex of a certain number of successive gatherings and make easily a large ball of 40 at 50 kilos ».

« The handling is made easy by a fulcrum that they erect behind the buyon, by means of two forks and a cross-bar, distant of 60cm from the ground on which the workman puts one of the extremity of the stick, while he presses the other on his thigh. Kept so, he makes to roll the balocha, sometimes above the basin, in order to water it with latex, sometimes over the stove for operating the coagulation ».

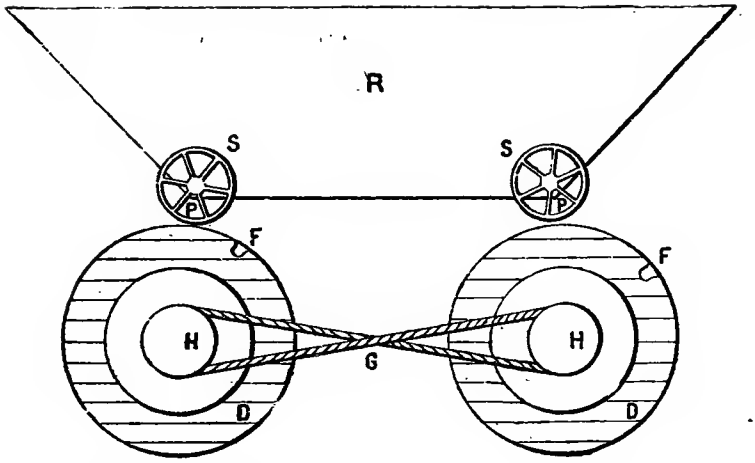
« We had bolachas of more than hundred kilos made, which worked carefully offered the aspect of a sphere completely plain. »

Relynig on this fact that the coagulation of the rubber by the smoke offers two distinct phases:

1° Solidification of the mass by the heat, 2° desinfection of the produce by acid formique, M. Mathieu invents an ingenious machine that he describes in this manner: (1)

« The latex is emptied in R, recipient masked with a thin sieve, inside the recipient and at each end there is a lengthened tap, which crosses the recipient from one side to the other, and that they turn, on the right or on the left, by the hamper S — At a moment, the split of the tap is front of a split P. done in the recipient and by which slips away the latex and a slice of 60 centimeters broad (length of the split; the thickness of that slice follows the thiness of a film in turning the hamper S at the righ posítion. »

(1) Culture of Para Rubber by C. Mathieu.



R. Recipient for latex.
P. Split of flowing of latex.
S. Hamper serving to regulate the tap in the inside of the recipient.
H. Pulley.
D. D. paddle boxes.
G. Rope without end.
F. Gullets for introducing hot watter.
The shaded party only is full ofwater.

« The paddle boxes DD. formed simply of two galvanized sheet-iron concentric cylinders receive the latex at its issue fromthe split P. They are heated by hot water having 50 at 55 degrees centigrade, that they introduce between, the two cylinders by a gullet in F which is shut by a stopper with screw ».

« At the moment that it touches the paddle box, the film of the latex coagulates by the effect of the heat of the water inside. and as soon as the coagulation is effected, the antiseptisation takes place by a throwing of formaline extremly divided, which slips away from a reservoir placed so as the throwing bits the film of rubber, right under the point of coagulation. This act is a copy of the act which takes place in the brezilian smoking, in which as soon as the coagulation is over, by the heat, the antiseptisation is produced by the acid formique contained in the smoke. When the cylinders have done a complet revolution round their axis, they are entirely surounded by a very thin couch, and as they continue to turn the tiller in H, a second thin couch is formed over the first, and after a third and so on, till they may obtain a couch of rubber, composed of couches superposed, thick of 4 or 5 millimeters. They introduce a blade of penknife in the mass from one end to the other of the cylinder

and they unroll it from the cylinder, in a sheet which will have as length the diameter of the cylinder and as breadth, the length of the cylinder eith er 60 centimetees. They begin again the same working till the latex may be used up. »

The advantages of the coagulation by the smoke have been often pointed out by the manufacturers, Whilst they found some objections to the proceedings in which acids are employed. The following letter adressed by MM. Zenis et Peat of London, to the rubber planters is a proof. (1)

« Our attention has been called up on some parcels of rubber-biscuits, in appearance well prepared, which arrived here heated and sticky, and the question was put to know if the present manner of preparation, and even the shape of biscuits are the best, and in second plan if the rubber prepared as it is done on the plantations is as strong as that prepared according to other proceedings. In sight of the rubber production increase, we are in the way of thinking, that it is of the greatest importance for the planters to be well settled on the comparative worth of the rubber prepared on the plantations and that prepared by the native Brazil method, it is to say, coagulated by the smoke. »

This inquiry is of a vital importance, and our purpose, in addressing ourselves to the planters is to well convince them of the absolute necessity that there is, for them, to present the produce of their plantation under a shape which ables it to hold up the rivalry with Brazil rubber prepared with smoke, which is yet the highest classified and has kept, during 50 years, its fame as the most elastic, the strongest and the most durably for the various manafacturing uses.

It is necessary that the rubber-plantation may be coagulated and prepared so that it may comply with all the uses of its fabrication. Till now as well as we can know, it is scarcely employed as dissolution and some others limited uses, not being strong enough, and badly complying with articles, waterproofs, or pneumatics, or many others items for which, alone « the fine Para » can be used.

« We have at many favourable times called the attention on cases which arrived to us with biscuits all sticked together or even as freczed by the heat, what never happens to « fine Para » of Brazil

« Till now we have imputed this at a preparation badly looked, or at an incomplete drying, but after an opinion of clever professional man, a great doubt is drapped in our mind, it is to know if inproportion as the arrivals increase, the method of preparation, used in Ceylon and in the Straits now, is well the good one. The theory that

(1) Culture of Para Rubber by C. Mathieu.

our friend gives, is that the biscuits and sheets coming from Ceylon are too pure,it is to say that they have taken out too much of dampness at the damage of the strength and of the elasticity of the product, and that there will result a more rapid detorioration of the rubber, which becomes soft if they keep it some moment, or if it is submit at a high pressure or at an increase of temperature.

He even thinks, that it is the remaining of dampness, that renders « The fine Para » stronger, better suited at all the uses and less liable to spoil if they keep . it even long time in store. Conclusion is that the alone remedy for planters is to prepare their rubber with the smoke and to produce it in large balls or cakes as it is done in Brazil.

According to him. also there is no missing nut-trees of the family of Borassus, which give to the combustion the thick smoke that is need and which contains the antiseptic principles « the creosote » which conserves the rubber prepared in this manner — He predicts that the rubber « Plantations » prepared so would be sold at a less price than the «biscuits» but than the profit in weight proceeding from the dampness remaining in the rubber, would compensate and more, the light difference of price. The present shape of «biscuits» must necessarily be left off for the shape of balls ; it complies with the influence of the heat, whilst the ball-shape, too much or in big masses comply very little, and he predicts that when the arrivals of Rubber plantations. Will take more important proportions, that defect will manifest of a more evident manner by the state in which the biscuits and thin sheets will arrive.

« As proof in confirmation of what he advances, he says that the same fact was produced wit hother rubbers in large balls. The true remedy is the coagulation by smoke, he is absolutely convinced of it. We also have received lots of rubler from Assam and Rangoon washed and very well prepared in India, arriving here all heated and, with the same invoice, rubbers of the same origin, prepared by the natives and mixed, ever so little with some earth, etc, arriving in very fine state and not at all heated, and we impute that fact to a too complete clearing, which reduces and destroys partly the rubber-fibre, putting it unable to endure the heat of ship-hold and the change of temperature in travelling. »

Those ideas seem to have so many adherents that at present they practice more and more this preparation. So it is not indifferent to know the practical method to dispose a smoky-room. Hereis one describe by H. W. Ridley (1).

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(1) *Agricultural bulletin of the Straits and federated Malay States*, March 1911 n° *3*.

«So many persons are asking about the best structure for smoking rubber that perhaps an account of our experiences in this direction may be of interest. I will first describe the smoking house in the Botanic Gardens, which has proved quite satisfactory and economical. The building is 55 1/2 feet long and 19 feet wide, oblong in shape, and made of ordinary planking with a high roof. The plank walls are 8 feet high, and the roof of attap, 15 feet high in the centre. The floor is cemented with concrete below. There are two or three windows which can be opened when required and one entrance door. This building is built on a slope of about 1 in 12, and drains run down the side to carry off rain water, inside are wooden posts sunk in the ground between which run thin rattans stretched tight over which the rubber is hung. Near the door are sunk in the concrete and cement floors circular pits one foot wide and 3 feet deep in which the fire is put and then are covered with iron cones with a flat perforated top. These cones are 22 ins. high. They have a small oblong opening at the base to admit air to the fire.

« The fires are made of dry old wood of some soft timber. That of *Albizzia Moluccana* is found good, but any light wood will do. The wood is cut up into pieces big enough to get into the fire places, and being lit is allowed to smoulder all day. The fires are usually lit in the morning, and renewed once to 4 times a day according to the size of the fire place, one fire takes about 2 baskets measuring 2 feet deep by 1 1/2 across of pieces of wood a day. When the cone is put on no flame is produced but abundance of smoke which soon permeates the whole building and keeps a thich atmosphère of smoke all day. The windows being closed it does not escape except by the spaces between the roof and walls or through cracks, so that none is wasted ».

« Three of these fire places keep the room full all day,but there are others at the upper end of the building which can be used to increase the smoke, if required, either for exceptionally heavy smoking or when the building in quite full of rubber, This house will contain 2000 lbs, rubber sheet or more. The newest made rubber is put nearest the fires so as to get the most smoking and moved further up the slope is that the smoke starting from the lowest point naturally gradually ascends to the upper end, and the surroundings are naturally drier and there is no accumulation of rain water round building».

« All smoke contains a certain proportion of water, and this and the free creosote, and naptha are practically absorbed by the wood work and attap so that the rubber is not covered with a wet unpleasant layer. At one time we built a brick smoking room with a corrugated iron roof. In this house the fire was outside and the smoke was conducted in by a tube, but we soon found that there were deposited on the floor and elsewhere in the rooms, a thick brown liquid

consisting of naptha and water. This stuff got, too, on the rubber. This mess is quite absent from the wooden drying house, though the woodwork gets dark brown or black from the deposited products of the smoke, the rubber is fry and of a good colour».

« No ventilation other than the cracks is required, as any open windows let out the smoke. The entrance door is usually kept open but as it is at the lowest end, the current of air that enters drives the smoke up to the other end through the rubber. The smoke should be as dry as possible, both for the benefit of the rubber and for coolies in the smoking shed as wet white smoke containing much water is very troublesome to the breathing, Coconut husk can be used instead of wood, but waste coconut dust and sawdust are apt to give off sparks, which being incandescent, pieces of wood fly up and settle on the rubber as charcoal. Attempts to improve the smoking by adding creosote did not prove successful. For one thing it is apt to raise the temperature and produce more rapid combustion ».

« In one estate recently I saw an arrangement of an oven outside the smoke house connected with a passage with the interior. Here the combustion as most rapid in the inner part of the oven, while the slower combustion was going on at the outer open end, so that the best of the smoke escaped to the open air while the more rapid consumption of the fuel in the mounth of the passage increased the heat of the air passing in. Thus much smoke was lost, and a larger quantity of fuel than necessary was used».

« In the Gardens smoking house no smoke escapes wihout having passed over some, at least, of the rubber, and much of it remains in the house nearly the whole day, so none of it is wasted. At the same time the slow smouldering does not increase the temperature nor is there any risk from fire, as the fire is sunk in the ground in the concrete, and produces no flame. However to avoid risks the fire can be extinguished at night fall».

« It is advisable to shift the rubber from time to time in the smoke house so that it may be evenly smoked. If not moved or turned over a pale line is left where the rubber is in contact with the rattan and consequently not smoked, and this spoils its appearance ».

« The advantages of this style of smoking house are cheapness of erection, economy of smoke, dryness and safety from fire, with complete efficiency ».

At Ongiêm we have tried to smoke the rubber as the quantity of latex daily produced was not considerable it required not a special building. Our machinery to infest with smoke was composed of a big white wood cupboard of 1 m. 20 large on 1 m. 50 high and 0 m. 60. of depth. On

the opposite side where the doors at two folds opened, was an orifice where ended in the pipe bringing smoke, and was beginning at the lower part of the inner surface. Inside the cupboard was stretched some iron wires on which they hanged the plates of rubber at the extremities of which they have put two small picklocks. They had to take care to put the sheets the farest possible of the smoke-hole in order not to let them touch by a too considerable flow of heat which had for effect to reduce them as bird-lime.

The stove placed a little downwards, was made up with a single petroleum-tin on which they have welded a tinned cone inverted, that they had passed along by a bent pipe also in tin. What gave us the best produce in view of production of smoke, it was grape-stalk of pepper from which they had taken out the seeds.

Besides the smoke obtained was tick, it antisepticed the plate sof rubber and gave them such a smell that the moisture was dispersed for ever. — Unfortunately it was not the same for the others smokes and we are persuaded, that the smoking-room must positively have a surface sufficiently wide, if they dont'want to exposse themselves to a great number of inconvéniences, the principal will be the following.

1° Frequent attacks of the plates by a heatstroke, because they will be to near of the entry mouth of the smoke.

2° Impossibility of building stoves inside the edifice, as it is advised by M. Ridley, and what seems to us very wise.

3° Deposit on the plates of a sticky, brownish material which wets deeply the rubber and brings in spite of cares and on the contrary of what they expected of the treatment, numerons slices of mouldiness on its surface.

We can second those affirmations by this fact, that the results obtained in Saigon were worse than those obtained in Ongiêm, and that only, we are persuaded, because the machinery of Saigon was smaller.

However it may be, our defective machinery allowed us to make the following remark : if they take fresh rubber, which has just been put in plates, after coagulation by acids and passage to the roller, and that they hang it immediately in the smoking-room, the results obtained are deplorable, for the smoke passes very unequally through the different parts of the plate and gives to it various colours depending of the place assailed. If in the contrary they take care to dry a little the rubber and to put it in the smoking-room only fifteen or twenty days after the gathering, they obtain uniform hues. It is sure that in the experiences we have tried, it was not question of coagulation by smoke, but only of a further protection against the microbs : the results obtained were so little encouraging that we have renounced to that method. It is not to say that we condemn that method of smoke coagulation, no, we simply estimate that they must place in better conditions that we were for succeeding.

However it is good to say that when they wanted to employ the Brazilian method for plantation-rubber they have not always obtained fine results according to the big quantity of water which remains in the coagulated mass. (1)

« In this process all the latex is coagulated although the latex may contain 50 to 60 % of water per se and from young trees, or on wet days, even more. During the process of smoking-and storing while curing-there is a gradual exudation of water, but the rubber is always very wet. The samples we submitted for analysis exhibited 17-25 % of moisture against 15-18% from Brazil. This higher percentage of moisture is most probably explained by the shorter time our smoked rubber was stored, whereas Brazilian smoked balls are sometimes 12 months old by the time thay reach their market. This higher percentage of moisture too, very probably also explains the excess of resin as the resin in plantation rubber as ordinarily coagulated is about 2% only. »

(1) *Agricultural Bulletin of the Straits and Federated Malay States*, July 1910, nº 7.

As they see, the question is complex enough — On one side the manufacturers complain themselves when the rubber is too dry, in the other hand the too considerable dampness harms to the produce because there is loss of weight at the selling-moment and perhaps also formation of fatal resin.

So they must not be astonished if they had looked for other coagulative than the smoke.

First they employed a saturated dissolution of alum, but they left off that method which did not give fine results.

They also tried the coagulation by the action of warm and antiseptic gas, which approaches each other to the smoke proceeding, It has been said, during sometime that the best method of latex coagulation is to add to the latex a little quantity of water and acid acetic and to carry all this in ebullition.

It had been also pretended that the sublimate was an excellent mean to part at the ordinary temperature the rubber from the latex.

« Mr. SANDMAN preconized the employ of fluor.

« To the purpose of that proceeding. is it said, (1) the latex freshly gathered, mixed with water if need, is, after filtration across a piece of rag in order to seperate extraneous corpses, also mixed intimately with the preparation of liquid fluor. Afterwards they let it to rest a few hours. After they take of the rubber completely seperated at the surface, they eliminate the water, as much as possible by pressure, and the rubber is ready for shipment».

By addition of complex fluor acid to the latex, all the germs of rottenness are destroyed, while the cells of yeast inciting the fermentation keep their vitally, and substitute themselves to the fruit-sugar, so that a part of the pectine is consummated as nutriment of the yeast-cells. The alcool, conjointly with the acid properties of the fluor, stimulates after, the coagulation of the rubber-clots».

« As the latex coagulation is relatively slow, it produces in proportion of the fluid-latex, chiefly by addition of water for instance. a separation, according to the specific weight, of the elements contained, so that the rubber rides at the surface of lighter elements, while the rosins and others are under and so it is easy to separate them by a washing».

(1) *Rubber and Gutta Percha*, nº 72, February 1910.

« The very little quantity of fluor acting in the proceeding is not an impurety for the rubber, its percentage in weight being very poor, and it is completely eliminated by usage of water. As it is known the rubber is not attacked by the fluor.

« When the dampness is eliminated by compression, there is no matter, concerning the lasting of the rubber, in order that what is enclosed may not be completely taken off. Being free of germs, it cannot damage the rubber. As for the surface, the clearing and the desinfection, they are always possible.

« This proceeding also allows to compress the rubler in thick lumps for shipmemt.

« The possibility of treating more largest quantity of fresh latex in less time is not less appreciable in a coagulation-proceeding.It is not need of many machineries nor of complicated means, and any native can without difficulty employ this proceeding.

