ALL ABOUT

ALOE AND RAMIE FIBRES;

DYE AND TANNING STUFFS;

DRUGS, &c.

COMPILED AND PUBLISHED BY

A. M. & J. FERGUSON.

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PREFATORY NOTE.

THE main object in publishing this little pamphlet is to embody a paper written on the minor products and resources of Ceylon about forty years ago by the late Mr. Henry Meade. This will be found on pages 49-84. We have also had in view, if possible, the encouragement of a new local industry in Aloe Fibre, such as has been successfully established in Mauritius, and under the name of "Sisal Fibre or Hemp" (see page 108) in the Bahamas and other parts of the West Indies and Mexico, and Yucatan. Mr. D. Morris's paper on Ramie or Rhea Fibre, page 85, is also well worthy of local attention.

We trust to see a considerable trade in Fibres beyond those now included in our Customs list, established ere long in Ceylon.

COLOMBO, 20TH FEBUARY 1890.

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PREPARATION OF AND TRADE IN ALOE FIBRE IN MAURITIUS.

WE are printing on page 8 *et seq.*, a pamphlet published in Mauritius in 1882 and translated for us in that year. Its publication has been delayed, in consequence of the very discouraging results of trials with the "Death" machinery to obtain fibre cheaply from the leaves of *Fourcroya gigantea*, the very species of aloe which has been so successful in Mauritius There it seems to spread and grow spontaneously and to be cultivated and prepared on a large scale, the export of aloe fibre from the sugar island having attained extensive dimensions. The plant could be grown to any extent in Ceylon, and the whole question hinges on the use of machines which will do good work and cheaply. Such machines seem to be available in Mauritius. In 1882, it will be observed? M. de Chazal stated that 3 per cent of the weight of leaves in fibre or 1½ ton of fibre per acre would pay him. As tea cultivation seems likely to be overdone, some of our readers may wish to turn their attention to the cultivation of fibre-yielding plants and to the preparation of the fibres. We therefore publish the long delayed translation, and we hope soon to get further information from Mauritius, especially as to the machinery and appliances (chemicals being deemed objectionable) used in extracting the fibre from the leaves. The mode in which Manila hemp *(Musa textilis)* is dealt with in the Philippines is thus described by Mr. Wilkinson, British Consul at Manila:—

"'Two strong uprights are firmly fixed in the ground and connected by a cross bar, in the centre of which a large broad-bladed knife is fixed downwards on a block of wood fastened lengthwise on the bar; the knife has a strong handle, which is connected by a cord to a long bamboo made to act as a spring by being tied in the middle and the butt parallel and above the bar; the free end thus forms a supple and powerful spring and holds the edge of the knife firmly against the block; below the bar there is a treadle attached by a cord to the handle of the knife: the mode of operation is for the worker to stand opposite the knife placing either foot on the treadle, which he depresses, thus forcing the knife handle down and the blade up; he then places a strip of stalk (called locally *sifa*) between the blade and the block leaving only enough to wrap round a stock on the near side; he then releases the treadle and the knife by the action of the bamboo spring nips the strip firmly against the block, and on the workman drawing the strip through the pulp is left behind. The apparatus is extremely simple and inexpensive.'

"In the *Bulletin* for April 1887 (No. 4) published by the authorities of Kew, there is a great deal of interesting information regarding the Manila hemp. It is there stated that the whole supply comes from the Philippine Islands; the imports to Great Britain 'amounts to about 170,000 bales and to the United States about 160,000 bales, equal to about 50,000 tons per annum.' The imports to Calcutta are comparatively insignificant, being probably less than 300 tons per annum. It is stated in the Kew report that a labourer working under pressure "can clean nearly 20 lb. of hemp per diem; but as a rule the quantity cleaned by one man working steadily day by day averages about 12 lb.; usually two men work together, one cutting down the stems and splitting them, while the other cleans the fibre. At the current rate of wages in 1879 one labourer's earnings were 7½d. to 8d. per diem."

ALOE FIBRE AND ITS PREPARATION.*

By Evenor de Chazal.

(*Translated by "Károly Fürdö."*)

Preface to the Second Edition.

The cordial welcome which this little book has met with at the hands of the public since its first edition, which was brought out at the expense and by the order of the Chamber of Agriculture, the sustained demand of which it has been the object in various directions,—a demand which has led to its exhaustion,—above all, the growing favour which the new industry enjoys, have encouraged me to bring out a second edition.

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* De la Fibre d'Aloës, et des Récents Perfectionnements apportés dans les Procédés d'Extraction. Etude lue à la Réunion de la Chambre d'Agriculture du 19 Janvier 1882. Deuxième édition. Maurice: *The Merchants and Planters Gazette.* 1882.

The only pretention to which this essay has aspired has been to call public attention to a new product, till then little known, but destined, in the opinion of a small number of followers, to march side by side, in the near future, with the great sugar industry in this colony. Its appearance has coincided with the discovery of new appliances, which have given a considerable impulse to the manufacture, because they lower the net cost of the fibres, and also with a rise of the article in the London market. These two causes united have brought about quite a revolution among us. Important affairs have been seen to take place in a few months; new companies have been formed; large extents of ground have been bought at prices which the former proprietors of land long depreciated no longer hoped to secure; works have been erected; and motion and life have all at once flowed into those vast solitudes of the coast, deserted since the disappearance of the cane.

It has been thought fit to accord to this pamphlet the honour of this transformation.

I will not have the false modesty to think that it has not helped towards it; but I believe that my duty is to make known the true causes of the industrial revolution which has just taken place, and to name the authors of it:—it is those who were not afraid, at the first news of the progress realized, to invest their funds in the new companies,—who, as partisans convinced of the great future reserved for the hardy plant, have not hesitated to devote themselves entirely to it,—and who, sympathizing spectators of the struggles of the early days, have understood that the moment had come for them to lend their effective co-operation to a work which was to endow the country with an important source of wealth, and have contributed in a large measure in overcoming the last obstacles.

One is, indeed, astonished on ascertaining what immense progress this extraction of aloe fibre, so long despised, has realized in so short a time. To be convinced one has only to cast his eyes over the list of societies formed in these last six months, all of which also are in a flourishing condition, though of recent formation.

The following are the principal in the order of their appearance :—

1. *Rouge Terre Hemp Estate Society Limited*, established with a capital of R140,000, and producing about 1,500 lb. per day ;

2. *Palmyre Hemp and Sugar Estate Society Limited*, established with a capital of R180,000, and also producing 1,500 lb. of fibre per day, but lime and sugar besides ;

3. *Massilia Hemp Society Limited*, established with a capital of R120,000. and producing 20 tons of fibre per month ;

4. *Mon Choisy Hemp Company Limited*, established with a capital of R400,000, and producing 30 tons per month ;

5. *Vale and Black River Hemp Company Limited*, established with a capital of R450,000, and producing 40 tons of fibre per month ;

6. *The Mauritius Hemp Company Limited*, started with a capital of R180,000, and producing 1,500 lb. per day ;

7. *La Société de Yemen*, R300,000, and producing fibre and vanilla;

8. *The Albion and Gros Cailloux Sugar and Hemp Company Limited*, established with a capital of R1,500,000.

Beside these joint stock Societies, a great number of private concerns have been set up, of which the principal are :—

1. *Vertou*, by M. de Mars, producing from 12 to 15 tons per month ;

2. *Palma*, by M. Bonieux ;

3. P. Toulet at La Montagne Longue ;

4. D'Unienville, at Beau Bassin, one of the promoters of the industry, and long at work ;

5. Vally, at La Petite Rivière, producing a superior quality ; and extremely particular as to the article that he delivers ;

6. J. Cauvin, at Les Pailles ;

7. M. Vigoureux, at Les Bambous, who not only cultivates vast extents of land covered with magnificent aloes, but is also planting up on a very large scale ;

8. *Balaklava*, by Messrs. Samuel Baker & Co., whose machines are put into motion by means of a powerful hydraulic apparatus ;

9. Lastly, *St. Antoine*, which combines the latest improvements and will soon begin producing.

All are active ; many produce over one ton per day—and some are already yielding dividends. This is not all. Everywhere planting is going on, and after a lapse of less than five years all that shore where nothing grows beside the "old maid" will be found valuable and entirely covered with aloes.

But it is not in Mauritius alone that the industrial and commercial world has been moved : our neighbours of the sister-isle, prompt to follow us in our advance, have adopted our processes, and have set themselves seriously to work. Less enterprising, less assisted, but as courageous and active as those creoles of Mauritius who were lately dubbed 'Lotus Eaters,' and whom people in certain circles persist in considering as attacked by *lethargy*, they have in their turn, with the help of some of our compatriots, acclimatized in their country our apparatuses, and are to enter upon a severe but happy competition with us.

If we look further afield, we see that in Ceylon they are giving us attention—as witness this letter which I have received by the mail from the editior of the *Ceylon Observer* at Colombo:—" We should deem it a great favour if you would send us a copy of your work on Aloe Manipulation.—Signed : A. M. & J. Ferguson." It is the same in Australia, the Cape, Natal, America. From all quarters our experiments are followed with interest, and our mode of procedure is sought to be adopted. Aloe fibre has henceforth its distinct place in commercial transactions, and it is to the island of Mauritius that modern civilization will be indebted for this important article, which will always make its way, forcing itself more and more, at first to the brush manufactory, to the makers of ropes, to the navy, and afterwards to the manufacturers of the finest and choicest textures. We have the right then of being proud of the result obtained, and that of hoping in the immense future which is opened out to us.

Every medal, however, has its obverse : and ours lies in the enthusiasm with which the birth of the new industry was received. We must be on our guard against the danger which may result from a hasty and badly-finished manufacture. If it is true that we have ended by winning the first place, it is no less true that we have only reached it by the force of patience and pains. Nowadays, in order to bleach the fibre, some have lost sight of this fundamental warning, incessantly formulated by our buyers in the English market: " No chemical process." They also add, it is true : " The longest, the whitest, and the softest possible," and it is to obtain one of these *desiderata* that sulphurous acid has sometimes been employed, or chlorine and its derivatives, such as the hypochloride or the chloride of calcium, in order to bleach the fibre. These means are bad, and they cannot but lead to a fall in the price of our manufacture. And the day that we sow distrust in the market we shall have great difficulty in restoring the paying prices that we are now actually realizing.

We must guard then against employing any chemical means which may be of such a nature as to diminish the strength of resistance of our fibres ; the greatest attention must also be paid to the packing, and it must be seen to that the fibres are not put into bales till they are perfectly dry, for the least damp causes mould, and consequently the depreciation of the article. We must, in fact, endeavour always to produce a manufacture of the first quality which shall reserve to us a rank which is soon to be hotly disputed, and not forget that the recommendations of the commercial houses which serve us as intermediaries are invariably to make *the longest, the whitest, and the softest possible, and to avoid the use of chemical processes.*

I have nothing to add to what I have said in this pamphlet on the recent improvements wrought in the apparatuses for extraction. It has not come to my knowledge that these have been sensibly modified in their construction since the day when I drew attention to them. The progress which may have been realized in this regard depends above all on the careful cultivation and the pains taken with the manufacture. Such as they are these machines are sufficient, and they can await the improvements which will not fail to suggest themselves, especially nowadays when so many interests are engaged in agriculture.

I must, however, mention the experiments th t have been made in this direction. Several new machines are in the course of construction, and I myself have an interest in two. However, I do not believe the time has yet come to speak of them in detail: It is enough that it be known that we are not asleep, and that we are aware that the *statu quo* in the matter of commerce is equivalent to an abdication. The law of progress finds its application here as elsewhere. From America there has lately come to us a new machine, which is under trial at this moment. It is as usual a wheel armed with paddles which scrape upon a surface sometimes movable, sometimes fixed, and one which does not differ from any others except in very unimportant points.

Finally, I wish it to be clearly understood, that, of what has been done in the way of inventions, our merchants possess that which is the most simple, the least costly, and which calls for the least exertion, while accomplishing the greatest amount of work. It only remains for me to wish them the confidence which commands success, and the perseverance which insures it.

EVENOR DE CHAZAL.

St. Antoine, 30th June 1882.

Mr. President and gentlemen, members of the Chamber of Agriculture,

The attention of the Chamber has been lately, and on several occasions, directed towards a new industry in the development of which I have taken a share large enough to believe myself justified in making it the object of a communication, especially at a time when an important improvement has just been introduced into it: I refer to the extraction of the fibre of aloes.

The proceedings of this Chamber have frequently made mention of the experiments which have been tried in this direction by some of our compatriots, and have many times included letters from the present Director of our Gardens, of whose devotion to our interests you are aware. In fact, during the voyage which he has just made round the world in order to supply our impoverished sugar industry with new species of canes, Mr. Horne has several times given us information regarding the aloe, its future as a commercial plant, and the possibility of extracting the fibre from it economically, by adopting known processes, especially those employed in New Zealand in the manipulation of the *Phormium tenax*; it was he also, who quite recently put us into communication with Mr. Wilson, a London engineer, to whom you have sent as a delegate our compatriot, Mr. George Mayer. You have been informed of the result of his proceedings. Mr. George Mayer is not a member of this Chamber, but he is interested in the future of aloes, and he is well enough up in the question which engages us to have been able to appreciate the progress realized by the machines which Mr. Wilson is constructing for Mexico, and which have been offered to us. It is apparent from the report sent by Mr. Mayer to the Chamber that these machines are not in any point superior to those that we already possess.

But, gentlemen, while we were seeking on all sides for that perfection so much desired, it has just modestly come to light here, in the very midst of us, realizing all our aspirations, and finally established in a durable and definite fashion the industry which for several years has been dragging itself painfully along.