For big lots of rubber they thought to profit by centripetal power in order to separate rubber-globules.

« It is known, states Mr Main (1) that amongst the mechanic proceedings employed or proposed for the coagulation, takes place the centrifugalation,and that many experiences have been conducted in order to arrive at a practical utilisation of that mean, either with machinery existing (cream-machine), either with those same machinery modified.The engine of which we want to speak today, on the contrary makes use of the centrepetal power. Its aspect is that of an common turbine, but the inner sides have small screw-prominence throwing up the rubber-globubes from the periphery toward an inner zone, where they are received by four vertical, fixed blades, of which incurved section sends of towards the middle the globules separated from the latex by the action of centripetal power-Those globules group so in a spongious cylinder that they take out with the hand from the center of the machinery, when it has obtained the sufficient volume and consistence.

« According to the inventors with Hevea-latex 5 at 15 minutes of turbinage for realizing the coagulation would suffice, helped besides by the addition of a little acetic-acid.

« The engine is preconized in order of making laminate and cut rubber which is offered on London-market under the shape of vermicelli (worm-rubber) »

Electricity also has been used for parting the rubber from the latex, in throwing an electric current across the latter « when it is found, says Mr Thomas Cockerill the inventer of the system, on or against an anode which moves continually outside of it or ghoes away constantly.

(1) *Journal of Tropical Agriculture*, nº 52, October 1905.

Then the rubber sets down on the anode,taking the shape of a thin ribbon without end, easy to dry. Without persisting longer on those different manners of preparation, we shall content ourselves in pointing out the fashion that we worked in Ongyêm.

After having passed over the latex, as we said already they added at the mass uniformly composed, 10 centimeters cubes of acetic acid for 100 of the mixing of latex and water contained in the cups (15 centimeters cubes by cup) and 1 centimeter of formole for a thousand of that mixing — That formole was destined to clog the further fermentations.

If the latex was put at eight or nine o'clock morning in the porcelain basins, about four o'clock afternoon the mass was completely coagulated and formed as a square of white cheese swiming in a light liquid.

That solidified part was then washed many times, then primitively, squeezed with a hand roller till they obtained finally a thin enough paving. In the last campaign we have employed a better perfected machinery for the execution of thin sheets, in the same model that those made by Messrs Walkers and Sons. It is made up with two hard wood rolls that they press gradually one against the other by the mean of a pressing screw. The coagulated mass is taken out from the basin where it is bathing, than it is washed with care in pure water. It is after squeezed against the two wood rollers that they turn in opposite side by the mean of a gear and a crank.

That pressing is gradually increased in turning the screw which makes the rollers to draw nearer. Primitively we obtained at last a too thin sheet,and as we have remarked that is was disadvantageous concerning drying and packing. we have reduced the number of time where the plate crossed between the rollers till necessary for taking out a sheet of 2 or 3 millimeters thickness-When the last crossing at the engine takes place, the plate is again washed in a

dissolution of 4 % formol, this in order to reduce at the minimum the possible expansion of moisture.

The drying has given place at some gropings which are now easy to avoid, Firstly if the plates are too thin, and besides too light, they easily raised by the wind and get rumpled-forming so inside some folds in which moulds spread out more easily.

On the other hand, if they place the plates to dry either on rattans, either on wood traverses, even in returning them, white trains are formed at the place where they were into contact with the fulcrums, and that sensibly depreciate the product. We are arrived to hang the sheets by the mean of two hooks (one at each higher extremity) after iron-wires. Here chiefly it is necessary that they may be heavy enough in order not to be too easily rocked by the wind. It is also necessary that the drying takes place in a draught, in order to hasten it and chiefly under cover of the sun. When the plates from white that they are become brown,they are then carried and hung in a dark piece, but aerated, where the dessication is ended.

It was inevitable that numerous engines may be invented for the washing and the preparation of the rubber.

In the big recent installation the product is introduced in machinery as soon as it is gathered: it is successively weighed, filtered, coagulated, washed, squeezed and dried.

Besides all the engines for queezing, or for slashing, (according to the term employed, the rubber is essentially composed of two or three iron or wood rollers, which offer a smooth or striated surface in different sides, according they want to obtain uniform plates or with drawings on their surface.

The principal shapes under which rubber is actually presented on the market place are: plates, biscuits, sheets or crapes.

Those various qualities are evidently compared at those of Para that they divided in three classes. 1° Para fin Rubber. —.On the section that rubber presents a colour which changes from the light grey to the dark yellow. — It forms a cake which is composed by the superposition of slices of one tenth millimiter nearly and which have been regularly smoked — It has a smell of wood tar. 2° Half thin or very thin Para Rubber — Here, the symmetry has disappeared, for in the middle of smoked slices are interposed pieces less or more considerable of latex spontaneously coagulated and of light yellow — The cake has methylamine smell. 3° Para Rubber in negro's head, or Sernamby of Para. It is a ball formed of all the rubber which has coagulated in the tree wounds and that they have after gathered, and of all the remains of the fabrication.

If we come back now to the preparation of the latex we see that after having been manipulated in order to obtain the commercial wanted shape, it is necessary to let it dry.

That drying can be obtained by single exposition of the product in the open air, or by artificial means. Amongst these last it is advisable to signal the employ of chloruret of calcium and dry air and sometimes the both together. Besides they have built drying-cupboard in which, not only they warm but where they help to the desiccation by the rarefaction of the air.

« Mr. M. P. Breuil says that (1) Those drying-cupboards proceed of the following principle: the water enclosed in the gum will tend to go away, so more easily than the temperature will be higher, if the gum is at the atmospheric pressure, but as the high temperature is not favourable at that gum because it easily provokes the oxidation they must limit at a value so-low as possible for that temperature and after this resign to have a slow dessication,if that dessication is effected at the atmospheric pressure.

(1) *Caoutchouc and gutta-percha*, n° 85, March 1911.

« But if the pressure at which the gum is submited is low, the water enclosed will have more easinesses to escape even at a moderate temperature, its tension finding not any obstacle

« So the drying-cupboards operate first at a maximum temperature that the gum can without inconvenience support and after with the empty in their room where the gum is placed, They understand that these two combinations allow to realize a fast drying.

« They have objected against the empty-cup-board that they dried the skins in hardenning them and in preventing the water contained in the middle of the thickness to get out. There is truth in that objection but it is a question of measure and regulation of the cupboard. Have they done any exact essays on that matter-We must doubt of it, and the great success that the empty-cupboards have found in the rubber-trade should be sufficient to prove that they have realized a real progress, in same time that the desiderato of their employers-Many firms fabricate those cupboards, in which, besides, the gum must be treated but only after having endured a proper essorage which rids it from its water-surface mechanically carried away with it.

« The essoreuses are engines too well known for insisting on their purpose.

« The Passburg's empty-cupboards are built in 18 height and have from 3 meters carrés till 215 meters carres of heating-surface. They are not only employed for rubber, but for a lot of other matters (colouring materials in paste, starch, soap, albumen etc. etc...)

« They are composed of a quadrangular cast iron or wrought iron box that they shut by single or double doors joined hermitically ».

« Those cupboards contain inwardly floors of heating plates or serpentines which are travelled over by pot water or steam, according to temperature at which the product being dried must be brougt Those heating-tables can support without damage an inwardly pressure of 5 atmospheres ; when the pressure exceed that value, they employ serpentines.

« They place those skins on those heated plates, they shut the doors, the stanching of those doors is assured by the mean of a rubbe-joining. They empty the cupboards by the mean of an air-engine ; they realize an emptiness of 740 m/m of mercury. Now the water boils at 35° when they have an emptiness of 740 m/m. They conceive then that the desiccation of skins is rapidly effected, some hours are sufficicient where it needed before many days ».

We have already given the swift drying proceeding for the rubber, however we must fear that a too fast and complete desiccation harms to the resistance, to the elasticity and to the lasting of the product. We have already given manufac-

turers opinions on the necessity that there is to keep a little dampness in the rubber, the buyers only can definitively decide as on that matter,

What is sure is that when the rubber is badly prepared, and besides damp, and a little exposed at the sun, it becomes sticky, and it is tranfomed in sticky rubber (from the english verb to stick.)

«The motives of stickage are yet badly known, says Mr Ch. HUGOT.(1) But they are fixed on the conditions in which it develops itself. The daily experience shows that the damp balls full of earth, of bark, of non caoutchouc-latex become easily sticky. So they will spoil sometimes after their departure from their origin country. Some sticky samples in the middle of a bag are sufficient for producing the sickness to the others parts. At all events, they have for power to provoke to the buyers, an interested depreciation of the goods.

« But the most favourable conditions for the stickage are the presence of damps and the action of the sun light.

« The high temperatures are not useful, since we could obtain sticky samples kept to the sun, in France, at a temperature between 30 and 40o

«On the other hand, all kinds of rubber do not turn also thick. They can say that all which have for origin Africa, such as those of Soudan, Guiney, Congo, Gabon, Madagascar, Tonkin and even those of Nouvelle-Caledonia are susceptible to stick. Only those of Brazil, of the Amazone-region do not seem to be exposed at that modification Then, there is an example where the kind of latex seems to have an influence on the preservation of rubber.

« But the fashion of coagulation, has none.

« In reality, the Paras of second quality, such as those of Landolphia, de Funtunia, de Ficus, stick, what may be the coagulative employed, even when they have recourse to the smoking.

« We have been able, to effect on the place, a great number of systematic experiences on the motives of stickage and we have stated that the dampness and sun were necessary to make to stick, but that those circumstances separated were not sufficient for arriving to the same result — Wet balls of rubber, placed damp in the bottom of a bag, have been exposed in the sun at Soudan near other balls also wet, but set down on the plain ground. The first did not become sticky, while the second have been modified in a few hours.»

(1) *Caoutchouc and Gutta percha*, no 77, July 1910.

Other damages have been stated on the rubber plates. Red spots, which are produced on rubber-crepes have been announced by M. C. T. Brocks (1).

« During the month of June 1910 my attention was called to the occurrence of crimson patches on para crepe which developed during drying.

« The patches varied in size from just visible red spots to blotches, a quarter of an inch or more in diameter, and as many as 288 occurring to the square foot in some samples.

« The spots become visible when the rubber had been drying for 12 or 14 days, then increased rapidly in size until drying was all but complete, after this no apparent growth took place. They were not observed on the crepe from bark scrap as it was too dark at this stage of drying for them to be visible.

« A close examination showed that the spots in the majority of cases had developed from a nucleus in the substance of the rubber.»

« Inoculations from freshly visible spots were made on sterilized bread and agar-agar, in a few days a strong crimson culture was obtained, this appeared to be Bacillus prodigiosus.

« It is a curious point that the colonies were so long in developing the colour. This is probably explained by the absence of necessary oxygen, which could only enter the tissues as the moisture evaporated,

« The infection lasted for a month to six weeks and disappeared almost as suddenly as it had appeared, without the certain source of contamination being discovered. The natural conclusion is that it was introduced by pool water which a tapping coolie was using to dilute the latex, it is hardly possible (as was suggested) that the bark was the primary host, as great care in sieving the finest particles of this from the latex would not prevent the bacteria from being washed into it.

« The colour in the crepe is almost completely removed by prolonged soaking in methylated spirit. »

We have sufficiently spoken of white moistures which stretch out on the rubber during the drying, in order that we insist on them any more-If they don't take care to clean the plates almost daily, indelibe spots are formed and underrate the produce at the selling-time.

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(1) *Agricultural Bulletin of the Straits and Federated Malay States*, January, 1911 nº 1.

b). — *Seeds*

The number of Hevea-plantations increasing every day, the seeds of that euphorbia give rise to important transaction, and it seems to us interesting to study them in two points of view.

1° Better fashion of packing for shiping at notable distances.

2° Possible contribution in cryptogamic-sicknesses consequently their introduction in country till then free of all flait.

The first question has given occasion to numerous essays, and we must soon say that the experimenters are not quite in same way of thinking. It is very important for Indochina, according that the germinative power of Hevea-seeds disappears quickly and that amongst the trees being in the Colony, a few only give fruits for the are still young.

Mr Ridley has studied the different possible packing and he pointed out the results of the following manner (1).

« Of 7.500 seeds sent to Jamaica on August 31st, were received on november 21st, and Mr. Fawcett writes : « the 7500 seeds sent in biscuit-tins are all germinating very well and we shall scarcely lose 500 of them ».

« One hundred were sent in a similar manner to Calabar on the date July 6 th,and arrived on september 20th.

« The Acling secretary writes in reply : « The seeds were soaked in water for two days on their arrival and were then planted with the upper portion left above the soil. Ninety out of the hundred seeds have already germinated nov. 7th and appear healthy young plants.

« To the Royal Gardens, Kew, 135 seeds were sent on July 6th, packed in charcoal, in biscuit tin. They arrived in a month, and 123 germinated.

In February 12th 1903, 20 seeds were sent to Mr. J.C. Harvey, Vera Cruz. Mexico, who writes, May 19th 1903, that out of the 20 seeds of Hevea braziliensis I have 14 young plants. They came up in a few days, and possibly a few more may germinate, though three seeds were decayed ».

« These were all sent in biscuit-tins. Those sent to Jamaica were packed in slightly damped incinerator earth, but it was necessary

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(1) *Agricultural Bulletin of the Straits and Federated Malay States*, January 1906, n° 1.

to replace the upper part of the packing with sawdust to reduce the weight, as incinerator earth is very heavy and the box, a two-pound tin, which contained 150 seeds, would have been over parcel post weight. »

« The other tins were filled with damp charcoal finely powdered, In packing, a certain amount of care is required in damping the charcoal so as to get it equally moistened, all through and not either over wet or over dry. This is best done by dambing the charcoal thoroughly and then drying it in the sun constantly stirring and turning it over, till it is uniformly slightly damp. »

« The incinerator earth which had been exposed to the elements was damp when received and only wanted partial drying to fit it for packing. Its weight is against its use, but both it and the powdered charcoal have the great advantage of preventing any attacks of mould or bacteria likely to cause decomposition. »

« Other experiments with powdered coir fibre, and coir dust, saw dust and variously prepared soils have been tried but the results do not seem to have ever been as successful. One experiment was made in putting the seeds in water for a month, but though that might be effective for a fortnight or so, they had all perished by the end of the month. »

So here the conclusions are clear enough : It is the charcoal which is preconized as giving the best results.

On the contrary if we are in accordance with wath Mr Prudhomme, (1) Director of the agriculture in Madagascar, says, seeds have been given, one month after a travel, when they were packed :

1° In the remains of coir 20 % of seeds arrived germinated, 70 % of germination on the remaining quantity : so in total, 76 %.

2° In the coir-powder 10 % of seeds arrived germinated 56 % of germination on the remaining quantity : so in total 61, 8 %.

3° In coal powder : not any seeds arrived germinated 53 % of germination. Then, in total 53 %.

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(1) *L'agrigulture pratique des pays chauds*, n° 14, September-October 1903.

Mr. Prudhomme concludes 1° that the packing in coir remains, seems to be considered as the most recommandable proceeding for 4 or 5 weeks travel, and even more, scarcely humected with water. 2° that the stratification in charcoal powder shows itself lower to the other manners of packing.

For our part, we cannot partake the way of thinking of those gentlemen, for we esteem that those earth, coir, charcoal proceedings, are also good, abstraction made of the weight. All depends of the shiping and of the degree of drying of the material employed.

For our part, we have seen opening a great number of boxes and if, of a general manner, we can say contrary at what Mr. Prudhomme observed that it is in the charcoal that the proportion of seeds germinated was the most considerable, per contra it is in the burnt earth that heating of seeds was the strongest. It is true that in the cases that we quote it was not question of some seeds shiping, but that each box contained many thousands. At all events we frankly prefer burnt earth at the others manners of shiping, because the germinated seeds are of a difficult resumption : the small organs which are already developed are often broken during the travel or deteriorated at the moment of unpacking.

It is agreed that they must well dry it and that it does not present wet parts before the employ.

Before passing at the second question, there is a condition on which we must call the seeds — contractors' attention, and which is not yet completely made clear. Here it is: Is it hurtful to gather seeds on trees that they tap. Mr. Francis J. Holloway answers : (1)

« An important point to be decided, and of interest to Para Rubber growers, is whether the tapping of a tree injures the seed fort planting. This question has been raised by a few planters when ordering seed, stipulating that the seed should be from untapped trees only.

(1) *Agricultural Bulletin of the Straits and federated Malay States*, September 1903, n° 9.

I have sold many thousand of seeds during the last four years, but only three planters have made this request. I have carefully tested seeds from tapped and untapped trees, of an equal number grown in beds side by side for past three years and I have never found the slightest difference. I have now large nurseries and am perfectly satisfied there is no difference, if one can judge by general healthy appearance of plants in the nurseries. I referred the matter to M. WILLIS the Director of the Royal Botanical Gardens, Peradeniya, and he has very kindly allowed me to publish his opinion which is as follow: — As to seed from trees which have been tapped (Para) our experience goes to show, that we get less seed when we tap, but the seed seems just as good on the whole. In some years our seed seems better than in others, but so far as I am aware this has no relation to tapping-weather has probably more to do with it. It is difficult without special observation on the subject to disentangle one effect from the other, Retapping Para, from experience gained in tapping 6.500 trees. I find that they can easily give I lb. per tree per year, if tapped twice yearly as is being done at present on this estate».

« And M. RIDLEY Editor of the *Tropical Agriculturist* adds : »

« We should certainly be inclined to recommend that seed should only be taken from Rubber trees set apart for that purpose just as Tea-bush-seed bearers are so treated ».

We are happy to meet here with that eminent man of science for we are persuaded, being very much inclined to believe to the transmission — laws, that if a tree suffers, and the tapping puts it in sickness state, its seeds will be necessarily less good. — To doubt of it is to say that they must condemn the principles of vegetal-selection :

But they tend more and more to constitute seed-trees which are destined only to furnish seeds that they need. It is that same consideration which will permit us presently to oppose at the introduction of seeds coming from sick-trees, but there, Mr RIDLEY will seem having forgotten those hereditary laws which conducted him to advise to take seeds for seed-bed but only on vigorous and healhty trees.

It is only after a report of Mr. VERNET'S chemist at the Pasteur's Institute of Nhatrang, in which he pointed out the existence of cryptogamic — sicknesses prevailing on Indies

(english) Heveas and their possible introduction in Cochinchina yet indemnified, that the Saigon Agriculture Chamber got alarmed and asked the application of strict decisions, in order to prevent the possible introduction and propagation of the devastating-mushrooms. After a second appeal of that assembly, more violent than the first, Indochina government thought of its obligation to gratify those who where interested in the matter and the following decision appeared:

The General Governor of Indo China,

Cabinet N° 1760, office: N° 479.

Goverment-Counsellor.
Commander of the « Legion of honour »

Considering the decree of the 21st april 1891.

Considering the necessity of avoiding the introduction in the Colony of cryptogamic-sickness, announced in Heva-plantation of Ceylon, of Malay States and Dutch-settlements.»

On the proposal of the Lieutenant Governor of Cochinchina and Superior-Residents. »

DECIDE:

Article 1. — The introduction of hevea-plants in Indochina is interdicted.

Article 2. — The fruits and hevea seeds imported will be as soon their disembarking and before any other manipulation treated by an antiseptic dissolution, conformably at the orders annexed to the following decision.

That performance will be done by the receiver and at his charge, under the inspection of a local Commercial, Agricultural-Administrations agent. Those administrations will furnish, if need, against rembursement, the material and personnel necessary.

An official report of that performance will be done by the agent that will assist.

The receiver must a few days before inform the commercial and agricultural administrations of the probable date of arrival of seeds, in order not to be behind time for their treatment.

Art. 3 In case that an importer would be convinced of having introduced in the colony heva-seeds without having submited them to the treatment said by this decision those seeds would be seized and destroyed without prejudice to pursuits to enter against the delinquent.

Art. 4. The Lieutenant-Governor of Cochinchina, the Superior-Residents and the general Director of custom are charged in wath concerns them, at the excution of the present decision.

Saigon June 7tes 1910.
Signed: Albert PICQUÉ.

Instructions joined at the decision n· 1740 of the 7 June 1910 determining the conditions in which hevea-fruits and seeds can be introduced in Indo-China.

The hevea fruits and seeds must be treated by the following manner :

The fruits and seeds, put in a basket or in a cloth with large stitch, will be immerged in an antiseptic dissolution during half an hour and brewed many times.

After the time required, they will be washed in three or four consecutive water and placed according to usual methods.

The antiseptic dissolution will be prepared with bichloure of mercury at one per thousand, either sulphate of copper at one per cent at less. However the proportion of this last dissolution can be increased by a single decision of the Lieutenant Governor, after advice of the Director or the Chief of agricultural and commercial administrations if the dosage is thought insufficient.

CERTIFICATE OF TREATMENT

Agricultural and Commercial Administration of.....(1) The undersigned..... (2) declares that the..... (3) Hevea seeds coming from ..... and addressed to M..... leaving at. .... have been disinfected in my presence.

This decision was afterwards modified of the following manner.

Governor general Cabinet No 2778. Officice No 680.

The General Governor of Indo-China,
Officier of the « legion of honour ».

Considering the decree of the 21st April 1891.

Considering the necessity of avoiding the introduction in the Colony of cryptogamic-sickness, affecting rubber-trees;

Considering the decision of the 7th June 1910, determining the conditions in which the hevea fruits and seeds can be introduced in Indo-China.

On the proposal of the Lieutenant-Governor of Cochin-China and the Superior-Residents.

DECIDE :

Article 1. — By derogationat the disposals of the art. 2 of the decision of the 7 June 1910, the conditions in which hevea fruits and seeds can be introduced in Indo-China are modified as following:

Till further orders, any importation of hevea-seeds in the Colony will be the object of a particular examination from the Custom-Administration before delivery of parcels to the consignees. Hevea-seeds must be imported in boxes sealed, with obligation for the planter to oper the desinfection on the plantation before an agent of Agricultural and Commercial Administrations who will verify if the seals are

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(1) Country of union.
(2) Name and title of the agent.
(3) Number of seeds.

those indicated by the planter, and will be present at the opening of the boxes and to the desinfection-operation, conformably to the instructions of the decision of 7th June 1910 and will prepare an official report of the preparation of which copy will be given to the planter. The packings will be also disinfected or destroyed by the fire. Carriage, residence and way expenses of the agent remaining at the planter's charge.

The receiver must inform some days before the probable arrival of seeds, the Commercial and Agricultural Administrations. In the other hand, Custom-office will also inform the agricultural and commercial administrations of all seeds-arrival and let them know the name of the consignee.

Art. 2.— The Lieutenant-Governor of Cochinchina, the Superior-Residents, the General Director of the Custom houses and the local Directors of Agricultural and Commercial Administrations are charged in what concerns them, of the execution of the present decision.

Saigon the 15 September 1910.
Signed: KLOBUKOWSKI.

At last, for want of competent personnel, the seeds-desinfection could bear a prejudicial delay for the interested persons, Mr the Governor of Cochinchina published the following circular :

Saigon the 21 October 1910
Cabinet, nº 202

CIRCULAR

The Lieutenant-Governor of Cochinchina to Messrs the Administrators of the provinces of Baria-Bienhoa-Thudaumot-Tayninh-Giadinh-Cholon-Travinh and Soctrang.

I beg to inform you that, for giving satisfaction to the desideratum expressed by the Society of Rubber-Planters. I have decided, in waiting the promulgation of a new de-

cision submited to Mr the General Governor, that the hevea-seeds imported in the Colony; could be since now, désinfected in the importers' plantations, under the control of a functionary belonging to one of the administrations represented in your province. You will design in preference the functionnary whose residence is the nearest of the plantation where must be done the anti-cryptogamic-treatment.

In case that any functionary cannot be disposed of your province, an agent of Agricultural Commercial Administrations will be named for looking after the disinfection, which will obligatorily take place according to the operatory fashion ordered in the folowing detailed instruction, (1)

The importers of hevea-seeds purposed for plantations situated in your province, must advise you some days before of the arrival of those seeds, in order that you may take your disposal in due time.

The material and the products necessary must be furnished by the planters who will assume carriage, way and residence charges for the functionary charged of the treatment-control.

The disinfection-operation on the plantations will be object of a detailed official-report in three copies, one for the receiver, the second adressed to the Agricultural Commercial Chief and the third for the conservator of records in the province.

Signed : GOURBEIL.

Meantime experiences had been undertaken under direction of Mr. MORANGE director of Agricultural and Commer cial Administration. by Mr. BUSSY, principal chemist of Saigon-analysis-laboratory and by ourselves. In order to multiply the experimental stations they asked to Mr. BELLAND who agreed willingly, to let the Agricultural-administration

(1) Look farther : orders given by M. MORANGE.

to make essays on his ground : Here are the results obtained :

Experience done in the Chemical-laboratory

Conditions of the experience.

Seeds immerged in antiseptic-dissolution during half an hour without being brewed.

Seeds of testimony lots directly sown without immersion in the water.

Seeds coming from the Plantation of Phu-Nhuân.

Results obtained after one month of germination, 13 July at the 13 August, on a bed of damp earth

NATURE OF TREATMENTS			CENTESIMAL PROPORTION of seeds germinated after 30 days	
				Average
1°	First testimony		78	74°/₀
	Second testimony		70	
2°	Sulphate Copper at 1°/₀. Immersion of 1/2 hour.	Seeds washed after the treatment	62	57°/₀
		Seeds non washed..	52	
3°	Sulphate of Copper at 5°/₀ Immersion of 1/2 hour.	washed Seeds.. ...	68	65°/₀
		Seeds non washed.	62	
4°	Bichloride 1 per 1.000. Immersion of 1/2 hour.	Seeds washed.....	70	69°/₀
		Seeds non washed..	68	
5°	Bichloride 2 per thousand. Immersion of 1/2 hour.	Seeds washed... ..	84	87°/₀
		Seeds non washed..	90	

IIº Experience done by M. Belland, on the plantation of Phu-Nhuan

Conditions of the experience. — 3 lots of 500 seeds each.

Lasting of the treatment: half an hour.

Seeds of the testimony lot immerged without brewing.

Seeds of the desinfected lots, brewed vigorouly enough and without discontinuity during half an hour.

Results obtained ofter 40 days (germination remarked from the 17 July to the 26 August.

NATURE OF TREAITMENTS	NUMBER OF SEEDS germinated	CENTESIMAL PROPORTION of seeds germinated
1° Testimony (pure waler).	400	80%
2° Sulphate of Copper 1 per cent.	38	7.6%
3° Bichloride 1 per thousand	54	10.8%

III° Experience undertaken in the botânical garden.

Condition of the experience 4 lots of 500 seeds each.

Lasting of the immersion : half au hour.

Seeds from the essays-fields of Ong-iêm.

The seeds have been washed with two waters after the immersions in antiseptic baths brewing).

Germination remarked the 11 October 1910, either after 80 days.

NATURE OF TREATMENTS	NUMBER OF SEEDS germinated	CENTEXMAL PROPORTION of seeds germinated
1° First testimony, dry seeds.....	400	80%
2° Second testimony, seeds plunged in water... ..	368	73,6%
3° Sulphate of copper at 2 per cent	308	61,6%
4° Bichloride at 2 per thousand....	320	64%

IV° Experience undertaken in the botanical garden the 12 August 1910.

Conditions of the experience — 6 lots of 500 seeds each.

Lasting of the immersion : half an hour.

3 lots have been brewed.

3 lots have not been brewed.

The seeds have been washed with 2 waters after the immersions in the antiseptic baths.

Germination remarked the 11 October, either after 2 months.

NATURE OF TREATMENTS	NUMBER OF SEEDS germinated	CENTEXMAL PROPORTION de seeds germinated
Without brewing :		
1° Lot testimony pure water.... ..	399	79,8%
2° Sulphate of copper at 2 per cent.	387	77,8%
3° Bichloride at 2 per thousand ...	371	74,2%
With brewing :		
4° Lot testimony, pure water	27	5,4%
5° Sulphate of copper at 2 per cent.	72	14,4%
6° Bichloride at 2 per thousand....	242	48,4%

Many conclusions seem to be derived from, those essays aforementioned, namely ;

1° They must of all necessity make the experiences with lots of seeds of the same origin (with seeds of a same tree if it is possible) for otherwise these one can not be compared between them, regard to the various germinative properties of those seeds.

2° The brewing has a very remarkable fatal influence ;

3° The sulphate of copper, even at 2 % and the bichloride, even at 2‰ exert none bad power on the germination.

We explain ourselves very easily the fact that the brewing harms at the welcome of plants. In reality in opening seeds having already made a long travel, in a packing more or less dry, we have remarked that the young plant without having yet burst the outer envelop, was ready to see the light. Then if they brew, they venture to break the small stalk and after to clog definitively the coming out of the plant.

In the instructions given by Mr. Morange, that remark is neatly observed. Here, how they must proceed for the disinfection.

Instructions for the Hevea seeds disinfection.

I. Verification to do at the arrival of the boxes on the plantation.

Before the opening, they must examine the state of the seals before the importer or his representive.

At the opening of the boxes, they will verify :

1e If there are seeds mouldy or cleft,

2e If there is heating in the mass of seeds.

3e If there are seeds of which the almond is loose and shakes in the shell.

The seeds offering that defect do not germinate. It is advised to the planter to put them aside for avoïding to impute the unsuccessfulness of the germination at the disinfection treatment. Those different establishings will make the object of an official report signed by the representatives of the plantor and of the Administration.

II. *Disinfectant to employ :* Sulphate of copper in powder at the dose of 2 %.

III. *Material necessary :*

Half-cask of Bordeaux.

Bags in jute.

Common baskets for the seeds-draining. It is advised not to make use of iron or metel tools, but only brass, for the sulphate of copper would be decomposed in presence of a foreign metal. An half-cash can contain 6000 at 7000 seeds.

IV. *Preparation of the dissolution.* The antiseptic dissolution will be done in dissolving in 98 litres of water, 2 kilogr. of sulphate of copper pulverized. They will take care not to throw the copper-salt in lump in the midst of water, but to put it in a knot of cloth that they will agitate in the water till all the contents may be dissolved (this in order to avoid that the crystals falling at once at the bottom of the recipient or by the fact of an insufficient agitation, they may be too slow to dissolve). The same dissolution can be used for many consecutive operations. It can be subsequently used for washing several places (stables etc...).

The seeds will be taken out with care and placed in a jute-bag, previously soaked in the dissolution or in a basket with stitches little closed provided with a cover.

The bag or basket containing the seeds will be kept immerged in the dissolution by the means of stones during half an hour.

They will take out from the antiseptic bath the bags or baskets including the seeds.

They let them drain and they dip them in a cask containing pure water,

They will give to the bags or baskets light oscillations from up to down and vice-versa.

It is preferable for that washing to keep the bags opened. they will make that washing operation in a new water (which must be used only once).

The first washing will last 10 minutes, the second 5 minutes. They will after leave the seeds draining and they will put them immediately into germination.

Signed : MORANGE.

To ascertain that the antiseptic liquid was unable to penetrate inside the seed and so kill the plant, if so much is that a so feeble dose of sulphate of copper or bichoride mercury may have that power. we have dipped seeds in a coloured liquid during a time gradually prolonged.

We could distinctly notice that an immersion of 48 hours was absolutely needful for light traces of water may been seen as existing in the inner textures of the envelop.

Besides it would be good to ruin once for all that affirmation that a suphate-copper bath at 2o/o may be susceptible to harm at the germinative quality of a seed If they open Barral's Sognier's dictionary (of which they cannot contest the authority in agricultural matter) they can read (2e book page 213) under the signature of Mr. Gustave Heuzé, member of the national agricultural Society, general honorary

Inspector of agriculture, professor at the national agricultu ral Institute.

« The cereales, during their vegetation, are assailed or invaded by various cryptogamic-plants which harms to their growth or reduce their products. As well as, the rye and the wheat are assailed by the horn-seed, the wheat by the rust, the oats, the barley, the wheat and the maize by the smut. »

« It is in order to prevent the apparition of the rust and the horn seed on the wheat, that they use before trusting the seeds of that cereal to the earth to make it to endure a preparation. That preparation is known under the name of liming, sulphatage or vitriolage, following to the produce employed. »

« The sulphatage of seeds had been conceived by Mathieu de Dombasle. It is most efficient than the liming. Here how they operate : »

« They make to dissolve 7 kilogrammes of sulphate of sodium or salt of Glauber in one hectolitre of water. When that dissolution is prepared, they spill on the seeds nearly 6 litres by hectolitre, and they quickly agitate the seeds in order that it may be perfectly wet. When all the seeds to be sulphated are wet, they throw in lime-powder in the proportion of 500 grammes by hectolitre, after they agitate again for leaving at itself when it is nearly white. After twenty four or forty eight hours, it is dry enough to be sown. »

« In this proceeding the lime, perfects the destructive action of the sulphate of sodium on the seminuls of the rust. »

« They also sulphate the wheat seeds with a dissolution of sulphate of iron or green copperas, or sulphate of copper or blue copperas obtained after having dissolved 4 à 5 kilogr. of one of those salts in 100 litres of water. The seeds treated by the sulphate of iron have their tuft greenish ; that colouring is blue when they are weted with a dissolution of sulphate of copper. »

« The seeds limed or sulphated that have been well prepared always increase of one fifth of their volume. »

« So 100 litres after been limed, have a volume equal at nearly 120 litres.

« When, by particular circumstances, they cannot sow in the forty eight hours, the seeds that are limed or sulphated, in order that they do not ferment or germinate they must turn them every day till they may be dry. Those seeds cannot be employed in the man-feeding, but they can give them to pigs, except those treated by sulphate of copper. »

They will allow us that hevea-seeds are less susceptible then corn or oats seeds and there however the liquid passes through the seeds treated of which the volume increases of one fifth, without damage for their futur life.

We regret only one thing it is that exaggerate fears may obliged to prescribe a wash after wetting in an antiseptic-bath. We should have prefered much more to see remained a light slice of suphate of copper or mercury on the treated seeds. That for two reasons first because so, they avoided the possible attacks of ants and other insects; after because they form an antiseptiptic ground in the middle of which the little plant saw the light.

In no events those preceding decisions could harm to the future Heveas-plantations, but on the contrary, they must be useful to theem in protecting them aganist a possible danger.

Then we don't share the opinion mentionned so by Mr Ridley (1).

« Personally I think the risk of importing seeds with spores of rubber-killing fungi is infinitesimal. Supposing, for instance, one rubbed a seed with spores of Fomes and planted it in the nursery. The spores would not last indefinitely and it would be probably two years before the plants in the nursery would be old enough to be attacked. It is in the highest degree improbable that any of the spores would germinate at all under the circumstances. In the case of Diplodia the risk would be still smaller, as Diplodia requires to be put on the cut end of a shoot to make a successful growth. As I have pointed out till decomposition of the exterior of the shell of the seed sets in the spores could hardly rest on the smooth surface, and would even, if attached by mud etc.., or included in the packing, be washed away by ordinary plunging in water and probably by the first rain also.