It is needful that I should tell you in detail how this revolution has been accomplished, because you will see in it, as I have done, the source of an increase to the public wealth. I do not pretend to present before you a complete work: my ambition is limited to collecting the scattered materials, to put in order the facts which have come to my knowledge, to fix undefined lines, to bring to your notice, above all, those amongst us who have been the first to enter a track, henceforth widely open to all, which has endowed our country with a new element of prosperity.

I. At the head of these men of energy, whom numerous failures at the outset have not disheartened, and whose perseverance has contributed to the foundation of the industry, my friend, George Bourguignon, naturally presents himself, the oldest surely of all those who have engaged in aloes in Mauritius. Although he has not been directly mixed up in the recent experiments which have resulted in the improvement I have pointed out to you, it can be said that but for him, but for his rare pertinacity, which has ended by triumphing over all obstacles, our country would still be in the gropings of the early days. Bourguignon, however, is not the only one who has occupied himself with aloes: there are others, not less energetic, not less patient than he, although of not such long standing, who have like him incontestable rights to the gratitude of posterity. I will cite, simply as they come to my pen, the Vallys, the Ryders, the Lecontes, the Trouchets, the d'Unienvilles. And Cazotet finally, Cazotet, the Lavignac of aloes, the pertinacious seeker whom nothing has discouraged, not even the loss of a little fortune entirely consecrated to the service of his adopted country, a fortune which is on the road to building up anew on those same aloes which have twice ruined him. It is to the painful toil of these courageous men that we are today indebted for seeing our colony endowed with an industry, the rival of sugar, and destined to restore the value of our coast lands, the extent of which amounts to many hundreds of thousands of acres. These seekers had faith in their final success. Behold them rewarded at last. You will not begrudge them the tribute of praise which is their legitimate due.

II. Gentlemen, I would lengthen this essay considerably if I undertook to give you the history of all the machines that have been invented to succeed in extracting the fibre contained in this wild plant. I cannot, however, refrain from mentioning to you that the first thoughts were turned to the mills in use for crushing the canes. Here is what the illustrious Cossigny says on the subject in his remarkable work entitled "*Des moyens d'améliorations proposés aux habitants des Colonies* Paris, year XI. This book, which displays an erudition as varied as it is extensive, has now become very scarce.

"The pita aloes afford the negroes, who derive great benefit from them, the material of all the ropes useful for colonial dwellings, where they supply the place of ropes of hemp and flax. This fibre serves to make all that is necessary for harnessing animals of draught and of burden.......The threads of the pita aloe are employed in Manila to make pretty thick stuffs, which are tinted blue, and with which the natives clothe themselves. Once I bought two hundred pieces at the Isle of France, which I distributed to the negresses on my settlement: they made petticoats of them. These stuffs have served me also in making sieves. I am not aware if, at St. Domingo and even at Manila, they soak the leaves of the aloes to separate the threads. This operation does not appear necessary when they are employed to make cordage; but when it is wished to manufacture cloths, the soaking would render the threads more supple and more durable. It is probably to the want of this operation that the fibre owes the stiffness which it always possesses. Then the juice of the leaves could be expressed by causing them to pass between the cylinders of a sugar-mill; then they might be put to soak for some days in stagnant water, which, aided by fermentation, would dissolve the gum which they contain; after which they would be washed in the river. I do not know whether the juice expressed from the leaves, put over the fire to evaporate, would not yield a gum fitted for some purpose. This could be easily proved. I commend these trials to the patriotism of the Colonists.

"In the Isles of France and Bourbon we pay no attention to our pita aloes, which spring up very freely in all sorts of soils, without any care whatever: scarcely is any use made of the leaves of the pine-apples, which possess great durability and which are preferred by the Chinese, especially for fishing. Beside the pita aloe, which we ought to multiply for its fibres, we ought also to cultivate the aloe of Socotra, in order to obtain the gum-resinous extract which it furnishes, and of which there is a great consumption in India and Europe. The Dutch colonists possess this industry at the Cape of Good Hope. It seems to me that they could also extract fibre from it. This plant would then yield two most useful products."—(Vol. I., Obs. XXIV.: p. 155 and following.)

And further on:—" Beside the hemp and the flax, we have in our Eastern colonies many plants which furnish fibre. I will first of all mention the two species of aloes which they have in the Isles of France and Bourbon, and which grow in the driest and most arid places. It seems to me that these plants are those which promise the greatest advantages," &c.—(Chap. XVIII, Vol. II., p. 407.)

Starting with this principle that it is necessary to bruise the leaves to cause them to rot easily, use was, as I have told you above, made at first of the cane-mills, but it was not long before it was seen that the cylinders cut the filaments, and the system was abandoned. It was the same with the soaking because of the lack of water. Later on mechanical beaters were made use of, imitating the human hand. The courtyard of my friend Bourguignon is still encumbered with these crude experiments, which witness to the variety, and at the same time to the sterility, of the first experiences. At last came *the scraper*, whose paternity has been claimed by many inventors, and which it is impossible to attribute to anyone. This is not Minerva sprung fully armed from the head of Jupiter: it was been born from the laborious and common action of all the manufacturers of fibres, who have all and turn about more or less modified and perfected it. The principle of it came to us from America.

III. The present mode of extraction consists of a pulley, or, to speak more vulgarly, a wheel, about as large as an ordinary cart-wheel. This wheel is armed, over all its circumference, with Tirous, or, if you prefer it, with scratchers, embedded in the wood and strongly fixed by means of bolts. There are of them about 14 or 15 on the whole circumference. If the wheel is 5 feet in diameter, and there are 15 scratchers thus disposed, it follows that they will be a foot apart from each other. This pulley, which is the soul of the machine, rests on trestles well bolted into their foundations : it is set agoing, like all machines of this sort, by some motive power and by means of a transmitting shaft like that for turbines. Imagine now, in the front of this pulley, which makes 400 or 500 revolutions a minute, imagine a table, like that which is found in front of the cane-mills, only narrower, and at this table a block of wood against which the scratchers of the pulley beat. This block of wood is the *servante.* It is regulated by means of a screw placed behind, and plays a very important rôle in the progress of the machine, for according as it is too tight or too loose, the fibres are cut or are not sufficiently scraped. There must be between this *servante* and the scratchers a space extremely exact, seeing that all depends on how the *servante* is regulated. I will not occupy my time in speaking to you of the little fluted cylinders placed in front of the machine, for they are only an accessory, intelligent it is true, and even necessary : but they are not indispensable to my lecture and would only encumber it.

You have now before you what in the language of a maker of fibres we have agreed to call the "scratcher" : put six or ten of them into the same building, and those amongst you who have not had occasion to see these machines at work will be able to get a general idea of them. Gentlemen, this scratcher is not perfect, but it is very near being so :

and when it is seen at work it is remarked with astonishment what small force it exerts and how little it breaks the fibre. The workman who serves it stands in front: he pushes the leaves one by one, rapidly, *point first.* (Keep this detail well in mind.) The leaf, dragged by the rotation of the fluted cylinders, which are under the hand of the workman, and which, in the new machines of which I shall have to say something to you later on, they have altogether omitted, is scraped over its greatest length, and effects its return by the same road in the state of fibre with the exception of an end which varies from 6 inches to a foot in length, and which it is the custom to call the "heel." This is the thick end, that which is attached to the stem, and the stumbling-block in all the experiments made up till now. What ought to be done with this heel? Ought it to be cut off, as some have recommended, or ought it to be scraped? But this second operation cannot be done in the same machine. Well, then, which is the course that ought to be adopted?

We will now, gentlemen, pass on to a new machine: the "rattletrap," the cause of all our misfortunes, which it is sought to suppress, and against which all our efforts have failed to the present day. It is essentially composed of a wheel identically similar to that of the scratcher, armed with scrapers like it, with the chief difference that instead of turning against a fixed *servante* it turns in a movable socket about 18 inches long, and forming a lever, or if you prefer it, a pedal. I have said that after having passed through the scratcher the aloe leaf, reduced to fibre throughout its greatest length, preserves a "*heel.*" The workman charged with the second operation hangs up the scraped portion of the leaves in bundles of five or six at a time on a hook which juts out above the socket, half-open at his feet: then, placing his foot on the pedal, he imparts to it a movement from below upwards, while he causes it to approach the wheel so that the scrapers, still revolving with the rapidity we have mentioned, take off what remains of the unscraped portion of the leaf, that is to say the "*heel.*"

Well, gentlemen, this was the weak side of the industry till lately. It does not enter into my plans to reply in advance to all the objections that might be brought forward as to the defects of such a machine. It was simply ruinous as much by the force it exercised as by the violence with which it worked.

If the scratcher caused little waste the "rattle-trap" on the other hand was defective in a grievous manner. Only, nothing else was found, and it was not known how to replace it. But why was the "rattletrap" so defective? It is not only because it exercised an excessive force which betrayed itself in an enormous consumption of fuel, seeing that it performed the work of a drag every time it was in motion, but also because it carried away a considerable portion of the fibres already scraped, which, not being attached to the hook on account of their shorter length, could not resist the tug and ran off with the refuse. Now, to understand why all the fibres could not have been fastened to the hook which overhangs the half-opened socket of the "rattle-trap," it is needful that we should know how the leaf of the aloe is formed not only to put ourselves in possession of the causes of waste, but to get the key to the progress that has been realized.

IV. The aloe, gentlemen, of which all the varieties which grow spontaneously in our soil are not uniformly profitable to our industry, the aloe is essentially composed of a stem around which group themselves spirally leaves varying in length from 3 to 7 feet to keep within the average. When these leaves are examined carefully, it is seen that the part which adjoins the stem is the thickest, heaviest, and most fleshy part. The point terminates in a strong thorn. All the fibres necessarily start from the stem, but do not all end at the terminal point, as can be ascertained by tearing a leaf lengthwise. Those of the middle alone reach it; those of the sides stop midway. It follows that when an aloe leaf is cut at a certain distance from the stem, this distance varying from 6 inches to a foot, all the fibres have been cut at a similar point. If now we suppose that it is this end which will be scraped first, we shall be sure of seizing all the fibres at their starting point when the leaf has to be turned round to subject it to the second scraping. But, gentlemen, this was not how it was done. If you remember the leaf was presented to the machine *by its terminal point first*; then, when it was three-quarters scraped, it was turned round to present the heel to the "rattletrap." In this second operation the longest fibres alone are retained on the hook; the rest are dragged away by the rapidity of the rotation of the wheel and are lost, so that the result of this second operation will have been, it is true, to scrape a heel of 6 inches or a foot in length, but will have been at the same time to destroy a part of the work done by the first machine, in snatching away some of the fibres already made by it because they were not long enough to be retained on the hook.

It is upon this important point that the improvement of which I have to speak to you has taken place. This does not consist *solely* but *principally* in the suppression of the "rattletrap," and its originality lies in its scraping the "heel" of the leaf before scraping the "point."

I have told you that the process did not consist *solely* in the fact of causing the heel to pass before the point. In truth, the *servante* plays a considerable part in the progress which has been realized; its regulation, the new shape that has been given to it, the new materials of which it is made, constitute so many perfections which have to be added to the mode of presenting the leaf, and contribute to increase the returns.

I have thought, gentlemen, that the Chamber could not remain indifferent or strangers to all that has been accomplished in this line of thought, and that it is its duty to direct and sustain the movement which has begun. An industry is about to be founded on solid bases, it is real, it may bring to the colonial treasury a considerable increase; to develop itself it only asks for its support and a little publicity, that it may find in disposable capital that assistance to which it certainly has a right because that right is now based upon an incontestable success.

V. It is generally admitted that aloe leaves give an average return of 2 per cent. Here we must explain ourselves; when we say 2 per cent we do not say 2 lb. of fibre for 100 lb. of leaf, but 2 lb. of fibre for 100 leaves, which is not quite the same thing. Whatever may be the defect in this calculation, it must be accepted as it is, for this is the way the manufacturers of fibres understand it, and because the leaves are more easily counted than weighed, and because, moreover, if the proportion of the weight of the fibre to the weight of the leaves were adopted, it would offer other inconveniences of which the least would proceed from the fleshy part, which yields a very different percentage according to the distance it is cut from the stem. I will not, therefore, insist any longer on this point but content myself with noting it, because it will serve as the basis of our comparisons.

However I may desire to avoid speaking to you of what is personal to myself, yet I cannot forbear mentioning to you that during my three years of manufacture at *Rouge Terre* my proportion has constantly been below this 2 per cent. In 1878 it was 1·76; in 1879 it whs 1·62 per 133 leaves, and 1·85 in 1880, that is to say, I only succeeded in extracting from 100 leaves brought to my manufactory about 1¾ lb. of dry fibre fit to be packed. You will see with me that this result was ruinous; consequently, I closed my factory and waited for better days. I have equally acquired the right, because I have asked him for it, of telling you the result obtained by my brother-in-law, Edward Trouchet, at La Riviere Noire during three years. He has been scarcely more fortunate than I, his average having been 1·97. I will not allow myself to speak to you of others, although I am led to think that the result reached by them has not been much more favourable. I will make an exception, however, of my friend George Bourguignon, who has reached, I am told, 2½ per cent. This result does honour to his management, and above all to his process of extraction. If you compare these figures, be they 2 or 2½ per cent, with those of the cane which rise to 9 and 10 per cent of its weight, you will ask yourselves how an industry can be maintained with such returns. To be frank, it is maintained with difficulty. For my part, I declare that if I had only obtained the 2½ per cent of my friend Bourguignon, I would not only have not closed my factory, but I would have made large enough profits to have never dreamt of doing so.