« The case is quite different with stumps or plantlets infected being brought into the estate. Here the fungus is established in a thriving state on the young plant, and can go on developing there. It is put in contact with healthy plants in the same conditions of life perhaps even thumb-nail pruned or with buds wounded in some away. By planting infected spore producing plants in such a healthy lot, a planter would be putting the fungus in the best possible position for its development. »

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(1) *Agricultural Bulletin of the Straits and Federated Malay States*, November 1910, nº 11.

We do not want to pursue longer that citation to make to understand the dangers that there are of introducing bad seeds. If they could at once import all the seeds that they need or will need after the argument of Mr Ridley could be hold. Then they will have a lot of seeds which would spread out together and the parasites would not find any ground favourable for following to live and to spread. Unfortunately it is not here the case. According to the penury of seeds the plantors have been obliged to place at intervals their orders. It is so more prudent that in ordering at once a few seeds, they could follow their growth, give them the care that they required and avoid the return of a possible clumsiness. The colonist anxious of his profits will prepar a seed-nursery that he will fill again by little and little and in proportion as the receipts. Then there will be in the nursery plants of every age and the flail that could not wait two years, will find as soon his arrival favourable grounds for his being, that it may be question of fomes or of Diplodia.

But Mr Ridley wants to give us again more convincing arguments. He says that mushrooms of polyporees-family live in quantity in tropical countries, in Cochinchina as elsewhere and it is not by prohibition-decision that you will arrive to avoid the introduction of sicknesses that are already in your land.

At this we shall answer two things :

1° If it is true that polyporees live in Indochina better reason for preventing to introduce seeds of trees already assailed and which will give, by the fact of their ascendency, products more qualified than others for serving of a centre of infection.

2° The smut and the rust live in France and precisely for preventing that the new plants may by reached by those sicknesses they take care, as we have already seen, to lime and to sulphate the seeds. What the french peasants admit as favourable in a country where the bacteries and the mush-

rooms etc... developed themselves less rapidly must we leave off and throw off in a country where their vitality is quintupled by the ambient circumstances.

It is not the administration that ought to ask to the cultivators to take such prudence measures, it is these-one that of themselves ought to never neglect them. There is only but one thing that, fortunately, puts a shade to those unassailable principles : it is the trade illfaith of some sellers who have not feared to dispose of all the stock of their damaged goods in pretexting with joy, that the antiseptic treatment that they made to endure to the seeds would destroy their germinatwe power. It is there a fashion less honest against which they would not too energetically protest,

We regret also that the carriage-means render often difficult the application of wise and preventive measures that we would be glad to see energetically maintained and to be applicable.

c). — *Oil.*

We just said that the seed-trade for seed-bed is considerable. However this source of incomes is not inexhaustible and it is for that purpose that they thought to draw another profit in using them for extracting oil that they contain. Since 1903, our neighbours of Strait-Settlement commenced to think of this possible outlet and they were happy to ascertain that hevea did not produce only rubber but that very likely, oil also of a great commercial value according to the first research.

In 1907, M. Carruthers pursued the study of the matter and came to these conclusions: (1).

« The commercial value of the seed of Hevea braziliensis has up to the present been rated on the amount and quality of the oil it possesses. This oil is similar in its character to Linseed oil and for

(1) *Agricultural Bulletin of the Straits and Federated Malay States*, November 1907, n° 11.

the manufacture of paints, varnishes, etc..., and other purposes for which Linseed oil is used Para seed oil compares favourably ».

Unfortunately M. Carruther's figures on the produce have been contested since, what made Mr Petch, Mycologiste of the Ceylon goverment to write as follows (1).

« Many articles have been published, which were to show to planters the possibility to sell at a remunerative price in the view of oil extraction, the excess of their hevea-seeds, not employed for the seed »

« In Ceylon CARRUTHERS having weighed hevea-seeds, arrived at this conclusion that 414.000 of these seeds coud furnish a ton of almonds-Each tree would produce nearly 400 seeds. He calculated, there after, that a little more of two hectares would give a tun of almonds, leaving a profit of 17 dollars by hectare (dollar at 2 fr. 90). But it is evident that the seeds weighed fresh, suffers a loss of 30 % by the drying, that they must notice.

« WRAY esteemed that in the Malay State 500.000 seeds ought to furnish one tun of almonds dried at the air. He estimated at 1000 seeds the production of a tree and 40 % the purport in oil of those seeds.

« A more recent experience made by Mr. MACMILLAN and ourselves at Ceylon, proved that 700.000 seeds, taken on tapped trees, were necessary for giving one ton of dry almonds. These were estimated 250 francs the ton, it remained only scarcely 0 k. 35 for covering the expenses of gathering, decortication and freight when it is of use to pay 0 k. 40 for the only gathering of a thousand seeds.

« Another experience, has been done at Ceylon on a greater degree. It proved that one million seeds was necessary for obtaining one ton of dry almonds and that the produce in oil furnished by the nature mills did not exceed 30 %. In those circumstances the extraction of oil could be of any profit.

« The superintendent of another well known plantation of Ceylon. having forwarded hevea-seeds in all the parts of the tropical zone affirms that he may hope more than 1000 seeds by tree of 12 years, in farming. The best production of old trees of d'Henaratgoda has been of 430 seeds by tree, we have observed that those trees are too near and that a higher produce would be obtained certainly of trees of the same age (20 at 30 years) more distant.

« The present problem must carry on the seeds-gathering by a more economical mean. They know that the capsules break suddenly in throwing their contents in all directions and that they ripen successively in a period of two months.

On the other hand, the seeds left on the ground grows in a little time. Unless that an economical method of gathering may be adopted.

(1) *Tropical agricultural Newspaper* — September 1910.

There is not hope of taking advantage of hevea seeds for the oleaginous industry ».

However the matter interests always our neighbours who gave the following recapitulation according to different appreciation emitted.(1)

« The United States Consul-General at Singapore suggests that the oil of seeds of Hevea Braziliensis will ultimately be of great commercial value. He recalls that it was a long time before the oil of cotton seeds became a valuable commercial factor. The Consul-General (Mr Dubois) reports that at present there is such a demand for the seeds of Hevea for planting that the supply is not sufficient. It is now suggested by experts, however, that in erecting machinery on new rubber plantations the plans should be made with a view to rubber seed crushing machines being included later. This would leave a residue on the estates which it is believed will prove good for cattle food, as well as a fertilizer for rubber trees. (United States Daily Consular and Trade Reports, September 13, 1910).

« At a recent meeting of the United Planters' Association of South India. Mr R. D. Anstead mentioned that a large number of Para rubber trees planted in that country are already beginning to bear seed, and each year more will do so. It has been estimated that trees after the fifth year will yield 500 seed each, and the product of 400 trees will weigh a ton. It is stated that the seeds contain about 20 per cent of an oil which has been valued at $ 100 (gold) per ton. Mr Anstead was of opinion that the planters should gather the seed, crush it for the oil, and use the residue for fertilizing the rubber plantations : — (The India Rubber World, Vol. XLIII, p. 16).

« The comparisons of rubber seed with linseed and cotton-seed have led to inquiries as to the possible commercial utilisation of rubber-seeds in the future. At present there is such a demand for seeds for planting that there is no surplus supply. The Botanic Gardens at Singapore-which is really the birth-place of the Malay rubber-industry have already furnished great quantities of seed for the plantations, but the authorities now refuse to undertake any more orders for seed before next spring owing to the engagements already booked. But that time will not be long in arriving when there will be a large surplus of seeds from the ninety millions of trees already planted. Scientific investigation of the rubber-seeds has proved that they yield a fine clear oil of good drying quality.

« It has recently been suggested that, having in view the future commercial value of the seeds, it would be wise in erecting new machinery on plantations to make provision for power and space for seed-crushing machines. By doing so the residue from the crushers,

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(1) *Agricultural Bulletin of the Straits and Federated Malay States*, nº 12, December 1910.

which is valuable both as cattle-food and for fertilising, would be left on the estates»

(The Chemist and Druggist Vol. LXXVII P. 63).

« We understand that there is just now rising a strong demand for oil of Para rubber seed in the United States of America. The failure of the linseed crops, and the substitution of the cultivation of the soy bean for the linseed by many planters has left the consumer of this oil short, and this is probably the cause of the interest now taken in Rubber seed oil.

« Reports and notes on this oil have been already published in the Bulletin, but in the days when the attention of planters was called to this product all seed were required for further planting, and since then the production of the rubber has been naturally the sole objective of the planter who has not bothered about the minor product.

« Now, seed is abundant, and it would doubtless be possible to bring this product into the market and so to add to the profits of the estates. In clean weeded estate it should not be difficult for women and children to collect large quantities of seed at a cheap rate, they being paid by results The seed could be shipped to the oil-mills, and there sold.

« Only to-day a merchant was enquiring where a few tons of the oil were to be had for shipment to America, and it is certain that the oil would fetch a ready sale were it procurable in large quantities especially at the present time.

We gratify ourselves in adding that, that oil can be obtained by hoat an by cold, at the laboratory of Saigon. In the first case a yellow brown liquid; in the second a yellow-clear liquid, of a better aspect.

4⁰ — Habitat and grounds

Every authors are in concordance to affirm that Hevea-tree requires a hot and damp climate, uniformity in temperature, which should be from 30 to 36° the highest, and not lower than 20° with an average of 28; a rainy season, which should not be distinctly settled by a dry weather during which no rain would fall; but on the contrary, there should be rain now and then during the period of dry weather and vice versa during the damp weather.

Per contra the persons who seeked for grounds, at least, we believe, they sometimes made haste to come to conclusions which brought some confusion in the planter's mind.

« According to M. Huber (1) the Hevea Brasiliensis likes plainly a little marshy grounds, along the borders of rivers which are inundated during rainy season and where subterranean sheet of water is in level here and there, however not covering large surfaces ».

« During the highest flood which lasts from one to three months, the seringuaes of the upper Amazone and its tributary rivers are inondated by the over flowing water that may raise up to one meter high. On the lower Amazon when ebb tides are less felt, but where the flowing of the water comes into account, things go differently. Here rivers loosing their borders are but only for a few days and water comes in and draws back with the ebb and low tides»

« In the Island's regions at the East of Marajo, for instance, the amplitude of oscillation of the river's level is not higher than 1,5 meter either in damp or dry season, while the difference between low and high tides equals 1,5 meter ».

« The level of the high water during dry weather is at something near the same, with that of the rainy season and the total amplitude of oscillations in a year is about three meters. In dry weather (July-december) the water from the canals does not reach the interior of Heva forests even at the equinox tides except by small dranages called *igarapes* even in winter (January-June) the hevea's trunks are irrigated by river but only during the highest tides».

« In the neighbourhood Balem and along the Braganca road there are seringuaes that are never reached by river-water, hut in rainy season, they are marshy»

« In general, it can be said that the Hevea Brasiliensis tree although seen more frequently near the borders of rivers is not limited to their inundation radius, but also in other grounds saturated with dampness during a great period of the year and situated for a part from marshy land.»

As we have seen beore Mr. A. Wickham who brought to kew seeds that he had gathered on the borders of te Amhazone rivers, says:

« As all plants and seeds good for plantations and culture of these trees, in tropical regions of the East, are the direct descendants of the former as well as of the latter from the 70.000 trees introduced by me in 1876-77 upon the India-governement's demand it is good to remember that their original country is situated at a south latitude of 3° and to bring the conditions in which they are in that region, to think that marshy or damp lands suit the hevea plant, it is a mistake from the explorers of little knowledge who have seen during their trips that trees growing along the Amazon rivea and its tributary streams, while the real forests of rubber trees are situated near

(1) *Review of the colonial cultural* nº 95, Fébruaay 1902.

the mountains and those seen by the inquisitive traveller are sick trees grown from the seeds brought by the inundation from the interior of the forests. »

« In fact, all the Hevea-trees that I procured for the India governement came from big trees growing in the forests which set over the broad uplands dividing the Tapajoz of the Madeira. Their ground well drained, very extended, is an upland covered with forest, not too rich; but deep and of uniform composition. The Hevea trees met in those uninterrupted forests compete with the thickest and reach the periphery of 10-12 feet (3m-3m. 60) in the bottom.

« Those extents of forests accentuated by broad uplands secure the space, including the great arterial system of the Amazon and the steep side which runs more or less far and ends shortly on the down lands, igarapes or vegas, that is to say on the borders of the arroyos which overflow when the principal rever swells on these uplands.

« The drainage is so accentuated on those uplands, that people who go in the interior of those forests to work the rubber once a year are obliged to quench their thirst in using bind weed from which they obtain water.

In spite of the rainy season which lasts for some months even in sinking wells, water cannot be procured. »

Mr. CIBOT protests (1) against these affirmation and he assures.

« These grounds the most favourable to heveas, at least in upper Madeira, Beni's and Acre's regions where the land is low and damp.

I will make to observ first, adds he, that Heveas can be seen, very seldom, on the borders of large rivers and their tributary streams of any importance and of rapid current, Hevea forests and to say better « Manchas » (blots, clumps) in fact are met at some distance from the great floods, but generaly it is by depression which, if they are not always watered by the floods of the principal rivers, are covered, from the high of the rainy season till the decline of waters (January to March) of a sheet of water of which deepness changes from a few centimetres to 1 metre, and many a time, it happened to me, in going out a reconnoitring to have to follow the paths of estradas on long distances, in walking in water till ham and sometimes till the belt.

In the farming that I was watching, I was making to follow the pica (tap) till the moment where the waters rendered impossible the walk. and the seringueros worked during two or three weeks in paddling in the water on half the passage of the best estrados.

They meet a few Heveas which are not numerous on some parts of the forest but in that case, very seldomly, the Heveas always grow

(1) *Journal of Tropical Agricullure,* nº 31; juannary 1904.

on brook side it is true naturel draining-tile sweled in winter, dry in summer, but always conserving dampness around roots of trees growing on their sides, even in full dry season The fact that those heveas are almost without exception quartered along those small drains or brooks, proves well, the preference of a damp ground for those trees ».

They can't hope discordance of view more clearly no ted. Their deduction in that is 1898. Mr Haffner, then Director of the Agriculture in Cochinchina, undertook Heveas plantations in Ongiêm Station, partly in a low and marshy grounds (late ground of rice continually damp, by places turfy and inundated once by year in the lowest part) and partly in the high places of that experimental station.

By slow degrees all the plants of the marshy parts disappeared and alone remained; 1° the low-part plants when they took care to drain the ground, 2° the high part plants. However it is important to quote that if they observe 42 trees of same age, being ones in the low drained part, the others in the high part, they have for 153 days, the following. latex-produce for the different methods of tapping employed;

Vernet's Method	42 trees (low ground):	110.011	cent. cubes.
	42 trees (high ground):	61.351	—
Fish-bone	42 trees low graund):	138.655	—
	42 trees (high ground):	134.324	—
1/2 Fish-bone	42 trees (low ground):	91.875	—
	42 trees (high ground):	90.172	—

So in those three methods the produce in latex is more important for the heveas planted in a damped drained ground, and however the trees of the low ground have much suffered of anterior bad made tappings; in the moment that they were not quite sure on technical proceedings of tapping.

This once more comes to confirm what we said before to wit that an irrigation (we have said before waterings) would be of better effect in a rubber-plantation, if they don't find a dry ground.

5°— Multiplication of Hevea-trees

a) — *Choice of seeds*

We have already said the interest which seems to be at forming seeds tree. We appraise that it will be wise that each planter left in his plantation a dozen of trees, or more, purposed to give seeds that he will be need after and which will not be tapped. Unfortunately in the present case, there is only a few heveas in Indo-China that may be speculated chiefly for the seeds. In realty we think that a tree less of ten years old is impropre to give good products, that because all the sap has been employed for the vegetal-composition at the detriment of his agents of reproduction. We shall even. advise to cut all the flowers that would appear before that age, so as not to consume the vegetal for an useless function. As we have seen, we are tributary of English Colonies for what is queston of seeds that are necessary to us. As we are obliged by the necessity, we must endure that evil but we think firmly and we persist on that condition, that it will be preferable to take our tree seeds as soon as we could.

We shall have so the double advantage to avoid the introduction of parasitic sickness and chiefly to have products coming from kinds already acclimated in the Colony. They can oppose that these one have suffered during vegetation (this has been asserted) and that it is preferable to find seeds of trees placed in most favourable condition, but if the fact was true, they would be exposed at a loss considerable of plants because all the young pitiful subjects will die by want of acclimation, and they can add also that it is useless to try a cultivation in a so unfavourable ground. Let us believe that there have been excess and error on all sides. — They did not know and it is not certain that they know yet exactly the living-conditions of heveas

and that unhappy experiments have made to conclude hastily from the seperate fact to the generality.

When they buy seeds, they must be bright (mistrust of oil diffused on the surfaces) and heavy They cannot as for the almost others seeds, have recourse at the experience of water bucket in which they place the seeds in order to take only those that go in the bottom of the recipient, since by their volume all (all nearly all) the hevea seeds float, nevertheless a little practice makes soon to destinguish the good ones from the bad ones.

A very simple machinery could even supply at the incompetency of the beginning. It would be made up of a conduit bringing the seeds one by one on a small platform which would let down if only these one had the weight required (5 grammes) in the contrary case they would be thrown.

(**b.** *Question of Nursery-Seeds*

There are three principal questions that they can employ for making a heveas-plantation.

1° Putting in place of trees having already a certain age ;

2° Transplantation of seeds after germination and short stay in the nursery or in baskets;

3° Seed-bed in direct place ;

In the first manner of proceeding they generally leave the plants in nursery during 6 months to one year, it is to say that till they have 1 m 50 to 1 m 80 in height. At that moment, at the biginning of the rainy-season, they pluck off and after having taken off the leaves, refreshed the small roots, cut off the extremity of the stalk and the principal root, they make bundles of hundred that they carry there where they want to ground the plantation. Besides they has taken care to make before in that place holes of 30 centimeters cubes, in the center of which they have digged a small excavation of a deepness such that it may be able to receive the extremity of the principal root.