But, gentlemen, it is not a question today of 2, nor even of 2½ per cent. It is at least 50 per cent above that that must be counted upon, as I will try to prove directly. And you will admit with me, that if it was possible to live with 2 per cent and even less, one has a right to believe in success when this same leaf gives a minimum return of 3 per cent, often more, without an increase of expenditure, and on the contrary with a motive power infinitely less.

Here are some experiments made by me at *Palmyre* on the 13th September with the new apparatuses :—

(1) 50 leaves of average size, 4 feet long, weighing 56 lb., gave of dry fibre 1·75 lb., that is 3·50 lb. for 100 leaves, or 3·12 lb. for 100 lb.

(2) 5 leaves of Madagascar aloes 7 feet long weighing 24 lb. gave 0·49 lb., that is 9·80 lb. for 100 leaves, but only 2·03 lb. for 100 lb.

At *Mont Choisy* in the machines of M. Cazotet I passed 25 leaves weighing 42 lb. which gave 1·28 lb. of dry fibre, that is 5·12 per 100 leaves and 3·05 per 100 lb. The present average of M. Cazotet with the new machines is from 3½ to 3¾ lb. per 100 leaves. At La Rivière Noire, with Trouchet, it is lower, but the deficit must be attributed to the small leaves and perhaps also to the lack of experience of the men, who have not yet acquired the knack of serving the new machines. Lastly, with M. Bonieux, at Tombeau, they have arrived at 4·16 lb. per 100 leaves for the average work of a week.

You see, these numbers are infinitely superior to anything we have obtained till now, since they represent an average of 3 to 3½ lb. of dry fibre per 100 leaves, whilst with the old machines scarcely 2 per cent, or by the most favoured 2½, was reached.

Who then, after all, you will say, is the happy inventor of the new process? I touch here, gentleman, upon a delicate subject, and would not say anything before you of which I was not absolutely certain, as these remarks may perhaps see the light of publicity. My impression, however, is that it is a collective work of which no one can claim the paternity. Several have put their hands to it and have modified it, often with advantage. Here, besides, is what I have been able to gather on this point; I give it with all reserve, and am ready to make honourable amends if I should inflict injury on any interests.

When the Government published the notice which you are aware of, and by which it offered a prize of R2,500 for the best machine for extracting fibre from aloes, the committee, of which I had the honour to form a part, found itself in the presence of three machines none of which combined the conditions of the prize. The first, the Marabal machine, did not complete the leaf; there remained a "heel," which necessitated the employment of a "rattletrap." The second, invented by M. Vigé, was not finished, and has never, to my knowledge, worked in a satisfactory manner, although it possessed some grand qualities. The principle sought by M. Vigé may be some day revived with advantage.

Finally, the third by M. Digard, made at the premises of M. P. d'Unienville, and with his help, has never been worked either. It took the leaf by its point like its predecessors, and has been patented. M. Digard, having left for Natal, handed it over to Messieurs Bax and Perdreau who had, it seems, advanced the funds, and who delivered it to M. Cazotet. The latter has modified it, has preserved its barrel, and originated the idea of causing the leaf to pass heel first. However, this process is discovered in the Marabal machine, so that its paternity could not even be attributed to M. Cazotet, although the considerable part which is due to him in the application of the new process cannot be disputed. This idea has been taken up by Messieurs Mérandon and Bonieux, and still further modified by them in the form of the barrel, the number of scrapers, and above all in the *servante*, which, as you have seen, plays an important part in the scraping of the leaf.

VI. A writer of talent, gentlemen, known and appreciated, Dr. J. Forbes Royle, has devoted to the aloes a chapter of his remarkable work on the textile plants of India.*

I must renounce the pleasure of transcribing it in its entirety, however much interest it may otherwise

* J. Forbes Royle, M.D.: "The fibrous plants of India, fitted for cordage, clothing and paper," page 43. London: Smith, Elder & Co., 1855.

present, and I limit myself to extracting the following passages from it :—

" The agave is originally an inhabitant of America, but it is so widely diffused over the surface of the globe, that it appears to be indigenous to Africa, India, and the south of Spain. The agave, to which the name of *American Aloe* is so often given, resembles the aloe by its sword-like leaf ; it has parallel veins, and attains a length of 8 to 10 feet from the stem to the point : it terminates in a strong thorn. It is this which renders this plant so useful for hedges and enclosures, and so sought after for this purpose in Italy and Sicily. It is completely developed at the end of three years, but does not flower before eight and sometimes twenty years. At this period they throw up a candelabra-like stalk. It is doubtless this peculiarity which has given birth to the fable that has been invented that these plants only flower once in a hundred years. It is in the leaves of this plant that the fibre is found. It is exceedingly long and tough, and cordage of great value is made from it. The juice, which flows from it, is sometimes, according to *Long*, substituted for soap.

" The fibres of these agaves are sometimes converted into ropes in Mexico, and these ropes often serve in the mines and on board vessels. Humboldt has given a description of a bridge over the river Chambo at Quito, 131 feet long, of which the main ropes, 4 inches in diameter, were made of the fibres of aloes. It is reported that in the West Indies the negroes make ropes, fishing nets and hammocks with the aloe fibre. The fibre is prepared as follows :—First the longest leaves of the plant are cut off, and then they are scraped with a bar of iron, which is held in both hands, till all the juice and pulp are expressed and only the fibre remains. Stedman says that the fibre resembles silk, and that the ropes made with it are considered in England as good as any others whatseever, but that, however, they rot more quickly in water.

"In Portugal this fibre is called 'filo de pita,' and is applied to several purposes. In Spain it is also called 'pita,' and as the plant abounds in that country, ropes of all dimensions on a large scale have been made from it.

"The fibre and the rope of 'pita' are in the south of Spain, the object of a pretty large trade, but we must not deduce from this that the sources of a manufacture exist there, for all of it is done by hand. M. Ramon de la Sagra recommends the introduction of new species from Guatemala and Columbia, where they are known under the name of 'Cabuila' and 'Cocaiza.' There are species of 'fourcroya' which also give excellent fibres, The 'fourcroya gigantea' is common at St. Helena, and has been introduced into Madras. The island of Madeira sent fibres of 'pita' to the Exhibition of 1851; we have had some aloes from the Barbadoes and Demerara. Mexico has sent yarn and paper made from the Agave Americana.

"The name of 'pita' seems also to have been given to similar fibres obtained from the *Bromelia* and *Yucca*, as well as from the Agave, according to Dr. Hamilton of Plymouth, and it is probable that this has been the case because they greatly resemble each other. Dr. Hamilton says also that this fibre is a sixth less heavy than hemp; this fact has importance and significance for vessels; he considers it also more tough and durable than hemp, and prefers it for cables, fishing-nets, &c., because of the facility with which it stands moisture. In an experiment that was made by H. M. Ship 'Portland,' a log-line 300 feet long of 'pita' fibre only shrank 16 feet, whilst a hamper rope of the same length shrank 21 $\frac{6}{10}$ feet; moreover the contraction of the 'pita' ceased on the third day, whilst that of the hempen rope lasted all the time. The two ropes were deposited in the stores at Plymouth Dockyard."

"Labillardière relates that at Amboyna the natives obtain from a bastard aloe, commonly called 'Agave Vivipara,' a long and fine fibre, equal to that of our best hemp. The Agave grows well in the north of Africa, and the French, since their occupation of Algiers, have paid great attention to it."

I regret being obliged, gentlemen, to shorten this quotation. Dr. Forbes Royle enters into many details on the resistance and the durability of the aloe compared with hemp; and in these experiments it is always the aloe rope that has the superiority. So at Paris, an aloe rope, coming from Algeria, supported a weight of 2,000 kilogrammes [4409·20 lb.], whilst Manila hemp of the same size was only able to sustain 400 [881·84 lb.]. At Toulon, the fibres having been plunged into sea-water for six months, the aloe sustained a weight of 3,810 lb., whilst the hemp could only support 2,538, leaving a difference of 1,272 lb. in favour of the former.

Finally, according to experiments made by Mr. Hornby, and sent by him to the Agricultural Society of India, the aloe ropes were constantly found superior, not only for toughness, but for endurance, to the ropes of any other source, such as 'jute,' 'manilla,' 'abaca,' &c. The chapter ends with these almost prophetic words :—

"The fibre is quite good enough to furnish an article of commerce of the first order, destined to have a considerable value in the future, especially since the prejudice against white ropes is inclined to disappear. It is to be wished that serious experiments were made to arrive at a knowledge as to what are the best conditions for cutting the leaf, and also as to whether the fibre cannot be extracted by mechanical means. When preparing the ropes care also must be taken not to cut the fibres while twisting them ; this is a delicate operation and ought to be done by professional rope-makers."

VII. Gentlemen, all those who have traversed the dry and rocky plains of the coast, and by the coast I mean all the lower region of the Island to a distance varying from three to four miles from the coast to the centre of the Island, all those, I say, who have had occasion to traverse these regions, and you all certainly have had occasion to do so, must have been painfully impressed by the aridity and sterility of a land, which was formerly the principal source, one may say the origin, of the public fortune in this colony. It was there, in fact, that the finest factories were erected, that the great fortunes were built up, that the aristocracy of the Island lived. How many years has it needed to render these localities, formerly so fertile and populous, deserted and desolate? A half-century barely, a half-century, when in another country the depth of the soil, the moisture of vast continents, the rotation of crops, would allow landed proprietors to transmit to their descendants, from generation to generation, a land always generous and capable of supporting those who knew how to till them by the sweat of their brow. Gentlemen, fifty years has sufficed in Mauritius for the soil to be ruined, and the father has transmitted to his sons only a cause of ruin. I will not seek to find out who is responsible for such a state of affairs, because that would be to go beyond my limits. I will content myself with establishing it in passing. Well, gentlemen, this land which refuses to produce canes, where it is said that the *old maid* itself grows with difficulty, is the country of a vigorous plant which accommodates itself admirably to the desolation that surrounds it. This plant is the aloe. Alone, it animates with its luxuriant vegetation a desolate landscape, and in gaiety obtrudes itself upon the universal death of a nature always burnt up by an implacable sun, which the heavy rains of summer revive for a few days only. I invent nothing, gentlemen, and if the picture I have drawn of these regions be exaggerated, I pray those of the members of the Chamber who hear me to stop me.

The aloe then comes there where nothing grows, in a land abandoned by the cane, without cultivation, without expense, fearing neither droughts, nor thieves, nor floods, nor cyclones, nor diseases, nor indeed the evils of all sorts that are accustomed to burst upon the cane, and which have pressed so hard the last few years, that it has become a problem to know how the inhabitants may succeed in withdrawing the interest of the immense capital sunk in this enterprise. Nothing like this for the aloe.

It comes by itself; and you, proprietors, formerly so chaffed, now envied, for these plains of the coast, you have at length reaped the prize of your patience, and you are again going to restore work and comfort to the despised localities, whilst preparing for your descendants the means of honourably gaining their livelihood, and of rebuilding a fortune exhausted by the hard struggles that had to be fought in attempting to retain in these regions the dying out cane!

Plant, plant therefore. Do not forget that the aloe is the only possible product in these regions, that this product is extremely renumerative, that the roads you have made, that the factory you have erected, that the houses you have built, for the purpose of an industry that has quitted you to take refuge in the high and damp regions of the island, will soon be serving you for another product; that this product is more adapted to your soil than the cane, that it offers less risks, and that it can give as good returns as the most favourable sugar properties. You are at last going to see these roads again furrowed by rattling carts, this chimney, long extinct, again vomiting forth volumes of smoke, these deserted houses repeopled, and the echoes asleep for so many years awaking with the tumultuous expressions of the joy and work of a whole population. Plant, and, believe me, do not lose a minute. The number of those who still smile, when the future of aloes is mentioned, daily diminishes. Plant! now above all when you have before you the machine which must create such a revolution, you cannot hesitate to plant. For my part, if I have succeeded in convincing a single one of those among you who possess lands at present uncultivated in these regions, I will have the satisfaction of having accomplished my duty, and will not regret the efforts I have attempted.

VIII. You have now before you an account which I have tried to make as faithful as possible of the present state of the industry. The essence of all I have just said is that the aloe gives now in fibre an average of about 3 per cent of its own weight, whilst with the old appliances scarcely 2 per cent was obtainable. I believe I have demonstrated that the extraction of fibres is at present a lucrative affair.

There remains the question of sale.

On this point I will be brief. It will be sufficient for me to say that aloe fibre, packed in bales, has sold in the London market, during the whole period that I have manufactured it, at an average price of £30 to £32 the ton. Just now the accounts of returns of the Blyth establishment show sales at £38 and £40, or an advance of £8 to £10 per ton. These figures possess eloquence and denote great stability in the article. They may also be explained in the following manner by this extract from the preface of Forbes Royle's work, already quoted :— "It has often been said that the only way of knowing the value of a fibre or any other product is the price which it realizes in commerce. This is very true for well-known articles ; but if a new product is sent into the market, it is clear that few persons will buy it, because it demands new machines to work it. I have been told that many years are needed before a new product can attract the attention of buyers. I readily believe it. This is one of the laws of commerce. We can see this by comparing the prices of jute with the former prices. It is plain, that in proportion as these new products intrude themselves upon purchasers, the properties are gradually taken note of, and their real value properly quoted," &c.