After having placed the plant at the place that it must occupy they fill up the hole in taking earth on the surface of the soil and in pressing it around the subject in trampling on. Sometimes in stead of contenting ones self of pinching the extremity of the stalk they act it and they reduce its height a 15 or 30 centimeters above the surface of the soil. Other branches are not long to come out. Sometimes also they combine the two proceedings it is to say that they begin to leave off the plant to itself in leaving a length of nearly 1 metre and it is only if they see that it perishes that they cut it and that they reduce it at a few centimetres.

They pretend that with this manner of proceeding they obtain at the minimum 80 % of resumption in dry ground and 90 % in damp ground. For us it presents multiple disadvantages : first a considerable slowness in the vegetation for it a is real transplantation that they operate, after they make to spread out two other branches at least and they must cut after one or many of them for obtaining a single trunk, they will uselessly worry the plant, at the prejudice of the future tree growth.

The second method consists in making the seeds to germinate previously in placing them in a special malt-floor well shaded and containing sand kept constantly damp, or more simply in leaving them under a verendah between two bags that they water frequently — When that germination is obtained, they carry the seeds in the nursery which is disposed, as we shall point out presently. Sometimes they make to germinate previously the seeds and they transplant after in baskets or in pots in bamboo. At last sometimes they place them at once in those baskets or pots where they will full grow — The baskets have various dimensions according if they are destined to receive plants or seeds, the more often they have only 0m50 of deepness and 0m30 of diameter in the first case and only 0m30 of deepness in the second case. These baskets are full of

mould. If they want to confide them plants, they will act so, when these one will reach in nursery, a suffisant strength in order not to fear a transplantation and they will place them one near the other under the shade of hevea already able to be a tree for instance. The bamboo pots are formed of pieces of bamboo of 30 centimetres that they full up with earth, and a seed is placed in the center at a deepness of 3 a 4 centimetres. They can also shade those pots, but more often, the baskets and pots that have directly received a seed, are put one after another the nearest possible of the place where they want to plant them definitively. At all events the baskets are put in ground, in the holes digged sufficiently for containing them and their further decay will make that the young plant will not find an obstacle for its growth.

For bamboo pots they must cut them and take out the pieces when the plant is put in place, and will be support with earth.

At last before those operatory ways, there is a third which is the seed-sowing directly at the place where the plants must be after growth.

So the question is the following: Must they or must they not establish seed-nursery. The main arguing of those who do not want to approved, will live in a principle of economy. The are others regards, but the first is this one:

We cannot prevent ourselves to find it strange. When they apply one's self at the cultivation in occidental countries they find it quite plain to make notalbe expenses for a small profit. Since on the contrary they become plantor in this country, for some ones, and they will be too many, the purpose to reach is to go fast and to plant much, that at the cheaper possible. That wish of cheaper. for us, is the most important mistake that they can commit, for they will amply pay later the economy that they have believed

to do. Every one will find surprising that a market gardener may not have garden frame, and yet it costs dear and the profit realized is thin comparatively at that what a hevea-tree must give, and however some persons will not hesitate to compromise the posterity of a plantation for a so moderate expense. Meantime, as in undertaking this work, we have wanted to put the planter able to judge by himself, we don't wish to leave off this manner of seing and we give hereafter the different opinions which have been given on that matter.

Mr Campbell, in a official-report that he done in 1907, appraises that even the seeds sown come from old trees the method of direct plantation is the best and the most economical. They must yet,says he,make the seed-sowing at a moment where they can foresee abundant and sufficient rains.

There precisely is the difficulty. Even when the rainy season is established can they assert that not any atmospheric perturbation, bringing a dry anormal weather during many days will not happen. Since we are in the Colony, soon ten years, we have so often heard saying that the weather was exceptional, the season late or advanced that we suspect willingly, and prefer not to expose ourselves at such aleas.

Mr Campbell adds that the growth of young trees will be so much the more hasty and more vigorous that the roots will be less manipulated and so wounded.

We shall answer at this that there is a question of care, and in agriculture they must have much.

Mr Vernet in a work on the hevea, that we have already had the opportunity to mention says this.

I think advantageous to place the fine seeds, directly at the place that they must occupy later. At that purpose, they will be put on damp sand, and, as soon as the radicel will appear as a small white point, they will be put in place.

If it dit not rain that day, a small watering should be neces sary.

This manner of proceeding will exempt us of pricking and of a loss ensuing at that way of cultivation.

On how many hectares that light watering will be accomplished.

If it is question of a plantation of some importance we dont think it suitable, and chiefly economically made. If unfortunately they must refreshed many times they will soon lose the profit of time and money that they discounted to gain by this proceeding.

In opposition to the opinions expressed abready, Mr Arden finds in a report very documented that he published in 1902, that the chief obstacle of seed-sowing directly at their precise place lies in this fact that this one conserving their germinative power but only a very little time, their plantation can take place only at fixed epoch sometimes defavourable at that sowing. However it is indispensable to sow the seeds, when they have the possibility, in the week that follows their maturity, then they cannot hope more favourable days.

As remembrance we shall only speak of the depradations produced by rats, wild-boars, deer, ants which devour the seeds or the young shoots and against which they can struggle less efficaciously on large extents than in seed-nursery of limited superficies.

Which is then the best method of working?

At our way of thinking, it would consist in nursery-plantation after previous germination on garden frame, and transplantation in the field when the young plants have nearly three years. This transplantation will be done in leaving a lump of earth after the subject, in order to not to touch at the root, and it placing it in a hole prepared in advance. In working so they can avoid the enemies or reduce the damages at the minimum, it permits to follow easily the growth of the seeds that they have put in ground

and to eliminate all those which grow too tardily, or give plants that do not flourish vigorously (it is a second choice); the watering in case of too long dryness is possible. they have the latitude of shading the young plants.

Unfortunatly here we cannot exactly follow those indications. In fact, in Cochinchina the hevea-seeds reach their ripeness about the month of August and September. When the plants are three months old, the rainy-season is over and the immediate transplantation becomes impossible. So the plants must spend one year in seed-nursery and then they have to place a subject of nearly $1^{m}50$: that working is very scrupulous. It is for that reason that we advise to take off the plants from the seed-nursery and to put them, at that moment, in bamboo baskets that they will place one against others-under the shade of older hevea-tree. The same advantages as before will be obtained, and besides in removing gradually the baskets, they will bring them in full light, and they will habit the little plants to the hot sun rays.

This couducts us to examine if yes or no, they must shade a seed nursery.

If they consult different authors they see that the opinions, various that they may be, are not less stated with the greatest neatness.

M. C. Mathieu (1) states that.

« The nursery establishing is the most important work of the plantation, you may not give too much cares, nor too much toil the ground which is going to receive your seeds.

The posterity is there, for of the treatment that will receive your young plants can depend an advance or slowness of one year or two of the produce period.

« All your efforts must then tend to obtain young healthy plants which will give you later strong trees.

« In the same way man is in the child, the same the tree is in the young plant. »

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(1) Culture of Para-rubber.

And however for reaching that purpose, M. C. MATHIEU praises the employ of the seed-nursery. It is that he does not find it unhealthy for then he says : (1)

« Whilst we are preparing our plat-bands, live coolies are occupied in covering again the seed-nursery with a light stubble for preventing it partially from the sun.

« This can be made in stretching a net of galvanized iron wire in all the nursery, up held at each 3 or 4 metres by stakes of six feet height. Transversely, on this first net, they place a second, the iron wires spaced at 1 m 80. at the point of intersection of the two nets, they tie them with rottan or with thin iron-wire, and on the frame so made they fix at flat, light screens made with lallang, or if they can proccure some lallang, of branchess or leafy twigs enlaced.

« Those screens must be exactly thick enough for sifting sunshine, no more. »

On the contrary, M. A. J. C. WELER makes to observe that they cannot easily move under the shades, and that, after the superintendance is difficult, that it costs dear, that the rain which falls on the plat-bands, across the roof-interstice is not equally divided on the ground, that the dew does not reach the young plants that grow in the shade.

« What nature gives (2) us during the day, that it may be sun or rain, and what the temperature produces us in the night, is stopped, on purpose by the mean of shade costly ».

There are also fire-fears or roof-sinking after a whirlwind or a violent breeze.

Briefly Mr A. J. C. WELER resumes :

We cannot understand why the must stop with so much animosity the sun-approach, which with the sun-heat forms one of the first wants of the normal growth of all what lives. It is precisely owing to the sun-rays that the young plant, very naturally grows, after having been able, during all the night to quench thirst at the dew-drops sliding along its stalk. Therefore is it an anomaly that to want to oblige that plant to grow in a half darkness. The proof that, this kind of growth is anormal it is that, so suddenly a part of the shelter is lifted up, the leaves whiten compteteły; dry up and fall.

That *the cultivation in the free nature* may he the plantors ! device »

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(1) That they call in Cochinchina; Tranh.

(2) Bulletin of the Association of Planters of rubber, nº VII, July 1909.

We cannot hide how much that conclusion is strange. But *in the free nature*, it seems to us that the young heveas are sheltered by the eldest ones or by the neighbouring trees. Nothing is more darkened than a forest, nothing keeps as much the dampness. It is there, the important matter for us, it is the great advantage of covered seed-nursery. Owing to the shade they keep around the seeds an air sufficiently warin and damp in order to bring a swift growth and reduce the watering expenses.

But of course, they must not put a plant sufficiently shaded in full sun, where they venture to make it die, it is gradually that this habit at the light must be done, and the shade must become less and less slight, till the day where they completely make to disappear.

For us the ideal will consist to make a seed-nusery at movable-shade, which could be lifted up in the evening or rainy-days in order to be placed again when the sun prognosticate to be burning.

And after young plants of three months old having been pricked out in baskets, would be placed under the shade of old heveas and gradually they would move those baskets till bringing them in full sun.

It is true that trees can bear the light when they put them out since the beginning. Children abstained of all medicinal attention can live and they will generally be strong, but how many die.

How many could they save with some elemantary precautions. How many would become healthty and strong men, that however have died. Though it may be, here is how they proceeded last year at Ongien-Station. After having had the seeds germinated in a malt-floor, composed of four coal-tared planks holding damp sand, placed under the house, they prick out the small plants in plat-bands, sheltered by big trees shade.

Those plat-bands measured 0m 80 broad and were separated ones from the others by paths of 0 m 50.

The germinated seeds were placed in line at 10 centim ones from others in all sides.

When it was question to place them they choosed plants having one year of nursery (coming from the precedent country but prepared in the same manner) and filteen days before the date fixed, and they put them in bamboo baskets. As the transplantation wearies the subject (they have taken out this one with the lump of mould without wounding it) they placed the baskets to the shade and they watered them, it is only gradually that they again accustomed the plant, of nearly 1 m 50, at the rough sun light. They carried then the baskets in the holes prepared in advance and they neglected them in meantime than the young heveas. There was not loss of leaves and not any died.

It is right to add that the holes had 1m cube and that the earth which was around and under the basket had not been strongly squezeed. It is only around the stalk that they trampled the ground.

6° — Putting down in place

a) *Clearing of the plantation*

We have already entertained of that question, in a preceding work on the cocoa-tree, and it will be enough for us to change the word cocoa-tree in hevea tree for explaining our opinion in the matter.

As for all the cultivations, the ground that must receive the young heveas must be very clean at the moment where they must be transplanted. When the place choiced is covered by a foreign vegetation, that they must destroy, it is preferable to work during the dry season in this way they can burn the most of useless branches. Before lighting the fire, it is clear that they must take off all the precious pieces of species wood that have any use. There is no small profit

in agriculture for, as they have much money to spend in order to manage well an undertaking, they must always try to attenuate the needful expenses by secondary receipts. We should not enough attract the planter's attention on the positive necessity that there is for us to root out the root stock at the brush wooding-time. This recommendation must be more observed when it is question of the hevea-plantation work. In reality those roots stock serve of shelter at numerous insects, on them multiple mushrooms grow, and they can be the spot from where will set off all the plagues that will throw down, on the plantation. Besides when they don't destroy the roots stock they are continually obstructed by new shoots and cultural works of keeping in good order, become very difficult.

At last, it is true that if the young heveas roots find obstruction inside the ground, they will be obliged to turn round, and during the plant will be tired by those efforts, the growth will be as so much delayed. Unfortunately that this pulling-up work of the roots-stock is hard and expensive.

When they have to do with trees yet in life the best is to degarnish the lower part and after having cut the big roots horizontally, to tie strings at the top. In pulling on those strings they easily arrive to make the tree fall, in the mean time that the root-stock comes out from the ground.

When the vegetal has been already cut, the work is more laborious. They have invented many machineries of which principle stands on the utilisation of a crow bar that moves round an axis, and a long handle ending by a string that men will pull; it is in that hook that rings of a chain will come and fix and that they will previously pass in the fork formed by two big roots that they will have digged out. They can supply the chain by a handle that they open and shut on the trunk of the bush to take off. Screw-servs to press strongly that muff against the pressure tree. Other tools for taking of root-stock make to combine the crow-bar and the crick.

We have employed last year with success, tools of that kind at Ongiêm, when they use of them, they must take care to have one pair, if not the tree goes of one side alone, hits against the side of the hole that they digged and often fix the tool.

At lasty the made with success employ of engines moving either by men-hands either by the help of animals and which have for object the rotation of the root-stock, so as to brake all the lateral roots.

b) —*Pricking and hole-opening.*

When the ground is completely cleared of all the root-stock which obstructs it they must proceed to a pricking of the plantation. Here again they must take much care. If in reality, the plantation is regularly made, the cultural works first, and then the latex gathering will be made with much easiness. They lose much time when they cannot go right front of them, but when on the contrary they must walk here and there for picking the buckets, for instance.

At what distance ones from the others must they plant the hevea — trees? Many experiences had been made in order to be fixed on that matter, but there are many discordance of views on it. It it certain that they cannot establish absolute rules for the hole-opening must depend of the climate of the place and of the chemical composition of the soil.

So it is very comprehensible that in a place where violent breezes blow they try to put obstacle with a plantation of trees more closed one against others. In the same way in a poor soil, that they don't want or that they cannot improve afterwards, the hole-opening between hevea-trees needs not to be so considerable, since their growth will be more reduct.

It is not those particular cases that must interest us ; but rather a normal plantation, all conditions being filled for having good results, or all improvments being done, for reaching that purpose.

It seems then that not any discussion is possible, that they are going to suggest of the great culture principles, of cultural hygiene if we can employ that word. They will admit without difficulty that if they want a vegetal to be strong, they must give him enough meals air and light, or more simply they are going to remenber that when they want to obtain long thread (as for instance in the textile culture) they press the plants ones near the others. No matter and they will do abstraction of all those indications for discutting out of sight and do onerous and fatal experiences

Now the wish of a swift and present gain makes that some persons plant at 3 meters in all directions whilst others, by contrary excess take those dimensions till 11 meters in all directions.

As the close-plantation gives trunks straight and long they are obliged to tap very high, in order to have a little latex, and we have already seen that the latex was of better quality when it is produced by the low parts of the tree.

Mr Arden in his official report that we have already given says this :

« For giving a notion of the space that they must leave at that three for its growth I can say that I have measured threes planted at interval of 11 m × 11 m and which touched themselves by the top, producing nine years after their plantation a thick roof. In supposing that the roots cover the same surface than the tree-crown, what can be put in fact, they will conceive easily how much the struggle for life will be difficult when the trees are planted at the opening of 3 m × 3 m. They will perhaps object, that if it is true that each tree secretes less latex in a pressed plantation, the loss will be compensated by the greatest number of trees contained by are, but that more asks to be proved. The pressed-plantation will present a certain advantage of a reduct expense for the weeding, while in the other system they must make a cleaning at the tapping-time. Nevertheless, all well observed, my way of thinking is that in a country where the earth and the workmanship are at a low prices the pressed-plantation is a false économy ».

Here are various interspace that they employ in Ceylon's plantations :

3 m × 3 m
6 m × 4 m 50
3 m 60 × 7 m 20
3 m × 9 m

At Buitenzorg they seem to have stopped at the following interspace; $6.^{m} \times 6^{m}.$ and $6^{m}. \times 9^{m}.$

If we must partake at the discussion we shall frankly say that we are not adherent at the pressed-plantation.

First by cultural hygiene: or close normal growth of the fettered individual, spreading of the cryptogamic-sickness made easy-after by economical measures for they will spend much money for building scaffolding in order to go and gather a bad rubber.

The great arguing given for defending the plantation in close order consist to say that they will cut the trees in too many, after having tapped them at death. But what do they make with the roots-stock? It is clear that they will leave them in the soil and so they will form a centre of infection, of parasite sicknesses, the most propitious that they can conceive.

For those reasons, we remain adherent of the quinconce-plantation at seven meters in the fine ground and at $6^{m}.$ 50. in ground less rich, specifying well that those are minima over which it would be bad to lower.

c). — *Transplantation.*

We have not great thing to add at that matter, if it is not that they must take care, contrary at what we have said regarding the seeds-nursery, not to shelter the young trees. The hevea likes the light and it would deform and grow in length, at the prejudice of the thickkness of the trunk, for going before it.

It is equally good to do not place props near plants recently put in place, for these one take the habit to lean on a prop and they grow obliquely since they take it out.

We do not persist any more to assert that, this transplantation must be done in rainy-season in deep holes of $0^{m}80$ at 1 meter, and broad of so much that they will fill of movable earth, a little pressed in the low part.