As for the planting, it is such an elementary operation that it appears to me idle to speak of it, the aloe being a hardy enough plant to be put out at any season. Vigorous specimens ought to be chosen as much as possible. One can plant all the year round, but naturally the rainy season is preferable. I have found it answer well at *Rouge Terre* to put my young plants into the old cane rows at a distance apart of 5 feet, so that an acre can contain 1,600 to 2,000 plants. As a general rule an aloe plant does not die if the root be covered. The plantation can be formed of young plants of that year or of plants of 2 or 3 years. I learn from my friend G. Bourguignon that plantations from seed succeed better. The older the aloes when transplanted the sooner do they flower; on the contrary, the younger they are the longer do they delay. It is the business of the owner to determine whether it is preferable to wait two or three years more in order to get several crops without having to renew his plantation, or whether he will find it more advantageous to enter promptly into production. I will add that aloes planted from seed or from young seedlings take 5 years to attain their complete development, whilst, if they are taken large, that is to say from 18 to 20 inches high, they take only 3 years. On an average aloes flower at the end of 7 to 8 years. They can then be cut 4 or 5 times before they have flowered and it becomes necessary to replace them.

With the new appliances the return may be estimated at 1½ ton of fibre per acre. At *Rouge Terre* my average has been from 1,700 to 1,800 lb. It has often happened that I have exceeded the ton with the bad outturn of the machines I used.

Gentlemen, I have finished. My friend, Albert Daruty, has been good enough to furnish me with some notes on the botanical part of my work. My brother, Régis de Chazal, engineer of the Forges and Foundries, has, on his part, consented to do the technical portion. This is the reason why I did not enter into a more complete description of the new machine of which I have spoken to you. On the other hand these descriptions may seem to resemble each other, especially in what concerns the 'scratcher'; on such a subject one cannot be too exact. My brother speaks as a specialist, I as a cultivator. I have scarcely spoken to you on anything that was not personal to myself; he describes to you the principal known machines; you will appreciate his essay.

I will say, in conclusion, to my colleagues, to my friends, to the proprietors of the coast lands : Plant. Four years are necessary for cultivation. In four years you will have the rudiments of a prosperity well earned. Establish your plantations around your factories so as to take advantage of your network of roads, and do not, in order to try and get returns sooner, go and set up your machinery in the midst of a field of naturally grown aloes. The industry is fixed and stable. It is a great mistatke to believe that it will be an advantage to render it nomadic. Plant then, and be proud of the progress realized by our compatriots on this Mauritius soil, so liberal to him who knows how to work it wisely.

EVENOR DE CHAZAL.

St. Antoine, January 1882.

NOTES.

Here are the notes which I mentioned above, and which 1 owe to the kindness of my friend, Albert Daruty :—

The following species are found in Mauritius in a wild state :—

(1) Agave Americana *L.* (Blue Aloe).

(2) Agave Angustifolia *Hano* (Aloe with small leaves).

(3) Fourcroya Gigantea *Vent.* (Green Aloe).

(4) Fourcroya Gigantea *Var.* Villemetiana *Roem* (Cabbage or Malagasy Aloe).

Fourcroya Gigantea *Ventenat.*

The genus Fourcrœa, of the family of Amaryllides, separated from the genus Agave, was founded by Venenat, and dedicated by him to the celebrated French chemist Fourcroy.

This genus was adopted by de Jussieu and other botanists, and Endlicher, in adopting it, gave it its true orthography *Fourcroya*, others formerly having written *Fourcroea*, *Fourcroea*, and *Furcræa*.

Ventenat in dividing the genus Agave gave to the agave fœtida the name of *Fourcræa Gigantea*: this is the species which now occupies us.

This plant was introduced into Europe in 1690, and it was only brought from Brazil to Mauritius towards the end of the last century by Father Seriès, almoner.

Aublet, who gives us this information, says that he cultivated it in the garden of the Redout; it sent forth, he says, a huge branching stalk which, instead of flowering, was loaded with a great quantity of bulbs.*

The type of the species known in Mauritius under the name of *green aloe* is then a native of South America and the Antilles. It is a plant with a stalk sometimes very short, sometimes very tall; the leaves are erect, numerous, rigid, dense, slightly groved, and disposed in rosaceous form at the summit of the stalk; they are glossy, of a bright green, about 2½ meters long [8·20 feet] by 15 to 18 centimetres broad [6 to 7 inches] exhaling a bad odour when crushed (whence the name *Agave Fœtida*). The stalk is very tall, paniculated, rising to a height of 10 or 11 metres [33 to 36 feet] with a diameter of 15 to 20 centimetres [6 to 8 inches] at the base. Flowers pendant, white, having a bad odour, with filaments longer than the folioles of the perianth. Perianth persistent with six folioles multinerved, exposed, whose 3 interior ones or petals (are) larger and more delicate,—stamens 6, inserted in the depth of the flower,—anthers linear,

* Fusée Aublet, Histoire des Plantes de la Guyane Française, Paris, 1775, vol. I, p. 305.

oblong, sloping to the summit and two-lobed at the base, fixed by the middle of the back ; varies with three multiovuled locules; style erect, thick at the base, fistulose, longer than the stamens; stigma obtuse with 3 angles or 3 boles; capsule ? (not yet observed).

The plant here multiplies itself solely by buds, which are developed on the stalk, often in such a great quantity, that it is bent down by the weight.

The variety *Villemetiana*, which seems to have developed itself in Mauritius, does not differ from the type but by its leaves which are larger, greener, and less thorny, often even unarmed. This variety must have originated in the high, moist, and fertile spots. A. Daruty.

And now for the description of the machines, by my brother, Régis de Chazal, engineer at the Office of the Forges and Foundries.

The juice of the aloe is strongly acid on a litmus paper; it attacks iron and dissolves it very rapidly. It does not contain tannin, or at least in a very inappreciable quantity, for the solution of iron is not black: cast-iron is scarcely affected, bronze and brass are not at all.

The leaf is composed of a bundle of fibres of different lengths, all starting from a common trunk or heel, and terminating, the longer at the point, the shorter at about the middle of the leaf. These fibres are surrounded, being united one to another by a porous, white, and very juicy pulp. The younger it is the more juicy it is; at full maturity, that is to say when the leaf is yellow, it is nearly dry. The epidermic cuticle is a thin layer (about ½ mm. [$\frac{1}{50}$ inch] of a tissue much more compact than the pulp, less moist, and containing an appreciable portion of resinous gum; the dermis is dark green, the epidermis is only a thin transparent skin which comes off easily. The leaf dried becomes ligneous, the fibre has lost its toughness, the dermis adheres firmly to the fibres, and this renders it very difficult to separate the fibre from its envelope. It is then preferable to treat the leaf while green, as it is done now.

The maceration can be performed quickly enough, even in cold water, but the fibre undergoes a change: at first it becomes red, then black; it is, ordinarily, five times as strong as hemp, but must lose its toughness, for our consignees in Europe reproach us with sending them red fibres that are not prized by buyers: they attribute this deterioration to a defective packing, but I rather think, as has been remarked to me, that the fibre has not been dried enough. It must then redden in transit, thanks to its own moisture. In this case would it not be preferable to dry it at a stove before despatching it? Experience alone will show this. Under these conditions maceration is not possible. What renders this operation still more difficult is that the localities where the aloe is planted are arid and generally lack water, the irrigable lands being reserved for the cane, which is a product of higher cultivation.

It is said that an apothecary of Réunion has succeeded in preventing the change of fibres during maceration by means of a chemical product added to the water; I mention this detail with all reserve, not knowing the process. Fuel being at a comparatively high price in Mauritius, we are shut up exclusively to mechanical processes, acting on the leaf in a moist state, that is freshly cut.

What is the richness in fibres of the aloe leaf? This ought to be the first question to put, and the first to settle; however, absolutely nothing certain is known upon this point. Many experiments for this purpose have been made, but they do not appear to be satisfactory. There have been so many important discrepancies that no conclusion could be drawn from them. From 100 fine leaves, green and young, 8 feet in length, E. obtained 9 lb. of dry fibre calculated according to the ordinary proportion of green to wet fibre, which is about 30 per cent, which gives about 12·12 per cent of the weight. With ripe leaves, four feet long, he got 3·52 per cent. These fibres were obtained from the present machines; but he has not taken into account the waste, which would be but trifling. All this is far from being mathematical. P. and C. careful y scraped the leaf by hand and obtained 5·50 per cent (of the weight of the leaf). Some say it does not contain 3·50 altogether; others assert that it has a yield of 7 to 8 per cent, All this is very vague. It would be very important, however, if serious and continued experiments were made. Even commercially, it is impossible to get any precise record of the outturn of the different machines actually at work. P. maintains 3 English pounds of dried fibre for 100 leaves; M. affirms 3·40; B. 3·50 to 3·75; F. 2·16 to 248.

One of my friends who buys his leaves has no permanent expenditure on cultivation; he pays his men by the day and keeps account of the profit which he makes in the following manner:—Two sets of 12 men each relieve each other in the day; the first represent his expenses, the second realizes the profit. He produces six bales of 150 kilos [330·69 lb.] a day. Another one manipulates 3 bales of 175 kilos [385·80 lb.] per day. He has 6 scrapers of the new system, a motive power of 8 horses, and a generator of 30, plus the transmission of motion. The newest, set up and working, would cost from 5,000 to 6,000 piastres in Mauritius.

Here now is a sketch of the different machines employed in the extraction of aloe fibre:—

The blacks content themselves with striking gentle blows on the leaf with a piece of wood, in such a manner as to bruise the pulp and render it less adherent to the fibre; then they scrape the surface (always by hand), and little by little remove this pulp. This is the principle of one of the first machines at the outset of the industry; it was composed of a certain number of blades set in a circular piece of wood movable upon an axis, and moved alternately by a shaft with cams; these blades strike very rapidly upon a surface on which the leaves are arranged. The result was to disintegrate the pulp, and to render it more easy of removal. The same end was attained in a primitive fashion by drawing over the leaves a heavy stone roller such as is used for smoothing grass. These two systems have been abandoned. Later on a pulley was employed of about 1·50 metre [5 feet] in diameter by 25 centimetres [10 inches] broad; on the felly following the generator were placed combs of copper of the width of the pulley; these combs had teeth 6 to 8 millimetres [¼ to ⅓ inch] in length; there were 6 to 8 combs on the pulley, to which a rapid rotatory motion was given. The leaf was firmly forced against these combs, and it became scraped. This was abominable: the teeth of the comb penetrated the leaf and broke the fibres.

Here are the modifications that were made at first of this machine, which, defective as it was, served later on as a type for the new ones which have since been constructed. The principal drum, which is a wooden wheel of 5 feet in diameter and 9 inches broad at the felly, rests on an axle placed horizontally on bushes. On the felly T irons were fixed at first of copper, and then of iron. There were 10 or 12 of them. The edges of these grooves are without teeth and slightly rounded. To the pulley is given a rapid rotatory motion by means of a pulley and strap. A little lower than the centre is found a joist *S* of hard wood (fig. 1) 4 inches in thickness and of the same width as the pulley. This piece is solidly fixed to a frame. Above and near the pulley are situated two small fluted cylinders *a* and *b*, of copper, gearing together, and having a length equal to the breadth of the pulley; the bushes of the axle of the small cylinder *b* are fixed, those of *a* are fastened to springs which allow the cylinders to recede and advance. *a* is moved by attraction; *b* receives its motion by a play of conical gearings and an apparatus which allows of giving at will equal and contrary rotations. The joist *S* or catch is regulated according to its separation from the pulley; it is cut roughly as the sketch indicates. The pulley turning in the direction of the arrow *F*, the leaf is introduced by the point between *a* and *b*; it is dragged rapidly in the direction of the arrow *f*; at the moment when it is about to pass through entirely the apparatus is acted upon, and *b* is caused to turn in the opposite direction and leads the leaf back. It is in this retrograde movements that the leaf, pressed against the catch and struck by the T irons is scraped; there comes out a skein of fibres adhering still to the "heel," which has not been scraped. This heel is a thick and fleshy portion.

In order to scrape it, the following machine, called by the makers *rattletrap*, is employed, (fig. 2). It is the very same pulley turning in the same direction. Only instead of the preceding catch, there is a *savate S*; this is a plank having the form *A S*, movable round an axle *A*. A roller *r* rests against the exterior surface; this roller is supported at the extremity of a lever *l* movable round the axle *a* which is fixed; at the other extremity a rod *b* fastened to a pedal *p* movable round the axle *d* which is fixed. On pressing with the foot upon *p*, *S* is pressed against the pulley, and on withdrawing the foot *S* is allowed to fall back, and it goes away from the pulley. At *c* is a hook fixed to a piece of the framework of the machine. And now for the working: the skein of fibres which comes out of the preceding machine is taken and fixed to the hook by rolling it round several times and letting the unscraped heel be taken; at this moment the *savate* is down, the pedal is pressed upon and this raises the *savate* *S*. This in its progress drags the heel and presses it firmly against the pulley, and the scraping begins; the reserve motion is put into action and the bundle of fibres is taken out completely scraped. These fibres, still moist and gummy, are put for 12 to 15 hours in hot water, then dried and packed. This proceeding is rough and coarse; the loss also is very great in this *rattletrap*; these are the machines which were used at Rouge Terre, and which are still used in two or three places.

The second machine which is about to be described is an improvement of the first in its mechanism. This is the machine invented by M. Marabal and constructed by Messrs. Bosnay & François, which has worked at Rouge Terre pretty regularly for nearly a year. I will not enter into any detail of construction, for it is rather complicated. This is the principle of it: *T* is a drum (fig. 3) of cast-iron backed by a good thickness of hard wood. At *m* is a chop, set into the wood; *t* a table doubled at *p* by a leaf of thin copper; *P* is a copper comb; *T'* a scraper in cast-iron with grooves absolutely similar to those already described; only it has a less diameter; it is about two feet. The movement of the drums is in the direction of the arrows *f*; the drum *T* turns with a speed of 30 revolutions per minute, *T'* of 200 or 300 revolutions. The following is the working:—The leaf is presented on *t* by the *heel*; the automatic comb *P* buries itself in the heel, and pushes it on at the moment when the chop *m* presents itself on a level with the table; the chop, which is automatic, is open; it closes rapidly and grips the heel, dragging with it the leaf, and forcing it against the drum; the rotation continning, the leaf arrives at *a* where it is cleaned by the scraper which turns in a reverse direction. The scraping continues till the chop arrives at the position *m* indicated in the sketch. This latter then opens, and rejects the leaf by a rapid movement on to a leaf of sheet-iron *F*, where it is gathered up. Then the chop takes up another leaf, and so it goes on.