7° – Care of the plantation

a). — *Manure*

We have already given rubber-analysis and we have seen that, this product contains particularly azote (either under albuminoïd materia, either organical azotous materia) and calcium salts.

Here is on the other hand the chemical composition of the various parts of Hevea Brasiliensis.

Analysis of Mr. Bruce, extracted from the Mr. Wright's book: *Para Rubber.*

	PER CENT Fresh leaves	PER CENT old fallen leaves	PER CENT fallen stalks	PER CENT wood	PER CENT young shoots
Water	70 »	60 »	60 »	60 »	50 »
Azote	3.44	1.92	0.84	0.59	0.62
Mineral materia.	4.69	4.08	3.18	3.12	2.62
Lime	0.51	1 40	0.80	0.80	0.83
Magnesia	0.56	0.89	0.30	0.15	0.17
Potass	1.72	0.54	0.64	0.30	0 28
phosphoric acid	0.60	0.30	0.15	0.18	0.09

Analysis of the Laboratory of Saigon. (Leaves turned yellow and gathered on the tree at the moment of their annual falling)

	PER CENT of dried leaves at 100°	PER CENT of leaves in the state they have been gathered
Water	»	57 25
Organic materia { Azoted	7.12	3.04
Organic materia { Non azoted.	84 48	36.12
Mineral materia	8.40	3.59
	100.00	100 00
Azote	1.14	0 49
Phosphoric acid	0.29	0.12
Sulphuric acid	0.33	0.14
Silicium	1.23	0.53
Potass	0.46	0 20
Lime	3.30	1.41
Magnesia	0.62	0.27
Alumin and Iron oxyde	0.35	0.15
Manganese	0.02	0.01

They can conclude of those analysis that what they must furnish in most great quantity to the hevea will be in first

line the azote and the lime, then after potass, magnesia and phosphoric acid.

As, in the other hand, the leaves and the boughs that fall contain a considerable enough proportion of materials usefull for the growth of the plant, it will be good to make a compost with lime that they will expand, after complete decomposition of organic materia.

Numerous analysis of Ceylon grounds have been done by Mr Bruce, it is then easy for us to see if the soil where our neighbours plant hevea are favourable for that culture.

The type soils employed at that use can be divided in five categories.

1° Schistose ground.
2° Alluvia.
3° Grounds for Cacoa-trees.
4° Grounds for tea-trees.
5° Grounds over flood.

Here are the average analysis :

	N° 1	N° 2	N° 3	N° 4	N° 5
Water	3.300	3.000	3.600	3.000	5.600
Organic materia mixed with water	8.000	11 000	4.600	6.000	20.400
Iron oxyde and manganese oxyde	7.400	8.000	7.200	5.200	1.200
Alumin oxyde	8.200	9 717	6.786	13.049	5.232
Lime	0 060	0 130	0.160	0 160	0.050
Magnesia	0.054	0.259	0.216	0.490	0.115
Potass	0.085	0.162	0.077	0.401	0 061
phosphoric acid.	0.010	0.076	0.064	0.089	0.064
Soda	0.074	0 188	0.233	0.137	0.182
Sulphuric acid	0.008	0.054	0.048	0.068	0.048
Chloride	0.003	0.014	0.016	0.006	0.048
Sand and silicats	72.806	67.400	77 000	71.400	67.000
	100.000	100.000	100.000	100.000	100 000
Azote contained.	0.128	0.230	0.100	0.162	0.448

Here are now the analysis of grounds of the principal countries where they have planted hevea trees :

	KELANI	KALUTAZA	MATALE	PERADÉNIYA	KURUNE GALA	RATNAPURA	PASSUARA
	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Organic materia....	8 to 13	7 to 15	8 to 14	9.2 to 10.4	4 to 8	10 to 12	7 to 11
Azote.....	0.05 to 0.2	0.1 to 0.15	0.1 to 0.2	0.134 to 0.184	0.08 to 0.11	0.01 to 0 2	0.1 to 0.15
Lime.....	0.05 to 0.15	0.03 to 0.15	0.08 to 0.2	0.06 to 0.08	0.1 to 0.35	0.06 to 0.2	0.06 to 0.1
Magnesia.....	0.05 to 0.35	0.04 to 0.2	0.05 to 0.25	0.072 to 0.115	0.1 to 0 45	0.07 to 0.15	0.07 to 0 13
Potass.....	0.05 to 0.3	0.04 to 0.2	0.03 to 0.25	0.092 to 0.270	0.08 to 0.18	0.04 to 0.1	0.05 to 0.08
Phosphoric acid....	traces to 0.07	traces to 0.06	0.01 to 0.1	0.038 to 0.064	0.02 to 0.04	0.03 to 0.8	0.03 to 0.04

If they want to remember that in a good ground there is one part per thousand of azote, 1 part phosphoric acid, 2 parts 1/2 of potass and 50 parts of lime, they see that those grounds are for the most part, sufficiently provided of azote and sometimes of potass, but that a little of phosphoric acid misses and chiefly lime. — It is why in the leaves compost that we spoke just now, they often add scoria of dephosphoration.

Are we better shared in Cochinchina and Annam. Here are some analysis that will direct us :

Plantation of Suôi-Giao (Annam).

Analyse done by M. VERNET.

Azote	0.672 %
Lime	0.530
Magnesia	0.12
Potass	0.665
Phosphoric acid	0.0904

Grounds of Cochinchina (Analysis done by Mr Bussy at the Laboratory of Saigon).

	BARIA	BIENHOA			GIADINH		
		1	2	3	1	2	3
	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Organic materia..	1.970	3.90	4.34	2.12	0.895	0.442	0.549
Azote	0.0753	0.239	0.126	0.107	0.0367	0.0363	0.0400
Lime	0.0448	0.042	0.014	0.062	0.0163	0.0135	0.0219
Magnesia	0.0400	0.015	0.015	0 075	0.0146	0.0144	0.0196
Potass	0.0678	0.076	0.051	0.163	0.0593	0.0439	0 0481
Phosphoric acid	0.6392	0.725	0.423	0.297	0.0119	0.0162	0.0071

So the quantity of azote is generally sufficient, the phosphoric acid lives, even in abundance, but the lime and potass (except at Suôi-Giao for this last element) are in proportion notoriously too weak.

In the botanical garden of Singapore they done manure-experiences on plants in nursery, and they obtained the following results:

	MAXIMUM height of the plants	MINIMUM height	AVERAGE height
	mèters.	mèters.	mèters.
Patch witness.....	0.940	0.305	0.622
Human manury.....	1.320	0.305	0.747
Lime.....	1.395	0.480	0.847
Earth, decobuage and leaves in compost.....	1.830	0.685	1.257
Ecobuage earth.....	1.650	0.610	1.165
Stable manury.....	2.440	0.920	1.445

At Ongiêm we have put at each transplanted young hevea-trees (plants having one year of seed-nursery) a dose of 2 kilogr. of the following manure:

Superphosphate	3/10
Mall-dust.....	3/10
Ashes.....	3/10
Lime...	1/10

And the effect was wonderful.

It is sure that those trees are very sensible to the manure and that they can, owing to it, make to gro.ı subjects remained sickly, which will regain then the others more vigorous. That will prevent an unequal plantation. thing more fatal in a rubber plantation than ewerelse, being the loss of time which results at the tapping-time.

(*b*) *Cleaning, green manure and ploughing,*

Sure that the planter is convinced of the necessity of taking out the rootstock completely from his ground, before planting anything, we do not come back on that point.

There is alas! another plague, if it is not the motive of sicknesses, is not less formidable.

We want to speak of the Tranh (Panicum spicatum), called in english, the lalang. They promise premium at those who will find the means of ridding of it. but it remains as a formidable threat. In fact that grassy plant, when they do not take care suffocates the young ones and when they are out of attaints, it draws the nutriment in the soil at the great damage of existing plants. Besides it is in the dry season, a continual danger of fire and some imprudent planters have paid dearly their carelessness. Ploughings, harrowings with a canadian hoe must be made in the plantation, and they must not hesitate to make to pick by the women the rhizomes broken and brought to the surface of the ground, on pains to see them giving birth at new grasses. Even if they don't destroy it completely they must often mow down that plant, in the way of preventing it to flower and to propagate by its seeds in the place where they are rid of it.

The practice which consists only to take of the grass round the tree on a ray of 1 m. 50 don't appear to us recommendable first because the radicular lateral system of heveas very developed and after because we pretend there is appeal of nutritive elements of consume regions about the parts of ground which are abundantly provided. Then if they let lines covered with tranh they volantarily deprive of that possible share of nutriment.

In order to reduce those needful keeping expenses, but really expensive, they proposed to make momentary intercalated cultivations, either of pine-apples, coffee tree, manioc, lemon-grass, tobacco curcuma, ginger etc..

That also seems to us bad, for they must leave to hevea-trees all the nutriments which are disposable at itself, we shall rather say, during the young age.

A better practice is the green manure cultivation it is to say plantations of plants, such as the phaseolus

lunatus, the mucuna utilis, the vigna sinensis, the passiflora fœtida, the arachis. that they will bury before the floner-apparition. They will have so covered the ground at the detriment of the tranh, and they will give back at the ground, the elements taken with, and more, a pretty big proportion of azote which will be obtained in the air by the roots-bacteris The indigo-tree and the crotalairius don't agree here on account of their ligneous stalks, of difficult hiding and decomposition. With the green-manure method they equally avoid the training of earthy particles at the strong-rains time.

c) — *Drainage and Irrigation.*

A marshy ground harms the heveas-tree,a too dry ground dimunishes the produce in latex.

The plantations posterity lives, for us, in the application of these two axioms. It is why, in this memento, it is perhaps good to give some indications of practice for the establishment of a drainage and irrigation method.

Before commencing a drainage, they must see which is the motive that gives birth to the stagnant sheet of water. The water can spring from grounds placed at a more elevated level. They must then prevent the water to come in the ground placed lower.For that they surround it by a ditch that they call draining-ditch, and which will drag the liquid either in a water course placed lower, either in a ground, equally in downwards, that they do not cultivate, either at last in wells. Then it will only remain to drain the field where the water stands.

If it is by the consequence of a water course increasing that the downwards grounds are inundated they must erect dikes.

The water can come from lower course and rise at the surface of an impermeable earth which wants of slope.

They then use of the gravity-action in order to make the water come down in the draining tiles.

It is good not to make open drains in the grounds in cultivation, but on the contrary subterraneous conduits of that manner, the surface being plain, the cultural works remain easy and the drainage is more lasting.

In a pebbly ground they make a drain of nearly eighty centimeters of deepness and in the bottom they put stones of which size diminish in proportion as they ascend, so that they leave a less important empty between them and that, consequently, the earth that they will place over, does not risk to run away in the splits.

They make so a stone bed of thirty or forty centimetres of thickness and they cover all with earth. The drain must go in growing thinner from the top towards the down and measure, at the down part, fifteen centimeters broad.

Water must also spread easily and for that the ground must be extremely bent.

They can put instead of stones, bundles of branches of twenty five or thirty centimeters of diameter at the bottom of the ditch. In this case this one remains round. This proceeding is less practical that the precedent for the wood rots and falls down in a little time and besides the water cannot flow away after a few years.

They can also make a ditch with two borders on which they place grass-plats the grass is placed under.

This grass is decomposed with difficulty and the conduit can serve long time enough.

In a clayish ground they can use of clay for draining-tile confection. They put a wood roller in the inside of cley lump and they take it out when this one is dry; then they have a conduit.

In turfy grounds they cut pieces of turf that they join two by two for forming the draining-tile. They use for that work of a special spade.

At last they can use of terra cotta pipes. They are evidently dear enough but they can last more than thirty years. The best shape for those draining-tile is the circular shape and they must have thirty three centimeters long.They must also be at close texture, that they may not stain the hands, that they may not have flattening and curve, that they may give a clear sound when they knock them with a hard corpse, and that the earth of which they are formed may not be too porous

They often put those pipes end to end in the bottom of the ditch but it is preferable to join them by the help of cylinders.

Owing to these ones the plant roots cannot pass through the pipes and more they prevent the ditches to remove one another.

The water passes through the intervals that pipes leave between them, and the cylinders do not prevent so the water to infiltrate.

In a drainage system there are :

1° The drying draining-tiles.

2° The collecter draining-tiles that receive the waters of the precedent and collect them in order to bring them fare.

3° The retirement draining-tiles which follow the circuit of the draining-surface and prevent the outside water to come in.

During long time they advised to place the drying, draining tiles following to a line which pursues the strongest slope, whilst the collecter draining tiles followed lines where the slope was the most feeble.

Presently the contrary has been admited has being preferable.

1° Because drying draining-tiles and collecter-draining tiles form a pointed angle instead of a right and then the pipes fill less easily of earth.

2º Because the collecter draining-tiles need a diameter less important, for being in slope the water runs faster in their inside.

3º Because the collecter-draining tiles are filled of sand with difficulty since the speed of water is more and more considerable.

4º Because that increasing of speed favours the airing of the soil and also a swifter penetration in the pipes according to a kind of an empty that products there.

5º Because the surface that they can dry is more considerable.

In general they will lay the draining-tiles at a deepness which will change with that of the permeable course of earth.

The roots must equally run downer than the place where are placed the draining-tiles so that they may be substract at the dampness action.

The deepness employed varies from sixty centimeters to one meter twenty centimeters.

The opening that must be between the draining-tiles varies with the deepness at which they are placed. For instance in a damp ground if the deepness is one meter fifteen centimeters the opening between two draining tiles will be from ten to twelve meters; for a deepness of one meter fifty it will be of twenty meters. The water that have been collected by the collecter draining tiles run into a river, in a channel or in a valley.

The slope to give to the draining-tiles is regulated by the ground slope, it can vary from one millimeter at the minimum till five millimetres at the maximum by metre.

The better slope is three millimetres by metre. If the ground is very stooped they make falls from place to place with collector-draining-tiles.

If the ground is horizontal they make an artificial slope.

The collector-draining tiles inclinatton can vary between eight and ten millimetres by metre.

It will be preferable that all the draining tiles may have the same diameter on all their length, but, par economical measure, they will begin to place pipes having three millimetres of diameter, after when the volume of the water that they must bring will become too considerable they will employ pipes of four millimetres diameter, after of five millimetres, and so on..

The diameter of the collector-draining tiles depends also of the volume of the water to throw out: it varies between seven and ten millimetres.

In general the small drying-draining tiles must not have a total length which exceeds three centemetres.

The irrigation-waters is not only usefull by the quantity of liquid, that it furnishes, but also by the element that it is able to dispose to the soil new substances, there are irrigation-water that are good and other bad. Firstly the water gives up to the ground the oxygen that it contains, but per contra, it charges itself of carbonic acid that the must make to pass away in aerating the liquid either in disposing falls, either in making to pass the water in the wheels. The water which are too slimy, though bringing manuring materials, can be fatal in certain case and in particular each time that they arrive on vegetables of which leaves are employed.

Spring water are generally cold and too pure. They must warm for if not they cede little manuring materials. It is so, that under 7° the azote of water is not fixed by plants. For rendering those water suitable for the irrigation, they let it to stay in cistern, that raises the temperature and aerates it in the same time.

River-waters are often very nice and they are so much the better that their course is more extended, and that they cross villages for they are stored of all the remains that they throw in, and which after decomposition will form manuring materials.

In order to employ pool water, fish must lives well and that the surface may not be invade by vegetation. When they can employ draining-water, it is excellent for those water always hold in much enough nitrates.

When they employ waters which are industry-remainders they must dilute them before use, or else they are too rich and can harm the cultivated vegetables in meantime that they make easy the apparition of hurtful adventitious plants.

The quantity of water to furnish to the ground varies with the quality of waters and their fecundity in mud, with the kind of ground and they can say more a ground is sandy more water they must furnish to it and in the contrary that more a ground is clayey less liquid they must bring to it, with the climate, the age of the tree.

The water that they bring in the ground is divided in many parts :

1° One part is lost by evaporation in the channels. It is here that the temperature of the place intervenes, for that evaporation is very variable from a place to an other.

2° One part is kept by the ground.

3° One part is lost in the subsoil.

4° One part is taken by the vegetables.

5° At last, a part flows on the ground and flees by the irrigating canals.

In order to obtain water for irrigation they can either dig ordinary wells or Artesian wells, either use drainage-water, spring water, either erect barrage for raising the nivel of a river or make to come a part of the water in a canal, either at last by the mean of elevatory engines.

The water taken of a manner or another must be distributed on the ground, that apportionment will depend as to the manners of the quantity of liquid to spill and also of the shape of the ground.

They have: the irrigation by pouring.
— submersion.
— infiltration.
— sprinkling.

We do not persist longer, for the dimension of this work don't allow us that, but we refer to our agricultural course (1) the reader that the question is susceptible to interest.

d) *Pinching and Heading,*

Some controversies are grown again about heveas pinching and heading — According to some ones when they don't head they obtain small shrubes all in height with an alone stick and without lateral branches. By the heading they arrive to correct that defect and to make to grow a ramification of two or three branches at a required height. The pinching, according to some authors, it is to say the working which consists to take off the terminal bud, would cause the formation of too numerous shoots, so well as at the top would be a crown of branches too heavy for the young subject. That inconvenience will be avoided in heading, it is to say in cutting the essential branch at the place where from green it begins to become brown. What is sure, is that they must not stop at that single operation, that it may be pinching or heading, but follow one's tree, conduct it, and prevent the growth of too heavy branches.