Here, again, it is the point which is scraped, and there remains a *heel*. There is indeed a *Marabal rattletrap*, but it has been put aside, and it never acted satisfactorily. At *Rouge Terre* they made use of the rattletrap, described above, in order to crush the heel.

It must be remarked here that in these two machines the leaf has a reverse movement from that of the scraping drum; this is a main point which has caused the Viger machine, which is now about to be described, to be rejected.

It is essentially composed (fig. 4) of a large drum *T*, of polished cast-iron, 2½ feet in diameter, turning round an axis *A*; three small cylinders *c*, *c'*, *c''*, of cast-iron, mounted on axes turning in bushes; scrapers *G* and *G'* in cast-iron, with T irons are supported by a triangular balance *a b d* movable round an axis *a*. To this balance is fixed a rod (which is not represented in the sketch); at the end of the rod a small wheel which revolves on a wedge-shaped cam upon the axis *A*; the balance thus receives an automatical and periodical oscillating motion. Lastly at *S* is a metal plate acting as a guide to the leaf. *c*, *c'* and *A* are furnished with a tightening screw for regulating; *c* touches *c'* but does not touch *T*; *c*' touches *T*; and so does *c*''. The directions of the rotations are indicated by the dotted arrows, the passage of the leaf by black ones. The drum, the cylinders, and the scrapers have an equal length of 6 feet, and are contained between two vertical frames of cast-iron. The working is easily explained: the leaf is introduced between the two cylinders *c* and *c*' the point foremost; it is squeezed, comes up between *c*' and *T* where it is again squeezed, but more strongly. Directly the point arrives at *h* the balance oscillates, the scraper *G*' comes in contact with *T* and the scraping begins, the leaf being retained by *c*'. When the heel is released by *c*' the balance oscillates in the contrary direction, and it is *G* which then comes in contact with *T* and which scrapes the heel, the leaf being then retained by *c*''. When this first leaf is done with, the balance oscillates again, and *G* encounters at *h* the point of a second leaf. And so on. So the leaf comes out completely scraped. The drum *T* and the scraper *G* in effect only form a Marabal machine, the cylinder *c*'' acting as chop; *G* scrapes in a reverse direction to the passage of the leaf; *G*'' scrapes in the same direction as this passage. At the trial of the machine, *G* gave an excellent result, whilst *G*' did not scrape at all; or rather the leaf submitted to the action of *G*' bore a series of transverse scratches produced by the grooves, the skin and the pulp were not raised. This caused the machine to be rejected.

Many other machines, among which those of Messrs. Digard, Carcenac, d Unienville, &c., may be cited, are the result of patient and laborious researches, but do not yet appear to realize the dream pursued.

In all these machines the end which has generally been aimed at has been to scrape the leaf completely, without having to scrape first one end and then to turn it round to scrape the other end. It is perfectly evident that in that case there would be a less expenditure of workmanship, but would it be worth the trouble? This cannot be done without complicating the mechanism, which ought to be as simple as possible, for it needs great precision, and as was seen above the juice of the aloe attacks iron. The wear and tear produced by these different instruments would without doubt destroy their good working powers. We will consider further on the present machine, whose value consists principally in its simplicity, its easy management, the nicety with which it is constructed, and its moderate price.

The machine sent by M. Paul d'Unienville to the Exhibition of 26th October last is similar to the first one described with this modification, that a "rattletrap" has been adapted to it; the catch and the scraper are identical, except the diameter of the latter which is less being about 1½ foot (fig. 5). A scraper *A* and a catch *S*, that's the old apparatus. At *c* and *c'* two cylinders of wood on smooth cast-iron, turning in the direction of the arrows. At *a* a scraper identical with *A*; *S'* is a joist or catch movable in two slides and which is worked by the hand by means of a lever. The leaf is introduced by the point between *c* and *c'*, the scraper *A* acts: at this moment *S'* is drawn away from *a*; when the heel is about to pass between *c* and *c'*. and at the proper time, *S* is brought back towards *a*, and this applies the heel to *a*, and the scraping is done.

A scrapes then in the direction of the passage of the leaf. It is to be feared that this may be a radical fault and a cause of non-success in the ulterior well-doing of the machine.

In all the machines previously described, it has always been pointed first by which the leaf has been presented ; then the latter was turned that the heel might be scraped. But as the starting-point of all the fibres is precisely in this heel, it follows that only the extremities of the fibres are first scraped, and that in turning the leaf round they are not all laid hold of, and that those which are not secured escape and are lost. If on the contrary the *heel* is first scraped, the extremities remain imprisoned in the pulp of the point and cannot escape, and all the fibres are certain of being seized upon at their source on turning the leaf round to scrape the point. This is an important improvement which has just been introduced into the manipulation, and which increases the return very sensibly. To arrive at this result it was necessary to modify the old machines which were not constructed so that the heel might be scraped first. The new machine is no other than the old pulley with T irons, with the difference that the latter has a diameter of 2 feet (fig. 7) ; the T irons being 2 inches, that gives an exterior diameter of 2 feet 4 inches. The speed is 500 revolutions per minute, which makes 3,658 feet per minute for the circumference. There are 18 T irons on the scraper; this number is essential, for the T irons must have the width they possess. With a different width the useful effect is no longer the same ; this is proved by experience. The drawing represents two of these scrapers mounted on the same axis, and a single governing pulley.

The advantage of this arrangement is to have three floors *A* which allow the shaft to turn round and to prevent shaking by means of a slight wearing-out of the bushes; besides, the wear and tear is less rapid. The drawing only shows one axis with its two scrapers, but it is only necessary to prolong the solid masonry and to lengthen the axis to have as many scrapers as are wanted. On each side of the scraper there is a piece of wood which extends in front. Between these two pieces is the catch which plays a considerable part in the new process. This catch is composed of a piece of wood *b* terminated by a piece of copper *a*; a screw, or, rather, two screws *v* allow the catch to be regulated, that is to say, to draw it from and towards the scraper, for the catch is supported by two T irons *c*. The regulation once established, this catch is firmly fixed, so as to avoid even the smallest oscillation; it is in this regulation that lies, if not the whole improvement, at least an essential part of it. The piece in copper is the chief point: here is an enlarged representation of it (fig. 6): it has 2½ inches of thickness and it is cut according to the shape *c a b d*; *c a* and *b d* are curves adopted by experience. *a b* is a straight piece of ¾ of an inch, which is the scraping surface. The edges *a* and *b* must be exactly parallel to the scraper, and as close as possible. If the width is too great the fibres are seized violently and broken, the leaf escapes from the hand which presents it; but if, on the contrary, the regulation is good, a child can present and withdraw a leaf without great effort and without breaking the fibres.

The improvement consists then :—

1st. In the small diameter of the scraper, which permits of it being made of cast-iron, whilst formerly it was of wood.

2nd. More precision in the taking up.

3rd. A catch having scarcely ⅝ of an inch of scraping surface instead of 4 inches as formerly, and made of hard cast-iron instead of soft wood.

4th. Finally, and above all, the possibility of scraping the heel of the leaf first.

It must be remarked that all these machines are built on the same principle, which is to scrape the leaf of the aloe with grooves by pressing it against a hard body, which is the "catch." The scraper acting *only on one side* cannot then scrape *but this one side*; it is in the backward movement of the leaf, and by the *pressure against the catch* that *the other side* is scraped. This is very crude.

All the experiments up to date have been carried on upon a certain plan of machine, none has had for its aim the scraping of the *two faces simultaneously*, at least no result in this direction is known.

The problem remains then for the experimentalists of the future.

REGIS DE CHAZAL,

Engineer of Arts and Manufactures.

[In view of the admitted imperfection of the machines, we have not reproduced the diagrams. There may be better appliances now employed in Mauritius, and there may be aid given to the extraction of fibre from aloe leaves by the result of the competition which has lately taken place in Paris, of machines calculated to dealwith stalks of rhea or ramie.—ED.]

ALL ABOUT DYE STUFFS, OILS; TANNING SUBSTANCES, FIBRES, STARCHES, CAOUTCHOUC, TOBACCO, DRUGS, &c.,

FOUND IN CEYLON.

(By the late Henry Meade, written some 40 years ago.)

DYE STUFFS.

THE coloring substances are very numerous, although many of them are scarcely worth the attention of the merchant, owing to local difficulties in the way of procuring them at a reasonable cost. The art of dyeing was, no doubt, once extensively practised by the Singhalese, but at present it is confined to the fixing of a yellow color on the robes of the priests and to the staining of mats. The dyers have not that command of tints, or that skill in blending them, which is possessed by the Hindus, and the result is, with very few exceptions, that the colored cloths worn by the people are imported from India. There is a small export of Chaya root to the Coast, but it decreases yearly in point both of extent and value.

At the head of the list of Dye Stuffs stands the *Roccella Tinctoria* and *Roccella Fuciformis*, the Orchella weed of commerce. This article was first exported by myself, in the beginning of 1859; it was found growing in great abundance at Calpentyn, and over a range of about fifty miles of the narrow strip of sand, which lies between the Calpentyn lake and the sea. Enormous filaments of the *Tinctoria*, some of them as much as eighteen inches in length, by three quarters of an inch in breadth, were found hanging in clusters on the decayed branches of the oldest mango trees, whilst the mimosas and several varieties of *Asclepiadeæ* furnished varieties of the *Fuciformis*, still more valuable. The Palmyra trees and Coconut trees were found to be thickly clothed with the lichen, except in those instances where they had been frequently climbed. There was scarcely a tree or bush that was not covered, more or less, with the Roccella, of the worth of which the people were wholly ignorant. It has now become a regular article of commerce.

Except on the tract of seaboard, stretching from Chilaw to Tangalle, the whole line of coast exhibits Roccellas, growing more or less luxuriantly, but always confined to a narrow belt of vegetation within the influence of the sea air. On the salt marshes of the western coast, and on the borders of the lagoons it is invariably found, and there is a large growth on the eastern side of the Peninsula at Trincomalie, and about the leways of Hambantotte. Where the roots are not torn off, it is reproduced yearly.

Though every variety of Roccella is well worth gathering, there are some kinds that are much more valuable than others; and the following simple test will enable anyone to ascertain the comparative richness of the coloring matter which they contain. Fill a bottle half-full of water, put as much of the lichen in, as will leave room to shake the contents of the bottle thoroughly, and add as much spirits of ammonia as will make the liquor unpleasantly pungent. Shake the bottle occasionally during six or seven days, opening it now and then to admit the air, and at the end of that time the water will exhibit a rich purple color, deepening in intensity for about a fortnight when the maceration is completed. A comparison of the result of different experiments will show the colorific value of the various kinds of weed, and the test is one that never fails. If a lichen fails to impart color to a mixture of ammonia and water it is not a dye stuff, whatever else it may be good for.

The Orchella dye requires no mordant. To fix the color on cloth it is merely necessary to pour the solution above described into boiling water, and immerse the wool or cotton to be dyed in it for half an hour. The dye is not a permanent one, but its extreme beauty will always make it acceptable to manufacturers, who use it to impart a finish to their goods. The value of the weed in the home market varies from £45 to £60 per ton. The latter price was obtained in July last for a shipment of the Ceylon article.*

* This was written about 40 years ago: the price of orchella weed is now from 20*s* to 30*s*, a cwt. The Export in 1888 from Ceylon was nearly 490 cwt.—Ed.

Cæsalpinia Sappan.—This very useful dyewood is to be obtained in considerable quantity over the southern parts of the island, and was at one time largely exported. In 1842 nearly 400 tons were shipped to the home market, but since then new fields of supply have been opened, and the trade in Ceylon Sapan is absolutely annihilated. It is procured more cheaply, and of equal if not superior quality, from Siam, Manilla and Japan. The local price here is £6 per ton, a rate which leaves a loss to the exporter. The coloring matter of Sapan is a rather weak red, but by adding lime to the solution or a quantity of Cassa leaves it is considerably strengthened. In a few years' time when the cessation of demand has allowed the growth of trees to be largely increased, it is probable that the Ceylon trade in Sapan may revive and assume its old proportions.*

Artocarpus Integrifolia.—The wood of the Jack, and especially the roots, furnish a lasting and good yellow dye which is materially improved by adding to the bath a limited quantity of the leaves of the Bombee. But though the article would always command a sale in the home market, it cannot be made to any extent an item of profitable export. The wood fetches a higher price for furniture uses than the merchant could afford to give for it, so that it is only the roots and the sawdust that can be considered of value for dyeing. During the last few years it has been cut down so abundantly, that

* The price of sapanwood is now £5 @ £8 per ton. The export in 1888 from Ceylon was 3,803 cwt. valued at R20,190.—Ed.

it will soon be necessary to search for the tree in more remote localities.

Vitex Trifoliata.—The Kaha or yellow Mililla yields a very delicate pure dye which the priests use chiefly for giving the required religious hue to their robes. It has been sent home and sold as Fustic, with which it seems to be identical in point of coloring matter. It is not used for furniture like Jack, but is much employed in buildings, and would be barely worth exporting as a dye stuff.

Oldenlandia Umbellata.—*Saya Vaya.*—This variety of Indian Madder grows wild on the western coast, especially in the Akerapatteo, where it is gathered, dried and exported to India. It gives out a dull but lasting red color, which local dyers know how to improve by the addition of about five per cent. of Cassa leaves. The price realized on the spot is 30s. per cwt., a rate far beyond its worth in the home market, so that the article never finds its way to England. Surprise has often been expressed that it has not been sent home in quantity, but the fact last mentioned furnishes the required explanation.

Lawsonia Inermis.—This sweet-smelling tree, the Maritonda of the Tamils and the Henna of the Arabs,* grows plentifully in the western and northern parts of the island. Its leaves are extensively used by the Mahomedan women to dye their nails red and their husbands are accustomed to employ it in staining the tails and manes of their horses. It might be made an article of considerable export.

* Populaly known as the "country mignonette," from the odour of the flowers.—Ed.

Memecylon Tinctorium.—The Gorakaha of the Singhalese and Cassa of the Tamils is to be found over the whole face of the country, and is a perfect substitute for Sumach, to which it is in reality superior both as a dyeing and tanning material. The leaves should be gathered and dried, in the nuts when they will turn yellow and emit the exact odour of Sumach. The annual import into England is about 14,000 tons, with an aggregate value of £150,000, so the article is one of very considerable importance. The young twigs may be gathered and ground up with the leaves for shipment.

Bixa Orellana.—The shrub which yields this useful dye is a favorite with Bhudist priests, and is usually found growing near their pansalas. The coloring matter* is contained in the casing of the seeds, and can be obtained in the simplest manner. It is only necessary to wash them until no more color can be obtained, and then carefully boil down the liquor to an extract. The seeds give out a very large proportion of color, and as the cake is worth over a shilling per lb., it would pay very well to prepare it. It is used to impart a rich orange tint to silk, and for giving a golden color to butter. It is sent from Brazil and Cayenne in the shape of square cakes weighing two or three lb. each wrapped in plantain leaves or in rolls, not exceeding two or three ounces. Exporters of such articles from new countries would do well to imitate as much as possible the prevailing style of packing and shipping, or their first venture is likely to be disregarded in the home market.

* The "arnotto" of commerce.—Ed.

The above are the principal Dye Stuffs in the island, but a thorough examination of its resources in this respect might bring many new articles to light. The leaves of the *Teak* tree make a tolerable red, and yellows of more or less intensity are furnished by several kinds of bark, and the wood of the *Acacia Catechu*, the fruit of the *Embryopteris Glutinifera* and the barks of the *Mangrove* and *Terminalia Alata* make excellent browns. An easy method of detecting the presence of coloring matter in any vegetable substance may be practised as follows:—Take a piece of wool, either cloth or yarn, with two per cent of its weight of alum, and an equal quantity, of bichromate of potash. Boil the wool for twenty minutes, then take it out, wash it in clean water, and hang it up in the shade to dry. It is now mordanted or ready to receive the dye, and it is only necessary to immerse it in boiling water again, with three or four times its weight of chips, bark or leaves, as the case may be, and in the course of half-an-hour the coloring matter, if it exist at all, will have been taken up by the cloth. There are some dyes which have a stronger affinity for Cotton, but the cases are rare in which they are not to be exhibited on wool. In such instances the cloth to be dyed must be worked about for half-an-hour in a decoction of Sumach or other astringent substance, and then repeatedly immersed in a cold infusion of the supposed dye, care being taken to dry it after each immersion. In this manner, at scarcely any expense and at small cost of labour, the existence of coloring matters may be easily ascertained. That point being settled, the rest is for the consideration of the merchant and the manufacturer.

OILS.

The climate and soil of Ceylon seems peculiarly favorable for the growth of oil seeds. It produces a great quantity of indigenous fatty substances, as well as a number of volatile oils. It is needless to say much upon the wellknown subject of coconut, the oil procured from which ranks first in the scale of importance. An acre of land under native cultivation will yield from forty to fifty nuts a tree annually, but in estates planted by Europeans, the average is not above ten to a tree.* The weight of the nut varies very much. In some cases but little more than 1,000 make up the candy of 560 lb., whilst again there are plantations where 1,500 are required. If 1,250 are assumed to be the average, then the European cultivator gets a candy from an acre and a half, whilst the native realises a ton from the same breadth of soil. The price of "copperah," as the kernel of the nut is termed, may be set down at 70*s* a candy or £2 7*s* per acre in the one case and over £9 in the other. † Seven and a half candies of copperah go to the production of a ton weight of oil, worth in the local market say £30 in the average.

The manufacture of coconut-oil is a very simple affair. The nuts are plucked every second

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* A strangely erroneous statement. The yield in the case of European plantations, unless in exceptionally unfavourable conditions, is by far the higher, and is only limited by the amount of culture and manuring bestowed on the trees.—Ed.

† Could such a contrast ever have been true?—Ed.

month in the dry season, and after being kept in a heap for a few days, the outer husk is taken off, the shell broken, and the kernel put out in the sun. Rain discolors it, but when carefully dried it will keep for months without injury. To convert it into oil by the native method, the copperah is cut into small pieces and put into the checko, which is a part of the trunk of a tree, sunk in the ground to the depth of some feet, and hollowed out for about 18 inches at the top. A beam twenty feet long is fitted into a groove at the bottom of the checko by a sort of a collar, and the pestle, a heavy piece of wood, is secured to the beam by a shifting contrivance. The machine is merely a druggist's mortar and pestle on a large scale, but rude as it is, it is so efficacious, that only a hydraulic machinery of the very best kind can extract more from the copperah. Nor is it really worth while to exert more pressure, as the oil cake is worth 25 per cent of the value of copperah, and if it is too dry it is proportionately less nutritious for the cattle. A full-sized checko will hold 56lb. of copperah, and it takes about two hours to exhaust a charge. The oil is sent to market very dull in color, and contains much more impurities than the article turned out by English machinery, but it commands almost if not quite as good a price and is produced at a cost which beats all competition. To beat the largest and best appointed machinery that can be established, it is merely necessary to multiply the number of checkos, and whether in the outlay in plant, or the expenses in working the native has it hollow. In the one case, deterioration alone costs ten per cent per annum, and whether it is profitable or not, all hands from engineer to stoker must be kept on pay as usual, whereas the native manufacturer under like as circumstances, literally loses nothing except the interest on the price of his checko. The bullocks and their driver are set to other tasks and all are ready to begin at oil-making again when the rates are once more favorable. The export of oil for the past year was 5,709 tons, and will increase yearly, since every day witnesses the planting out of new coconut gardens. There need be no fear of overproduction, for were the supply doubled it would find a ready market. The coconut is a mine of wealth to the inhabitants of Ceylon, and in time will no doubt be made to contribute to the resources of the state, as well as the prosperity of the people.*

Sesame Orientale.—Teel or Gingelly Oil.—This very useful oil, which is in great repute on the Continent, where it is used as a substitute for Olive oil, is cultivated to a considerable extent in the Anuradhapura district, and could be grown almost anywhere as a dry crop. There are three varieties—the black, white, and brown—the white being the most esteemed, but I have never met with it in Ceylon. The local demand, together with that for the India market, absorbs the whole of the supply, but if inquiry were made for it, in proper quarters, a surplus would soon be

* The export of coconut oil from Ceylon in 1888 was 364,116 cwt. valued at R4,531,223.—Ed.

created. The increase of Gingelly seed is sixty-fold, and the price on the spot about 2*s* 6*d* per bushel of 45 lb. at the commencement of the season.*

Cardole.—This is the oil contained in the pericarp or inter shell of the "Caju" nut, *Anacardium Occidentale.* It is of a deep black color, with a nauseous smell, and is extremely acrid, raising blisters almost immediately. Its properties are known in England, where it is much valued. The native method of extracting it is very effective, but too costly in a country where fuel costs little or nothing. The husks are put into a chatty, the mouth of which is covered with the net-like substance procured from the young coconut-tree, and an empty chatty being in like manner secured, the two are put into a hole in the ground, the full chatty being placed with the mouth downwards on the top of the empty one. Earth is then heaped over them, and a large fire kindled on the surface, which is kept up for a dozen hours or so, until every drop of oil has filtered into the lower vessel. Five thousand three hundred nuts gave nearly 8 lb. of oil in a recent experiment, and with a simple contrivance for removing the outer husk, and a less expensive method of making the oil, the manufacture might be made a source of much profit.

Ricinus Communis.—The castor-oil seed abounds throughout the country, many abandoned clearings being entirely covered with it, but it is only used to

* Gingelly poonac is largely imported from India. The Export from Ceylon of gingelly seed in 1888 was 14,050 ushels, valued at R32,800.—Ed.

produce a nearly black rancid oil, which is sold in the bazaars at a much higher price than the best refined oil would cost, imported from India. Over the vast extent of waste lands, there are numerous tracts where the seeds might be scattered towards the close of the rains, and as the tree requires no care, a highly profitable cultivation might be set on foot at a mere nominal outlay. Efficient machinery for extracting the oil would cost but little; and where the first expense was an object, a careful process of boiling would produce a pure and almost colorless oil, quite equal in quality. As castor oil, when the price falls in the home markets to £30 per ton, can be sold in any quantity for soap making, there need be no fear of an excess of production.*

Margosa.—Thousands of tons of this seed could be annually collected, growing as it does nearly in all parts of the island, but except at Jaffna where it is largely procurable in the North-East Monsoon, it is doubtful if more than a handful or two is gathered elsewhere, and that for merely local use. The oil is seldom to be had in the bazaars for less than a shilling a pound, and its use is confined merely to the treatment of sores and cutaneous affections. Medical men who have studied the properties of margosa oil assert that it is invaluable in cases of consumption, its curative effects being quite equal to those of Cod Liver Oil. The nauseous smell makes it an object of dislike to the owners of native

* Both castor oil and cake are imported from India, where the plant is largely cultivated. The price of castor-oil now is from 3d to 4½d per oz.—Ed.

mills, who refuse to make the oil, on the ground that it would be almost impossible to make their checkos or pug mills sweet again. As an article of export it can only be made to pay by the use of machinery which might be very advantageously employed in the manufacture.

Bassia Longifolia.—This seed, the *Mee* of the Singhalese, grows extensively in the districts of the Northern and Central Provinces, and is everywhere carefully collected and sold at rates which afford the villagers good profit. Its local uses are confined to burning in lamps, and the anointing of the body with the oil cake which softens the skin, and is thought to have medicinal value, but in commerce it is reckoned the first of the vegetable oils for the manufacture of soap. It is exported from Jaffna to some extent, but the demand for local consumption absorbs nearly the whole of the local supply.

Jatropha Curcas.—Caat Aamunak.—This small tree, which is universally planted as a hedge in the North-Western Province, produces in great abundance a nut which has powerful purgative properties. It makes an oil of a yellow colour, very pure and limpid, and could be made an article of considerable commercial value.

Molabodee.—The wild nutmeg yields to pressure and boiling a very pure description of vegetable butter, but it is not found in sufficient abundance to make it worth the attention of merchants.

Murunga.—The oil from the seeds of this tree is the very purest known. Watchmakers use it under the name of the *Oil of Ben*, but though it would always command a very high price in the home markets, and grows tolerably abundant, the use of the legumes, as a favorite article of food, will always hinder the seeds from becoming an article of export.

In India the flowers of the *Bassia Latifolia* are used to make an intoxicating drink, but in Ceylon the seeds only are occasionally used. The oil which they yield is of very good quality, and if the jungles were properly searched, a large quantity might be obtained.

Kòn.—The produce of the Ceylon Oak is a small seed yielding a light-colored oil, suitable for burning in lamps. The tree is not a very abundant one, but it gives a plentiful crop of seeds and would pay coolies well for collection.

Croton Tiglium.—Neervalum Cottay.—Qualities of Croton oil are well known, and as the tree requires no care to bring up, and the oil is worth on the average 3s per lb., no greater proof of the apathy of the Singhalese is needed than the statement of the fact that it is never exported raw from Ceylon. *

Caju.—The oil expressed from the Cashew nut is far superior in purity, color and sweetness of taste to the best Olive oil. The seed is procurable in large quantities in the Negombo and other districts, where it grows wild in the jungle and is widely cultivated as well. No oil has ever been made in the island, the kernels being considered a great delicacy by the people.

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* The price of croton seed now is from 15s. to 20s, per cwt.—Ed.

Serthia Indica.—Semmanathy.—This oil is procured by the destructive distillation of the Semmanathy or Aghib, the wood of which gives out a pleasant but faint perfume, and is sometimes taken for sandalwood. The odour is due, to the presence of the oil, which is said to have antiseptic qualities, and is doubtless worth a close examination. The tree which never grows to a large size, is found abundantly in the country lying between Chilaw and Calpentyn, and on the Eastern coast in the Batticaloa jungles.

TANNING SUBSTANCES.

Ceylon is peculiarly rich in it a materials suitable to the use of the tanner, and if the native leather dressers knew how to prepare skins properly, the export of tanned hides might make a good figure in the Customs returns. The barbarous custom of branding cattle renders the skins so treated of no value for the home market, but buffalo hides and deer skins are to be had in abundance, together with a certain proportion of clean hides, so that there is no want of raw material. The process of tanning is not very recondite, and a little attention paid to the improvement of native methods would be of great benefit to those concerned.

The barks of the *Rhizophora Mangle* (Kadol), *Cassia Auriculata* (Poonasarie), and *Anarcardium Occidentale* (Caju), are solely employed for tanning in Ceylon. The first-named contains the greatest proportion of tannin, but it would not find favor in England on account of the red color which it imparts to the hides. This objection, however, ought not to apply to any great extent, as there is a vast quantity of leather manufactured for purposes where the mere color of it is of no moment whatever. The Kadol or Mangrove grows in abundance on the banks of the creeks and swampy grounds in various parts of the island.