It seems clearly, in all the cases, that this practice can be only good for what regards the latex formation. This materia being a reserve substance it will accumulate more if the sap is not all employed at the formation of the texture. More they will bring back the vegetative surface at a minimum, more the economy of usefull substance may be able to accomplish in the interior of the vegetal. This is not the way of seing of Mr. de Neve, who says:

(1) *Cours d'Agriculture,* F. H. Schneider. Editeur à Hanoi.

« In my opinion,(1) they must always dissuade the heveas-heading because its action is not natural it is equivalent in sum at cutting the left arm of a child, in order to give more strength to his right arm. The heading has many inconveniences that it is important to notice seriously it gives rise to bring the sickness, for what may be the care brought to the working they cannot prevent In many cases that the wood which is immediately under the plague may be rotten, even when this one had been tared ».

« In supposing even that they may realized the heading according to all the rules, the dead texture over the place from where the branches are going to arise runs to give a great evil. — They can easily convince when they see that a plantation assailed by the « djamoer oepas », in seventy five per cent cases the sickness appears in preference at the places where the heading has been done. — The apparition and the dispersion of the plague remain longtime invisible because the dead party of the wood, and the sickness which is born, are hidden as in a cavity by branches which grown all around. I have even stated numerous cases, where the dead party was already attacked of « djamoer oepas » when the illness did not yet reached the healthy parts. Yet an other fact aggravates the dangers that the heading makes to overrun – without speaking of the danger remarked above, it is that the breeze brings about unceasing compressions and depressions of the epidermis, at the place where numerons branches are going to partake and that the « djamoer oepas » hides of preference at the arm-pit of branches .»

To this we can answer, that if they had taken care to cut the dead part, once the secondary branches grown, a great part of objections opposed by Mr Neve would not easily be maintained.

8°. — Enemies of the plantation and remedies

All the vital parts of hevea-tree, that it may be queston of roots, of the stalk, branches or leaves are susceptible to be caught by the sickness.

In the sickness of white (fomes semistosus) the mushroom overruns on the main and secondary roots which disappear under its attacks; after the mycelium spreads and follows its damages farther. As they observed that this mushroom cannot grow when it does not find dead wood

(1) *Report of the Rubber-planters Society*, september 1909, n° IX.

of one the first principle [illegible] is to clear carefully the ground before the plantation.

If in spite of that a hevea tree was harmed, they must pull out and burn it on place, after surround the invaded part of a ditch of 0m60 of deepness and 25 centimetres broad. As on the other hand, those are low and damp grounds (with stagnant water) which are the middles where that sicknees spread the most easily, they must aerated its soil and drain it. If an attack has been observed on a subject-roots, it will be prudent to make a coolie to pass who will assure himself, by a light shaking that there are not any trees harmed. At the foot of the lowest branches or on the trunk, at the pitch fork appears an other mushrooms :

The corticium javanicum Zimmerma, that they call djamoer oepas (champignon vénéneux) in Malais. The sickness begins by the apparition of a small rosy whitish spot which increases rapidly, till surounding the brench or the trunk, and penetrates in the inside till the wood newly formed.

They always find after the apparition of Corticum. Javanicum, tapping insects (xylotrupes) which live in the bark become friable and cracked. It is chiefly during the rainy season that this mushroom takes its development. We have met that sickness on some trees at Ongiêm and they arrived to free from them, but in cuting carefully the trunk under the part assailed. That cut was to be made in bevel and they covered its surface of carbolineum and coal-tar. Besides all the neighbouring trees received at pitch-fork, by preventive measure, a same whitewash. They have adviced the following proceeding as preventive mean. During the dry season they whitewash the trees with some bordelaise pulp, so well as the mushroom-spores are at that moment carried away by the breezes, go and take place in the pitch-fork of trees so covered of antiseptic. At the biginning of the rainy season thoses spores germinate

but are killed before the mycelliem formed may could penetrate the inside of the tree. According to an indication furnished by the rubber-planters Society of Indochina (annals n° 4) on 60.000 trees treated so only three cases of sickness were stated and that in a part where the sickness prevailed.

Besides these two plagues there is another formed by the Diplodia Rapax Massee which gives, what is called, black canker of Hevea-trees. The sickness appears under the shape of black and dusty spots and prevails the barks that dry and die. — For Mr Ridley there would be, one of the most important danger for hevea-plantations, and he asks, with urgency that they prevent the progress of that sickness, which has already done its ravages at Johore, Borneo, and Selangor, by a appropriated legislature. (1)

« Presently, says the Dr Ridley, the diplodia appears here and there under the sporadic form. It kills the trees of 4 years in one week and they have seen 40 trees occuping half an acre, destroyed in that time; all in good health on a saturday, they were dead on the next saturday ».

« The young and tender shoots of the top of trees are the prefered place for spores of that sickness. Rapidly those spores send out their long silky roots till the cambium, the tree is killed since the roots can come down, and it is died, enterly, in a few days. When the head shoot is without leaves, then that the others have an excellent appearence, you can be sure that the sickness has begun. The second indication of the sickness evolution consists in the apparition of small pustules which are the diplodia elllorescence. Those pustules burst in opening and leave to escape a soot which form the spores or germ that the breeze spreads abroad, what makes to tell that the sickness is disseminated by the breeze. One of those spores, and they are by millions in each pustules, knocks down on the young shoot of a hevea-tree and is sufficient for killing it».

«The opinion of Dr Ridley is that as soon as the top-shoot of a hevea tree shows evident marks of blemish, the tree must be examined immediately carefully and the top must be cut under the living party till not any black spots may be seen under the last section made».

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(1) *Annals of the Rubber planters of Indochina*, n° 3, March 1911.

«I should want adds Dr Ridley to make the planters understand the importance that there is to cut the tree at less at 6 inches under the place where the black spot is well in evidence and which also must be immediately burnt, on place, the sick part taken off, in watering all around with some bordelaise pulp and also immediately the neighbour trees».

There are besides,those cryptogamic sicknesses,numerous ravages produced by insects which assail either to the roots either to the collar, either to the young shoots. either at last to the leaves or to the terminal bud.

The larva of the lepidiota pinguis Burm comes down in the ground and assails the roots. In order to rid of it, they can with succees use of Carbon sulphuret that they inject in the ground nearly at 0m. 20 of the assailed plant.

There is also a larva of longicorne which destroys the roots. By a cleaning (ploughing and harrowing) sufficiently frequent, they will be easily right of those subterraneous enemies.

The white ants also can make ravages, but chiefly on sick trees presenting dead parts — However there is a kind of termite that they call the termes gestroi which is really formidable. They distinguish those insects by this fact that the soldiers leave to ooze between their mandibles a drop of white milkyliquid, as mean of defence. Although those insects have not been signalized in Indochina, it is prudent not to leave the termites around the trunk-trees and for that it is sufficient to brush now and then the surface of this one.

They can quote also a caterpillar of butterfly which digs the bark (the caterpillar of comoeritis pieria Neyr), some scolytes, some longicornes, some acridiens that unfold in the dead parts of young branches or avail the leaves or the terminal buds but, in fact, all those enemies are not very dangerous.

The deer, the porcupines and the wild-boars are more dangerous in eating the young shoots. It is for preventing

then that it is needful to surround the plantation of many ranges of bramble iron wire. A good support will be made with the kapokiers which products will extenuate the expenses.

9°. — Growth of trees

Before searching which is the growth of hevea-trees, it is good to remember, for making useful comparison, that the circumference of the tree taken at 0 m. 92 of the ground (one yard) is a little broader of 2 centimetres nearly) at one meter.

At Ceylon numerous measurements have been done M. Wright in his book the « Para rubber » mentions a few here they are:

At Henaratgoda the prettiest tree planted in 1876 and, measured at 0 m. 92 of the ground, gave in.

1878 (2 years)....	0m35	1887 (11 years)...	1m337
1880 (4 years)....	0 40	1888 (12 years)...	1 50
1881 (5 years)....	0 525	1889 (13 years)...	1 744
1882 (6 years)....	0 626	1890 (14 years)..	1 825
1883 (7 years)...	0 75	1892 (16 years)..	1 925
1884 (8 years)...	0 90	1893 (17 years)...	1 987
1885 (9 years)...	1 075	1905 (29 years)...	2 737
1886 (10 years)...	1 235		

In 1905, they had for the totality of trees old of 29 years:

9	trees	that had a circumference	from 0m15 to 0m30
67	»	»	0 30 to 0 60
130	»	»	0 60 to 0 90
139	»	»	0 90 to 1 20
79	»	»	1 20 to 1 50
35	»	»	1 50 to 1 80
14	»	»	1 80 to 2 10
2	»	»	2 10 to 2 40
3	»	»	2 40 to 2 70
1	»	»	2 70 to 3 00

At Peradeniya (in the alluvia) the average for trees old of 24 years was at 0m92 of 1m508.

Edrangoda	some trees of	2 years	measured (average of 20 trees)	0m144
	»	3 years	» (average of 50 trees)	0 218
	»	4 years	» (average of 100 trees)	0 324
Yattipowa	»	3 years	» (average of 108 trees)	0 234
				0 228

In Annam, at Suoi-giao, Mr VERNET gives the following measures taken at 1 meter from the ground (for comparing with the precedent figures, increase these one of nearly 2 centimetres.

at 2 years.....	0m102
3 years.....	0 18
4 years.....	0 299
5 years.....	0 417
6 years.....	0 535
7 years.....	0 665

And he dicounts for trees of.

8 years.....	0m79
9 ayers.....	0 91
10 years.....	1 04

At Ongiêm (Cochinchina) the measurements were done to 0 m.50 from the ground (they must diminish the figures of nearly 5 centimetres in order to compare them with those of Ceylon.

1 year 9 months	varies from	0m04 to 0m22	(average of 50 trees):	0m107
2 years 3 months 1/2	»	0 04 to 0 28	»	0 135
2 years 11 months	»	0 05 to 0 39	»	0 191
3 years 1 months	»	0 06 to 0 47	»	0 193
3 years 5 months	»	0 06 to 0 48	»	0 215
4 years 1 months	»	0 07 to 0 62	»	0 249
5 years 1 months	»	0 085 to 0 79	»	0 346
11 years 8 months (at 1m. from the ground)		0 40 to 1m05	average of 98 trees	0 606

Then they can approximately establish the comparative following list, in bringing back all the measures as if they were taken at 1m from the ground.

Age of the tree	— Ceylon	— Suoi-giao	— Ongiem
2 years	0m144	0m182	0m071
3 years	0 223	0 20	0 143
4 years	0 324	0 319	0 199

Let us notice in ending that according to Mr. Cibot, the heveas would not reach in Amazome 0m. 63 of circumference before the age of 15 years.

10— Gathering and produce.

(a) *Beginning age of the tapping.*

They have actualy a tendency, that we shall qualify of sad, not to consider the age of a tree, but only its circumference for beginning to pad.

Though we are not in concordance with all the authors, it seems to us that they commit so a great imprudence. If they want to give us permission to do a comparison we shall tell that a child, even irregularly grown, cannot make the work of a man and that, if he however resists to the excess of fatigue that they tax to him that will be at the prejudice of his future growing and of the good working of his muscles. We have said that the latex is a produce of reserve and it is at the moment where the tree spends all his activity for growing and increasing that they are going to ask him yet the few materia that he can hardly put atside.

It is those considerations and others, that did to write :(1)

« As for the premature tapping of trees too young, we do not find ourselves here before a problem to resolve but in front of facts acquired, that condemn the preconised method .

More a tree is formed, and more its organic materia reserve disseminated in the different parties are important. It is at those reserves that he make appeal in order to react against the momentary

(1) *Report of the planters association*, April 1909, n° IV.

privation, local or total, that the incisions of tapping give him, of those materia normaly brought by the circulation of the sap. They permit to it not only to resist more powerfully at the effects of its wounds but assure a most swift cicatrization and, so, a quicker recovery of his normal functions. In a young tree those reserves are insignificant the,experiences of the Dr Hans Fitting prove it.Its power of resistance and reaction is, so, very weak and the time for the reconstitution of its bark, for the recovery of its normal life and its growing, will be elongated of so much. At what will it be used then, to obtain some grammes of rubber of a 3 or 4 years old tree perhaps at the price ofone or two years delay, for the obtaining of the production that it would furnish normaly at six or seven years? It is realy to discount at a usurious rate the future dividends.

« Besides it is unanimousness acknowledged by the most earnest specialists that the rubber obtained from too young trees wants of essential qualities, especially of elasticity and contains a much more abundant proportion of rosin than that of worn out trees.

The rubber of four years old trees is according to WRIGHT, assimilable to the secondary rubber of Africa and they can wonder if that of younger trees would be even equivalent to this quality. It is certain, at all events that it is unsuitable at numerous manufacturing uses. Besides it is what worthed at the plantation-rubber the prejudice, so difficult to extirpate, that numerous manufacturer maintained against it, which, on the trust of the first shippments from India obtained from too young trees, have concluded that plantation-rubber had not the elasticity of Silvester-rubber.

Not only they expose themselves to lose one part of the future years-production, but also will they only gain but a moderate price for the gathering obtained so laboriously by the personnel, and of so a dangerous manner for the trees.

« For let us not forget « as says Dr Bernard in his work on a few rubber trees sicknesses, that if even the conditions of a plantation are anormal and unfavourable to the rubber trees at the view of parasites and infections sicknesses-propagation, that danger is strongly increased when they are in presence of wounded trees-or weaken irregularly. If those conditions they form, a prey easy to parasites, such as termites, and to sicknesses such as root-mushrooms and the corticium javanicum, said Djamoer œpas. The latter assails in preference young weakened trees. How those sicknesses will behave, of which cases showed themselves but lonely when they may exert on spacions extents of vigor very diminished trees.

Will they not take a sharper character and do they not venture to see extend one fine day with a celerity that will avoid to stop the ravages.

b). — *Height of the tapping.*

If what we just affirmed as relative to the age at which they must begin to tap a tree is exact, at least to the quality of latex gathered, it must follow that more they will make the tapping at a considerable height, less the flowing of the milky sap will be abundant. Numerous experiences have proved the veracity of that fact. They have been mentionned in the so documented report of M. ARDEN, report all ready quoted. Here is a list which gives the result of tapping of 5 years tree tapping in V) begun at 1 m 83 and followed till the base in reducing of 15 centimetres for each incision. They made three incision by tree, that at the same nivel and in separating horizontally by the same distance.

NUMBER of incisions by a day	HEIGHT of the incisions over the foot of the tree	PRODUCE in rubber	AVERAGE of dry rubber by incision
	meter	gramm.	gramm.
15	1.83	42	2.8
15	1 68	42	2.8
15	1.52	49	3
15	1.37	71	4.6
15	1.22	134	8.6
15	1.06	127	8.4
15	0.91	149	9.8
15	0 76	184	12.1
15	0.61	198	12.9
15	0.45	262	17.1
15	0.30	319	21
15	0.15	319	21

As they could fear only the custom-phenomenon of which we shall speak presently, may be felt they began again the experience in beginning by the foot, and they had the following results.

INCISIONS BY DAY	HEIGHT OF THE incisions over the foot	PRODUCE in dry rubber	AVERAGE of dry rubber by incision
	mèt.cm.	granm.	gramm.
15.....	0.15	354	23.3
15.....	0.30	298	19.6
15.....	0.45	269	17.7
15.....	0.61	212	14
15.....	0.76	156	10.2
15.....	0.91	134	8.8
15.....	1 06	120	7.9
15.....	1.22	106	7
15.....	1 37	113	7.4
15.....	1.52	106	7
15.....	1.68	85	5.6
15.....	1.83	78	5.1

Then the results are clear and it seems that above nearly 1m50 it is useless to make tappings.

But there is more : not only the quantity of latex gathered is less considerable, but more, that obtained is of inferior quality.

M. Ridey, who since longtime follows tapping experiences at the Botanical garden of Singapore, expresses himself so (1).

« One result of the experiments conducted here, proves that the flow of latex is more copious, thicker and therefore contains more rubber, at from the base to say about a height of four feet on the trunk of a tree. Higher up, the latex is more aqueous and not nearly as abundant, in addition to which, it is also said to contain a larger percentage of resinous matter. »

(1) *Agricultural report of the Straits*, nº 3, march 1903.

c). — *Period and Hours of tapping*

Multiple experiences have proved that the rainy days the latex-flood is more notable that when it is dry.

We also have observed that when the dew is simply abundant the proportion of milky sap increases.

They must so resume :

1° If they must stop the tapping in order to let the tree rest during a determined period, it is preferable that this rest moment may be during the dry season.

2° They must tap very early in the morning. This practice is of current use in Amazonie where they apply themselves at that working at the first hours of the day in lighting themselves wih a torch.

He are besides the result of an experience done by Mr VERNET on 3 trees :

Evening tapping 91 centimetres cubes of latex.

Morning tapping 296 — —

An other information seems to us, we repeat it again once easy to draw from these facts, namely the usefulness to water or better to irrigate the plantation when the ground is dry or when the season makes that the soil is deprive of dampness.

d). — *Custom-phenomenon*

The list that we have extracted from Mr ARDENS report proves that the tree accustoms itself to be tapped and that the latex flood increases after a few days.

That phenomenon has been observed since longtime in Amozonie. There is no matter to surprise us for the function makes the organ. Here is as new proof:

Tapping in 1/2 fish bone made on 20 trees and begun the 1er June 1910

DATE of the gathering.	TOTAL IN centimètres cubes of latex gathered	DATE of the gathering	TOTAL IN centimètres cubes of latex gathered
1er June.....	12	16 June.....	487
2 —	28	17 —	443
3 —	32	18 —	404
4 —	63	19 —	376
5 —	58	20 —	519
6 —	37	21 —	615
7 —	83	22 —	589
8 —	148	23 —	618
9 —	220	24 —	621
10 —	252	25 —	561
11 —	275	26 —	589
12 —	331	27 —	459
13 —	354	28 —	544
14 —	395	29 —	636
15 —	472	30 —	557

If we consider one tree only of that same series during the same time, the results will be more notable, if not more convincing :

Tapping in 1/2 fish bone made on the tree nº 114.