The *Cassia Auriculata* furnishes a light-colored tanning material, which if exported in quantity would command a ready sale. The same may be said of the *Anarcardium*, which however has a much smaller percentage of tannin, a disadvantage which is neutralised to a certain extent by the abundance of the tree, which covers a large extent of ground in the Southern and Western Provinces. In all cases where barks are collected for export, they should be boiled down to extracts, care being taken not to employ vessels made of iron in the operation. The new substance which I have been able to discover in the class of astringents as being of use to the tanner, are the *Memecylon Tinctorium* (Cassa leaf), the barks of *Careya Arborea* (Kahata), *Terminalia Alata* (Kumbuk), and the *Cathartocarpus Fistula* (Siniconda). The first-named article tans skin rapidly, producing a light yellow color, with considerable bloom upon it. The *Careya Arborea* which forms jungles in many parts of the Central Province and elsewhere contains more tannin even than *Cathartocarpus* which yields above half its weight of astringent matter. When converted into an extract, it falls into powder, which is not the case with the *Terminalia*, which forms a solid coherent substance and will doubtless find favor in the tanyards. It abounds on the banks of streams in the North-Western Province, and attains the greatest size of all the timber trees in the island. The whole of the articles mentioned in this paragraph are of much importance in a commercial point of view, and are to be had in any quantity.

The *Acacia Catechu* is of course well known as affording the famous Pegu "Cutch," but its existence in Ceylon was wholly unsuspected until November last, when I found it in a jungle at the southern end of Patchilapallai in the Jaffna district. I could never discover that it extended beyond a patch of four or five miles in extent, and Mr. Dyke, whose acquaintance with the *Flora* of his district may be considered almost perfect, had never met with it elsewhere. The presumption, however, is that a diligent search would be more successful, and in that case the inhabitants of the northern portions of the Peninsula would find it to their interest to prepare the Cutch for local consumption, bringing as it does a high price in the bazaars. There is no skill required in the way of manufacture. The tree must be cut down and converted into chips, which are boiled for many hours in earthern vessels. A second boiling of the wood follows, and the two waters are then mixed and boiled down to an extract, which is poured into moulds and left to dry slowly. Cutch, which is often mistaken for Gambier or Terra Japonica, is always worth about 30 per cent more in the home market, and contains in its purest state 53 per cent of tan.

The *Embryopteris Glutinifera*, Timbiri of the Singhalese, has never been employed to convert skin into leather, but it is universally employed to tan fishermen's nets, and the gum which exudes from it contains no less than 70 per cent of tannin, the largest proportion known to exist in any vegetable substance. It contains an oil, a gum and a brown dye, and growing as the tree does in inexhaustible profusion, the extract made from it would be a source of abundant profit.

To ascertain the existence of tannic acid in any vegetable material, the best mode to adopt is to take a piece of thin skin, and having carefully cleaned and weighed it, to steep it in an infusion of the article under experiment and apply a gentle heat. Perhaps in the course of a few hours the tannin will have penetrated through all the pores of the skin and converted it into leather, when it is only necessary to dry it, and on weighing it a second time, the increase of specific gravity will be the measure of the amount of tannin absorbed. A quicker method than the above is within reach of those who have chemicals at hand :—Make an infusion of the supposed tanning material and add a few grains of sulphate of quinine. Pour a few drops of sulphuric acid, when the tannin will fall to the bottom in the form of a grey precipitate. To get a knowledge of the comparative amount of tannin, evaporate the solution of the material to dryness and weigh the grey precipitate against that formed by an equal quantity of Cutch, "the Cashcuttie" of the bazaars. If it nearly approaches the outturn of the latter, it may be relied upon as worth further notice and investigation.

FIBRES.

Almost every known kind of fibre flourishes in the island, the *Urtica Nivea* or Rheea perhaps excepted. The soil and climate are peculiarly fitted for their growth, so that if the experiments for utilising those valuable substances can ever succeed, Ceylon affords the best chance of achieving such a result. With an increase of population it might be made to produce cotton largely of an excellent quality.

Cotton has always been raised in the island to a certain extent, but at one time it formed the chief staple of the Jaffna Peninsula which is well suited for its growth, as there are several months in the year during which no rain falls, and the work of picking can be carried on without loss or difficulty. It is still grown in chenas in the Anarajapoora district, but only for local consumption, neither the quality nor the quantity of it offering any inducement to extend the cultivation. In no place is it sown regularly; a handful of seed is thrown broadcast over the clearing together with one or other of the pulses, and the cotton comes up like a weed. It is difficult under such circumstances to form an idea of the yield per acre, but it does not exceed five of clean cotton. It is not therefore a favorite culture. Gingelly seed which is always saleable at paying rates, is preferred to it in the majority of instances, and in Jaffna the people mainly devote themselves to the cultivation of tobacco, and could scarcely be pursuaded to abandon it in favor of cotton. For the reason hinted at above, cotton cannot be expected to flourish in the Central and Western Provinces. Heavy showers of rain would interfere sadly with the picking, and these may fall at any season of the year. But there are districts where this grave objection does not apply. We owe our knowledge of its capabilities in this respect entirely to Mr. T. Power, Assistant Government Agent at Ratnapoora, who writes on this subject as follows:—

"The cotton I send is from Native seed and also from Sea Island. The garden is thriving magnificently; nothing could look better than the plants and pods. The climate here appears quite the thing for cotton,* and my plants are now giving their third crop within the year."

If a supply of labour could at all times be depended upon, there is little doubt that the tract of country described by Mr. Power might be made eminently productive as a cotton tract, but unless it pays better than other crops, the resident cultivators will not grow it, and there is always that difficulty in the distance. By the aid of bounties or the influence of headmen, a cultivation can be got up of any kind of produce, but upon a large scale no crops will be raised except those which are most profitable. A few model farms established in vario s parts of the island and cultivated after a fashion which could be imitated by the bulk of the population might be successful in inducing an extended growth of cotton, but nothing should be done by the European which the Singhalese could not easily follow. It is not likely that Ceylon will ever be a great cotton growing country, but it may by judicious

* The climate of Ratnapura is one of the rainiest in the island.—Ed.

management be made to export a considerable amount of it.*

A far more hopeful prospect exists with reference to wild fibrous plants, such as the *Sanseviera Zeylanica*, Niyanda of the Singhalese and Marool of the Tamil, the Aloe, Agave, Pineapple, Plantain and *Asclepia Gigantea*. There are literally millions of tons of these plants scattered over the face of the island. They grow in any soil, the sand or the swamp seems to afford equal nutriment to them, and if one cared to make a plantation of them, a limitless supply of fibre could be obtained. But the draw-back to the production of these exquisite threads have hitherto been such as to render their existence of no practical value except to the fishermen and the villagers who require the occasional use of twine and rope. The labour needful to extract the fibres is nothing of course to these persons, so far as the supply of their own wants is concerned, but if they are employed in the work at daily wages, or asked to furnish fibres to the merchant, the cost of production is out of all proportion to the value of the articles. It would take ten hours of persevering labour to enable a man to make 8 ounces of fibre, which if he were paid only 6d. per day would thus cost in the village nearly £60 per ton. In no part of the East, however densely populated, could fibres be prepared and sold at a profit in the only way that hand labour can turn them out fit for the weaver's loom, for if we halve the rate of wages, the

* The establishment of a cotton mill at Colombo alters the conditions wholly. The export from Ceylon of Cotton wool in 1888 is given as 2,320 cwt., valued at R56,919.—Ed.

cost would still be too dear. By adopting the retting process, as it is termed, steeping the fibres in water, and letting them remain submerged till the pulpy substance is quite decomposed, a large quantity of fibre can be beaten out in a day, but it is harsh and woody, and would have to be submitted to chemical processes before it could possibly be made fit for conversion into cloth. As material for cordage and manufacture of paper, fibres prepared in this way, lose but little of their utility.

It must always be borne in mind that in estimating the value of fibres as textile material the quantity to be obtained is the first matter for consideration. Small parcels are literally worthless, except as objects of curiosity. Weaving is done universally by machinery, and you cannot work up a new fibre with the machines that have been contrived for those in common use. The first inquiry which the manufacturer would make on being shewn a sample of it would be as to the prospects of an abundant supply. If he saw his way clear in this respect, he might feel inclined to alter his machinery to suit it, but not otherwise. It is only as paper material that small exports could be made available. At least hundreds of tons must go forward of any material meant to be woven in order to make it saleable at its true value, and as yet there are no signs of such a result in the case of succulent plants as those are termed, the fibres of which form the body instead of the bark. The reason will be readily comprehended when we state that the average weight of fibres derived from the plantain and *Sanseviera* is but 4 per cent. An ordinary plantain tree yields about 40 ounces of fibre, so that it would take forty-five trees to furnish a cwt. The labour involved in cutting and transporting this vast quantity of useless material is so great, that it renders even machinery worked by steam of no practical value, except under very peculiar circumstances. It would require nearly two acres to give a ton of fibre at one cutting and the manipulation of a thousand trees, and nowhere do we find such tracts of the plants growing wild as would supply a factory. A cultivation of the Marool on a scientific system, the fibres being extracted by Benke's machines would yield magnificent results. The Marool fibres obtained from the fresh plant are scarcely inferior to silk in beauty and softness, and would command very high prices. So would those of the Pineapple, and also there can be no question as to the quantity of fibre that could be grown, and the permanence of the demand for it, if it could be had to any amount. The sole problem to be solved is the invention of a cheap and efficient method of extracting the fibre. If a simple machine can be found, that is within the reach of village skill to construct it, and present means to buy it, there is no saying to what extent fibres may not be ultimately forthcoming. Every village hut is overshadowed with its plantain tree, and if that can be turned to account for fibre, as well as fruit, the relief to the cotton market would be of the greatest possible value. I have reason to believe that a French invention which was rewarded with a prize at the Exposition in Paris, will supply what is wanted and shall be able to test its usefulness, the result of the experiment shall be duly communicated to the Committee.

The *Coccinium Frustratum* (beniwelle) is a creeper which grows in vast abundance in the Western and Central Provinces, is an excellent febrifuge, and was warmly recommended as such by the late Dr. Elliott. As a bitter tonic it is serviceable and pleasant, and could be converted into an extract for the smallest trifle of cost. But there are so many medicinal substances worth enquiry and analysis, that it is idle to attempt to enumerate them. Were the Government to engage a competent person to report upon them, they would do great service to the colony, and perhaps even to mankind at large.

THE FIBRE INDUSTRY.

RAMIE OR RHEA.

(*Boehmeria nivea*, Hk. & Arn. *Boehmeria nivea*, var. *tenacissima*, Gaud.)

Readers of the *Kew Bulletin* will have noticed that considerable attention has been devoted in its pages to the subject of the present note. The previous history of Ramie or Rhea, and of the various efforts that have been made in recent years to render its valuable fibre available for commercial enterprise, have been already fully summarised (*Kew Bulletin*, 1888, pp. 145-149; pp. 273-280; and pp. 297-298). During the present year interest in Ramie appears to have become more and more general, and judging by the correspondence addressed to this establishment the subject is followed with keen interest at home as well as in India and the Colonies.

In connexion with the Paris *Exposition Universelle*, 1889, a special series of trials was held of machines and processes for decorticating Ramie (Exposition.

Universelle: Essais spéciaux de machines et appareils pour la décortication de la Ramie), and at the request of the India Office, and in continuation of similar action taken last year, Mr. D. Morris, F.L.S., the Assistant Director, was appointed to represent this country and to prepare a report of the results. This report, with the permission of the Secretary of State for India, is reproduced below:—

Royal Gardens, Kew, October 26, 1889.

A series of interesting trials of machines and processes designed for the decortication of Ramie was held by the French Minister of Agriculture at Paris in 1888, and a report on the subject, which I had the honour to prepare for the information of the Secretary of State for India in Council, was published in the *Kew Bulletin*, 1888, pp. 273–280.

These trials were resumed this year as an integral part of the *Concours spéciaux des instruments agricoles* of the Exposition Universelle, and opened on the 23rd September last. The jury consisted for the most part of the members of the Commission of 1888. The attendance of foreign representatives was considerably larger than in 1888, and the greatest interest was manifested in the proceedings by a large concourse of visitors.

The machines and processes this year were confined to those which had been shown as a regular part of the general exhibition. As will be seen later, all the competitors were French, and this in spite of the fact that more than a dozen machines and processes have lately been designed in this country, which are now in course of being carefully tested.

In my previous report it was pointed out that amongst the French there was attached an importance beyond their value to machines for cleaning Ramie in the dry state. I ventured to express the opinion (p. 278), that as regards India and our own Colonies it was essential that Ramie machines and processes should be competent to deal successfully with the green stems and not the dry; and that until this end was gained Ramie fibre would, I feared, continue to remain unavailable for commercial enterprise. At the recent trials this was all changed. It was a noticeable feature throughout the proceedings this year that no importance whatever was attached to the decortication of dry Ramie stems. The trials were entirely confined to results obtainable with green stems, and in order to make them still more applicable to field operations some of the stems were supplied freshly cut with leaves and some without leaves.

The following six machines and one process were submitted to the jury:—

1. E. Armand—Paul Barbier, 46, Boulevard Richard-Lenoir, Paris.

2. P. A. Favier—Société la Ramie Française—14, Rue Saint-Fiacre, Paris [for treatment of dry Ramie stems].

3. P. A. Favier—Société la Ramie Française—14, Rue Saint-Fiacre, Paris [for treatment of green Ramie stems].

4. Norbert de Landtsheer, 2, Place des Batignolles, Paris [large machine].

5. Norbert de Landtsheer, 2, Place des Batignolles, Paris [small machine].

6. Félicien Michotte, 43, Rue de Saintonge, Paris.

7. Ch. Crozat de Fleury et A. Moriceau, Villiers-le-Bel, Seine-et-Oise [process for the treatment of green Ramie stems in the field].