DATE of the gathering	VOLUME of latex in centimètres cubes	DATE of the gathering	VOLUME of the latex in centimètres cubes
1er June.....	0	16 June.....	19
2 —	0	17 —	15
3 —	0	18 —	23
4 —	0	19 —	28
5 —	2	20 —	33
6 —	1	21 —	30
7 —	3	22 —	34
8 —	5	23 —	50
9 —	1	24 —	56
10 —	2	25 —	50
11 —	6	26 —	42
12 —	5	27 —	17
13 —	8	28 —	45
14 —	9	29 —	55
15 —	15	30 —	48

This custom is produced besides when they stop for a moment the tappings. It is this way that at Ongiêm we have not tapped since the 31 décember till the 5 april 1911. Now that same tree nº 114 had given successively.

June 1910. . . .	612	centimetres cubes of latex
July	518	—
August.	526	—
September	459	—
October.	381	—
November.	488	—
December.	654	—

and from the 5 to the 31 april 1911 gave only but 300 centim. cubes of latex.

e). — *Frequency of the tapping*

A deduction which must flow from what we just signalized is that the produce reduces when they space the tapping-period.

Comparative experiences have been done at Ongiêm here are the results :

Vernet's Méthod

DATE	TAPPING EVERY DAYS			TAPPING EVERY TWO DAYS			Difference in less for the tappings every two days average by tree.
	Number of trees	Volume in cent. cubes	Average by tree	Number of trees	Volume in cent. cubes	Average by tree	
January 1910.	10	1.713	171.3	14	1.022	73	97,3
Febuary.	10	1.252	125,2	14	571	40,7	84,5
March.	10	1.520	152	14	701	50	102
April.	10	1.740	174	14	946	67,5	106,5
May.	10	1.557	155,7	14	762	54,5	101,2

2° Tapping in 1/2 winding

DATE	TAPPING EVERY DAYS			TAPPING EVERY TWO DAYS			Difference in less for the tappings every two days average by tree.
	Number of tree	Volume in cent. cubes	Average by tree	Number of trees	Volume in centi. cubes	Average by tree	
January 1910.	8	1.156	144,5	14	608	43,5	101
Febuary.	8	994	124,2	14	232	16,5	107,7
March.	8	1 815	226.8	14	647	46,2	180,6
April.	8	4 805	600,6	14	2231	159,3	441,3
May.	8	6.068	758,5	14	4168	297,7	460,8

Much more after the month of May, they tapped those same trees that it may question of Vernet's method or in 1/2 winding every days and the results become .

Vernet's Method

DATE	NUMBER of trees	VOLUME in cent. cubes.	AVERAGE by tree	Difference in more on the best average produce in january (73)
June	14	8.288	592	519
July	14	7.899	564,2	491,2
August	14	10.265	733,2	660,2
September	14	7.165	511,6	438,6
October	14	7.104	507,4	434,4
November	14	6.845	488,9	415,9
December	14	5.910	422,1	349,1

Methode in 1/2 Winding

DATE	NUMBER of trees	VOLUME in cent. cubes.	AVERAGE by tree	Difference in more on the best average produce in may (297,7)
June	14	4.615	329.6	31 9
July	14	6.417	458.3	160.6
August	14	7 572	540.8	243.1
September	14	6.805	415.3	117.6
October	14	6.974	498.1	200.4
November	14	8.302	593	295.3
Décember	14	9.472	676.5	378.8

f). — Produce

The figures given for the dry-rubber produce by tree and by year has been the most various.

It could be otherwise. In reality, the latex-production has multiple motives but different we have studied a few. We believe so more prudent to study the produce of trees at Ongyiêm for the different tapping-methods, and without

generalizing, we shall have a produce-example in Cochinchina.

1° Vernet's method (tapping every day).

DATE of the gathering	NUMBER of trees	PRODUCE by cent. cubes.	NUMBER of tapping days	AVERAGE by tree and by day
January 1910.....	10	1,555	31	5.01
February.....	10	1,143	27	4.23
March.....	10	1,520	29	5.24
March.....	42	3,865	10	9 22
April.....	10	1,740	30	5.80
April.....	42	14,925	30	11.64
May.....	10	1,557	30	5.19
May.....	42	15,110	30	11.99
June.....	14	8,525	24	25.41
June.....	10	5,595	30	18.65
June.....	42	14,138	30	11.22
July.....	14	8,085	29	19.91
July.....	10	4,795	29	16.53
July.....	42	11,585	29	9.51
August.....	14	10,265	31	7.33
August.....	88	42,987	31	15.75
August..... ...	10	7,194	31	23.20
August.....	42	12,330	31	9.46
September..	88	42,158	28	17.10
September... ...	10	5,635	28	7.19
September.....	42	11,586	28	8.82
September.....	14	7,165	28	18.37
October.....	88	44,615	31	16.35
October.....	42	12,593	31	9.96
October.....	10	7,632	31	24.61
October.....	14	7,104	31	16.36
November.....	10	7,730	30	25.76
November.....	14	6,845	30	16.29
November...	42	11,892	30	9.43
November.....	88	54,870	30	20 78
December.....	14	5.910	28	15.09
December.....	10	7,439	28	26.56
December.....	42	12,962	28	11.02
December.....	88	45,870	28	18.61

What makes a general average by tree and by day of 14 c. m. c. 04, whence an average annual produce of 5.124 centimetres cubes and in admitting a rubber contents of 20%, 1 k. 024 of dry rubber.

2. — Tapping in 1/2 winding (*every days*)

DATE of the gathering	NUMBER of trees	PRODUCE in cent. cubes.	NUMBER of tapping days	AVERAGE by tree and by day
January 1910.....	8	1.156	31	4,62
February	8	994	27	4,60
March	8	1.815	29	7,81
April.....	8	4.805	30	20,02
May.....	8	6.068	30	25,28
June.....	8	3.985	30	16,60
June.....	14	4 457	27	11,78
Jully.....	8	4.505	29	19,41
Jully.....	14	6.231	29	15,34
August.....	8	7.785	31	31,36
August	14	7.572	31	17,44
September	8	7.270	28	32,45
September	14	6.805	28	17,35
October.....	8	8.420	31	33,95
October.....	14	6.974	31	16,06
November	8	8.380	30	34,91
November	14	8.302	30	19,76
Décember.....	8	9.712	28	43,35
Décember.....	14	9.472	28	23,87

What makes a general average by tree and by day of 20 cmc. 84, whence one average annual produce of 7.606 cent. cubes, and, in admitting the same rubber contents of than before 1 k.521 of dry rubber,

3° Tapping in fish bone (*every days*)

DATE of the gathering	NUMBER of trees	PRODUCE in cent. cubes.	NUMBER of tapping-days	AVERAGE by tree and by day
January.....	20	4.842	31	7.80
February.....	20	2.765	28	4,93
March	20	7.550	31	12,17
April	20	10.956	30	18,26
May	20	11.704	30	19.50
June	20	6 447	30	10,74
July.....	20	5.885	29	10.13
August.....	88	65.175	31	23,89
August.....	20	11.874	31	19.15
September.....	88	48.360	29	18,94
September.....	20	12.786	29	21,70
October.....	88	56.505	31	20,71
October.....	20	7.792	31	12,56
November.....	88	61 905	30	23,44
November	20	9.429	30	15,71
December.....	88	58.570	28	23,76
December.....	20	12.085	28	21,57

What makes a general average by tree and by day of 16 cent. cubes 76, whence an average annual produce of 6.117 cent. cubes and in admitting always the same rubber contents, 1 k. 223 of dry rubber.

4o Tapping in 1/2 fish bone *every days*

DATE of the gathering	NUMBER of trees	PRODUCE in cent. cubes.	NUMBER of tapping-days	AVERAGE by tree and by day
January.....	20	895	26	1,72
February	20	4.159	28	7,42
March	20	9.821	31	15,83
April.....	20	8 962	29	15,46
May	20	9.034	30	15,05
June	20	9.720	30	16,20
June	20	10.500	30	17,50
July	20	7 680	29	13,24
July	20	6.267	29	10,79
August.....	20	11.073	31	17,83
August.....	20	8.108	31	13,06
August.....	128	54 682	31	13,77
September.....	20	12.312	28	21,96
September.....	20	6.484	28	11,57
September.....	128	49 210	28	13,72
October.....	20	10.164	31	16,38
October.....	20	5.510	31	8,87
October.....	128	55.065	31	13,87
November.....	20	12.513	30	20,85
November.....	20	7.547	30	12,57
November.....	128	57.370	30	14,93
Décember.....	20	9.010	29	15,50
Décember.....	20	8.538	28	15,24
Décember.....	128	63.675	28	17,76

What makes a general average by tree and by day of 14 cent. cubes 14, whence an annual produce of 5.161 cent. cubes and in the same rubber contents, 1 k 032 a of dry rubber.

Those produce-experiences conduct us so to the following list for what is of the quantity of dry rubber gathered by tree and by year.

Method in 1/2 waiting	1. k. 521
— in fish bone	1. 223
— in 1/2 fish bone	1. 032
— Vernet	1. 024

The method in 1/2 fish bone comes only at the third line and however it is what we shall advise, in ending this work on the produces, for it permits a reconstitution of the couches of the cut tree, reconstitution impossible or difficult in the laps of time wanted, with the methods where they assail the half of the tolal surface of the trunk.

11º — Distribution of lands.

planted with heveas-tree.

According to Mr Ferguson of Ceylon, there were 87.000 hectares at the 1at July 1909, planted with heveas-trees. In the Malais Straits, those trees held possession of more than 100.000 hectares in end 1909.

At Borneo and in the Deutch Straits Settlements at the same epoch there were a surface of 36.800 hectares. At last in the South India and Birmania 10.000 hectares.

For what is in Cochinchina, the rubber-planters Society of Indo-China puts at our disposal the following indications, which have been prevently published in the nº 5 of the Annals.

STAT

Of the principal Rubbe

	NAMES OF ASSOCIATION OR LANDLORDS	NUMBER OF HECTARES	
		BOUGHT or in concessions	PLANTED ALREAD with plants al 1h 1er january 1911
			Provinc
1	M. Ascoli.....	1.500	»
2	Association of Baria (M. F. Fraissard manager).....	2.457	
3	Rubber Association of Indochina M. M. Cihot manager.....	1.500	»
4	Plantation of Courtenay M. Sipière manager.....	4.000	300
5	Denis Freres.....	1.296	»
6	Lê-phat-Tân.....	450	100
7	Veillet and Bonnefoy.....	1.000	140
			Provinc
8	Agricultural Association of Suzannah M. E. Girard manager.....	3.316	450
9	Agricultural Association of Thanh-tuy-Ha MM. Saliège and Desbordes managers.	3.200	»
10	Association of Binh-truoc M. Vallon.....	500	20
11	Charrousset.....	600	»
12	Cremazy.....	2.050	»
13	Dupuy.....	1.900	»
14	French Association of Etudies and coloniales entreprises.....	6.000	»

MENT

lantations of Cochinchina

NUMBER OF TREES		NATURE OF THE GROUND	OBSERVATIONS
PLANTED t the 1er january 1911	FORESEEN		
Baria			
»	300.000	Red grounds (1)	
»	300.000	id.	In seed nursery 6000
150.000	1.000.000	id.	
»	»	id.	
30.000	200.000	Red grounds and clayey silicious ground	In seed nursery 170.000
56.000	200.000	Red grounds	
f Bienhoa			
192.000	400.000	Red-grounds	In seed nursery 100.000
»	600.000	Clayey-silicious	In seed nursery 100.000
7.000	150.000	id.	
»	»	id.	
»	200.000	id.	
»	»	id.	
»	»	id,	

(1) They denominate red ground a clayey course of volcanic constitution containing a great proportion of iron rich in phosphoric acid and in Azote. In the south of Cochinchina they cover n area of nearly 400.000 hectares.

	NUMES OF ASSOCIATION OR LANDLORDS	NUMBER OF HECTARES	
		BOUGHT or in concession	PLANTED ALREAI with plants at 1r 1st january 1911
15	F. d'Hangouwart	120	20
16	Hevea association of Xuân-lôc	1.850	50
17	Ippolito	1.000	»
18	Issaverdens	671	»
19	Lachenal	60	12
20	Messner	550	»
21	Payot	225	»
22	Association of Anloc Plantations M. E. Girard manager	2.300	75
23	Association of Donaï Plantation M. Fordan manager	140	100
24	Association of Gianhan Plantations M. X.	450	20
25	Association of Hévéa Plantations of Cochinchina M. Salomon manager	2.000	130
26	De la Souchere	820	150
			Province
27	Andouin	45	25
28	Bec, Muet and Desmidt	450	250
29	Blot and Lefebvre	25	11
30	Bussy	50	50
31	Canavaggio	30	15
32	Chapal	250	»
33	Etievant	64	62
34	Favereau	20	15
35	J. Ferrière	25	25

NUMBER OF TREES		NATURE OF THE GROUND	OBSERVATIONS
PLANTED at the 1er january 1911	FORESEEN		
5.000	50.000	Clayey-silicious	In seed nursery 40.000
17.000	100.000	id.	In seed nursery 80.000
»	»	id.	
»	»	id	
4.200	25.000	Clayey-silicious	
»	100.000	Red-grounds	
»	50.000	id.	
30.000	150.000	id.	
45.000	65.000	Clayey silicious	
5 000	50.000	Red grounds	In seed nursery 40.000
45.000	200.000	id.	
50.000	100.000	silicious grounds	In seed nursery 70.000
Giadinh			
10.000	20.000	Clayey-silicions grounds	
80.000	150.000	id.	
2.400	10.000	id.	
20.000	20.000	id.	
5.500	15.000	id.	
»	150 000	id.	
25.000	25.000	id.	
6.000	10.000	id.	
11.000	12.000	id.	

	NUMES OF ASSOCIATION OR LANDLORDS	NUMBER OF HECTARES	
		BOUGHT or in concession	PLANTED ALREADY with plants at the 1er january 1911
36	Forterre	60	60
37	A. Lecœur	120	80
38	Matard and Guyonnet	1.200	200
39	Maurice	32	21
40	Mercier and Richardson	37	5
41	Muller and Vinson	434	»
42	Paris and Guery	675	675
43	Phu-nhuân and Hanh-thong-Tây plantations (Succession Belland)	90	90
44	Renoux	600	»
45	L. Rousseau	66	66
46	Association of Tanninh M. Hénaff manager	360	220
47	Association of Vinh-phuoc MM. Filhol and Bresset	500	220
			Province
48	Anonyme association of Phu-quoc M. Legrand manager	2.680	300
			Province of
49	Deleurance and Jousset	1.350	350
			Province of
50	Rubber association of Indochina M. Cibot manager	10.300	»
51	Association of Heveas plantations of Xatrach M. Haffner, manager s/manager M. Salomon	1.200	550

NUMBER OF TREES		NATURE OF THE GROUND	OBSERVATIONS
PLANTED at the 1st january 1911	FORESEEN		
22.000	22.000	Silico-argileux	
20 000	40.000	id.	
95.000	200.000	id.	
12.000	16.000	id.	
2.000	13.000	id.	
»	100.000	id.	In seed nursery 60.000
200.000	200.000	id.	
30.000	30.000	id.	
»	50.000	id.	In seed nursery 20.000
22.000	22.000	Red grounds and clayey-Clayey-silicious	
66.000	120.000	Clayey-silicous	
70.000	200.000	id.	
of Hatien			
75.000	100.000	Clayey-silicious	
Tayninh			
150.000	300.000	Clayey-silicious	
Thudaumot			
»	2.000.000	Red grounds	In seed nursery 200.000
200.000	200.000	id.	

12° *Price of the rubber.*

The rubber has endured in its market-prices immensely fluctuations. — It was at the last rate known by us of 16f55 for the darked crapes and 19f25 for the smoked leaves (those prices are for a kilo). — Nevertheless we think useful that in those calculation of produces the planter does not amplify their profits to realize, and he will be prudent to count, before settling his plantation, on a sale of 5 francs the kilogr. price that will be surely fixed before long.

13° *Study of a cultivation schedule.*

We have at our disposal numerous figures which would have permit to us to establish a cultivation-Schedule, and however we shall do nothing, for the chance and the errors are too numerous concerning the rubber. If we want with a certain easiness foresee the cost of an installation of plantation and its keeping, it is not the same when it is question of the price that soon they will pay the workmanship and in particular the tapping-men.

We think that it will be prudent that the planters of Cochinchina mind already to make apprentices for that delicate work and we are happy to put ourselves at their disposal.

14° *Conclusion.*

That it may be permit to us to end rapidly this rapid work on the hevea-trees in summoning the wise words of M.H.Brenier Inspector-Counsel of agricultural and commercial administration, upon the plantation rubber in 1909, for they deserve not to be forgotten and they come to confirm that here nothing must be left indiscriminately

In short, alone will survive, or at least will excel (in the crisis of plantation rubber that we must foresee) in a few ten years, and probably before.— The entreprises of whose, at natural equal conditions, will have the preponderance of the Human-factor, by the more prudent employ of good sense enemy of the over capitalisation. in the business overlating by the application of intellect and science in the direction, by the most healthy organization, of a numerous efficacious workmanship, well interested to the ground by good condition of hygiene and installation and an adequate-pay at his effort.— Those establishment only will survive and will excel. – And it will be an a act of justice.

CONTENTS

Saigon. — Imp. F.-H. Schneider