BARBIER MACHINE.

The machine of M. E. Armand, constructed by Barbier, and more generally known as the Barbier machine, was in every respect the same as that tried in 1888, and described in my previous report. It is constructed to be worked by hand or by steam power. It weighs 625 kilos., and the price is 48*l.* The construction of the machine is comparatively simple, and consists of a number of cylinders and beaters with a reverse action attached. This latter allows the stalks to be withdrawn when about five-sevenths cleaned, and of the other ends being put in to complete the operation. The disadvantage of this method, as regards time and output of ribbons, is more fully discussed under the De Landtsheer (small) machine. During the trials this machine caused a considerable loss of fibre, carried away with the pith and wood. In the first trials 10 kilos. of green stems without leaves were passed through the machine in six minutes. The result was 1·300 kilos. of wet ribbons of fair quality. This would be at the rate of 130 kilos of wet ribbons per day of 10 hours; or of 96 pounds (avoir.) of dry ribbons for the same period.

In the second trials 24 kilos. of stems with leaves were put through the machine in 10½ minutes. The result was 1·200 kilos. of wet ribbons of moderate quality. This would be at the rate of 68·500 kilos. of wet ribbons per day of 10 hours; or of 50 pounds (avoir.) of dry ribbons for the same period.

Taking into consideration the cost of this machine and the power necessary to drive it, the outturn of ribbons is much too small to prove remunerative, and the machine in its present form is useless. Better results than these have been obtained by decorticating Ramie by hand.

Favier Machine.

Two machines were shown by M P. A. Favier whose name is well known in connexion with the

Ramie industry. Machine No. 1 was designed for the decortication of green Ramie stems, while Machine No. 3 was designed for the treatment of dry stems. In this report the remarks apply only to Machine No. 1. This machine was 2 m. long, 50 cm. broad, and weighed 800 kilos. The price was not stated. It required three-quarter horse power to drive it, and two persons to feed and receive the ribbons. The machine is adapted to be worked by four persons, but at the trials, owing to want of space, it was worked with only two persons. M. Favier stated that it was designed to produce ribbons entirely free from wood and pith, ready to be converted by a chemical process, also by the same inventor, into the finest filasse ready for weaving. In outward appearance the machine was a long narrow iron box furnished with numerous small cylindrical crushers and beaters. These were entirely covered by a number of movable iron sheets, which both protected the intricate system of cylinders and prevented the escape of dust and *débris*. The feeding apparatus consisted of a long narrow trough, in which the stems were arranged in lots of four to six and fed to the machine at two apertures leading to the rollers. The first pair of rollers was furnished with fine corrugations to grasp the stems and pass them on to a somewhat complicated system of crushers and beaters. The ribbons passed continuously through the machine, and were ultimately delivered into the hands of a workman at the other and perfectly free from wood and pith. In the first series of trials 10 kilos. of green stems without leaves were passed through the machine in 4½ minutes. Once or twice some of the ribbons were caught in the rollers and the machine had to be stopped. The time occupied in these stoppages was not counted. The wet ribbons yielded by 10 kilos, of stems weighed 2·820 kilos. This would be at the rate of 376 kilos. of wet ribbons per day of 10 hours; or, 276 pounds (avoir.) of dry ribbons for the same period. In the second series stems, more or less with leaves, weighing 60·350 kilos were passed through the machine in 18 minutes. The yielded 18·100 kilos. of wet ribbons. This would be at the rate of 603 kilos. of wet ribbons per day of 10 hours; or 443 pounds (avoir.) of dry ribbons for the same period.

The ribbons in both cases were well cleaned. There appeared to be no waste. The *débris* under the machine consisted almost entirely of wood and pith.

These results I regard on the whole as satisfactory.

The somewhat intricate character of the various parts of this machine would be against its general use by planters in the Colonies, but there can be but little doubt it is a great advance on most other Ramie machines now available. It might, however, be adapted for use in central factories or *usines* where skilled labour would be obtainable, and for this and similar purposes the Favier machine may be recommended.

MICHOTTE MACHINE.

The Michotte Machine, called "La Française," at first glance resembled the Barbier and De Landtsheer (small) machines. It was driven by steam power, and consisted of a pair of large rollers, each furnished with helicoidal grooves running their whole length. The large rollers first crushed the green stems and then passed them on to beaters with movable bars intended to get rid of the wood and pith. In the first trials, 7 kilos. of green stems were passed through the machine in 1½ minutes, yielding 1 kilo. of badly cleaned ribbons. In the second trial 17,400 kilos. were passed through in 2½ minutes, yielding 6 kilos. of similar ribbons. In both cases the ribbons were mixed with crushed and mangled stems, full of wood and pith. The fibres were also cut transversely (probably by the helicoidal grooves) and rendered useless.

This machine in its present state possesses no merit whatever. It is difficult to realise under what circumstances it could have been entered for trial.

DE LANDTSHEER MACHINES.

M. de Landtsheer exhibited two machines. The small machine was very similar to that exhibited by him in 1888, but meanwhile it had received some slight modifications intended to accelerate its movements. It was driven by steam-power and required two men to attend to it. It had a horizontal feed plate, and consisted of a series of rollers and beaters which received eight or ten stems at a time. These were cleaned for about five-sevenths of their length, and by a reverse action (operated by a long handle pushed by the workman) they were then withdrawn and the other ends put in and cleaned. It will be noticed that each lot of items, under this arrangement, had to be presented twice to the machine before they were cleaned. This involved a considerable loss of time and reduced the daily outturn of ribbons. In the Favier machine, as also in the De Landtsheer large machine, this difficulty has in a great measure been overcome. The De Landtsheer small machine was used for green stems in the second trials only. In these 24·400 kilos. of stem, with leaves, were passed through the machine in 10 minutes. The yield was 6·500 kilos. of wet ribbons of good quality. This would be at the rate of 390 kilos. of wet ribbons per day of 10 hours; or 286 pounds (avoir.) of dry ribbons for the same period.

In the first trials this machine was used by de Landtsheer to complete the cleaning of ribbons previously passed through the large machine. In this instance 15 kilos. of partially cleaned and wet ribbons were passed through the machine in 6¾ minutes. The yield was 10,500 kilos. of excellent fibre worth, according to the opinion of experts, about 70 to 80 centimes per kilo.

The large machine of M. de Landtsheer, like the Favier machines, had a continuous movement by means of which the stalks passed through the machine, without withdrawal, and the ribbons were delivered at the other end ready for drying. This is an important point gained. Indeed, this was the principal improvement noticed in the machines presented at the Paris trials of 1889, and in all in which it had been adopted there was a marked increase in the outturn of ribbons. M. de Landtsheer's large machine consists of two pairs of cylinders. The first pair is furnished with grooves opposite one another, while the second have the grooves alternate. Beyond these are two sets of beaters (batteurs à ailettes) which break and get rid of the wood and pith and deliver the ribbons on a revolving stage placed beneath, whence they are quickly picked up by a workman and laid on one side. The particulars of weight and price of this new machine were not obtainable. It was driven by a two-horsepower engine and required two men to feed it and remove the ribbons.

In the first trial 36 kilos. of stem without leaves were passed through the machine in 2½ minutes. They yielded 10 kilos. of wet ribbons, but these ribbons had a considerable quantity of pith and wood lightly adhering to them, and in one instance the amount of wood and pith probably reached 20 to 25 per cent. of the gross weight. Taking the yield of wet ribbons as they left the machine, the 10 kilos. above mentioned would be at the rate of 2,400 kilos. of ribbons per day of 10 hours; or of 1,763 pounds (avoir.) of dry ribbons for the same period. Even allowing for the presence of pith and wood, which, when dry, might be removed by a light shaking or scutching, it is evident that this machine will prepare more than half a ton of dry ribbons per day. It is not at all impropable that M. de Landtsheer will be able to effect some further improvement in this machine. In any case the machine is worthy the attention of planters, who with a single instrument could work off about 50 tons of green stems per week. This is an exceptionally good result, and it serves to show what progress has now been made in perfecting machines for treating the Ramie plant on a commercial scale.

In the second trials 46 kilos. of stems with leaves were put through the machine in 11½ minutes. The result was 15 kilos. of wet ribbons (with particles of wood and pith adhering to them as before.) This would be at the rate of 783 kilos. of wet ribbons per day of 10 hours; or of 575 pounds (avoir.) of dry ribbons in the same period. There is a considerable difference between the results obtained by this machine in the first and second trials. This was also noticeable in the Barbier machine. The construction of these machines evidently does not enable them to cope with stems with leaves attached. On the other hand the Favier machine did better with stems with leaves than those without leaves. This, however, is not a matter of great importance. In the field the leaves could be easily detached during the cutting; and if not removed then, they would fall off of their own accord after lying in a heap (inducing a slight fermentation) for a few hours.

FLEURY-MORICEAU PROCESS.

Only one process was shown. This was singularly simple, and consisted of steeping the fresh (or dry) stems for a short period in boiling water and removing the ribbons by hand. An open galvanised tank about 6 feet long, 2 feet wide, and about 4 feet deep, filled with water, was raised on bricks (or stones) about 18 inches from the ground over an open fire. When the water had reached boiling point a crate containing 50 to 100 fresh stems was lowered into it (and depending on their age and character) left in it for 5 or 15 minutes. At the end of that time the crate was lifted out, the stems left to drain while another lot was put in. The stems already steeped were then taken up by a couple of workmen and quickly and effectually cleaned by hand. The action of the boiling water had apparently thoroughly loosened the attachment of the cortex to the wood, and ribbons were produced perfectly clean and regular and apparently without any loss of fibre.

This method was tested in the first trials only. The operation began by placing 18 kilos. of fresh stems in boiling water and allowing them to remain there for 10 minutes. In 36 minutes (or in 46 minutes including the time occupied in immersing the stems) the workmen, apparently not specially trained in the work, produced 5·600 kilos. of excellent ribbons. This would be at the rate of 73 kilos. of wet ribbons per day of 10 hours; or of 161 pounds (avoir.) of dry ribbons for the same period.

This process, it will be noticed, is of the simplest possible description. The only apparatus necessary is a tank. This tank could easily be moved from place to place in the field, and the wood of the stems after the ribbons are removed would probably furnish most of the fuel necessary. The process can, however, only be utilised in a few special countries where labour is very cheap.

M. Cromat states that ribbons produced by this process can be dried, baled, and delivered ready for shipment at a cost not exceeding 8 to 10 centimes per kilo. (about 85 shillings per ton). In Tonkin it could be done for even less than this.

It will be noticed that the Fleury-Moriceau prosess follows somewhat on similar lines to that of the Favier process of 1882. In this latter the stems were steamed for some time in a close fitting cylinder. The former is, however, much simpler, and requires absolutely no skilled labour, nor any plant except an open tank, large or small, according to the circumstances of the grower.

The inventors of the Fleury-Moriceau process are evidently of opinion that wherever cheap labour is obtainable it is in every way preferable, in the production of Ramie ribbons, to the best machine. After all, placing the Ramie stems in boiling water is only a modification of the old retting process practised so long by the Chinese, and by means of which probably the China grass of commerce is still produced. In any case the Fleury-Moriceau process deserves to be carefully considered, and especially in its applicability to the circumstances of India. There the ryots might grow Ramie in small areas, prepare the ribbons and sell them to merchants for export, or to a neighbouring factory or *usine.* The steaming process of M. Favier, designed for use under similar circumstances, failed no doubt on account of the restrictions placed on the use of the patent, and the uncertainty of the demand for ribbons, The Fleury-Moriceau process re-opens the question under circumstances much more favourable, and the subject is one which deserves careful consideration wherever labour is sufficiently abundant to permit of ribbons being produced at a price that will complete with machine-cleaned ribbons.

The relative value of the several machines, and of the Fleury-Moriceau process, tried at Paris in 1889. may be gathered from the following tables:—

TABLE 1.—FIRST SERIES OF TRIALS:—Green stems without leaves:

Machine.	No. of Hands employed.	Weight of Green Stems. (Kilos.)	Time employed.	Quantity of wet Ribbons produced. (Kilos.)	Estimated Quantity of *Dry* Ribbons producible in a day of 10 hours (pounds Avoir.).*
Armand-Barbier ...	2	10	6 m.	1·300	96
Favier (No. 1) ...	2	10	4½ m.	2·820	276
Michotte	2	7	1½ m.	1·000	—
De Landtsheer (large machine).	2	36	2½ m.	10·000	1,763†
Fleury-Moriceau process...	2	18	46 m.	5·600	161

* In preparing this estimate the wet ribbons are calculated to yield one-third of their weight of dry ribbons, and the kilo. is taken as equivalent to 2·204 pounds avoir.

† This large yield of ribbons must be reduced about 20 per cent. on account of the pith and wood lightly adhering to them.

TABLE 2.—SECOND SERIES of TRIALS. Green stems, with leaves.

Machine.	No. of Hands employed.	Weight of Green Stems. (Kilos.)	Time employed.	Quantity of wet Ribbons produced. (Kilos.)	Estimated Quantity of *Dry* Ribbons producible in a day of 10 hours (pounds Avoir.).
Armand-Barbier ...	2	26	10½ m.	1·200	50
Favier (No. 1) ...	2	60·350	18 m.	18·100	443
Michotte	2	17·400	2½ m.	6·000	—
De Landtsheer:					
(*a*) Large machine	2	46	11½ m.	15·000	575
(*b*) Small machine	1	24·400	10 m.	6·500	287

AWARDS OF THE JURY.

As was the case last year, the official report of the jury will probably not be published till the appearance of the December number of the *Bulletin de l'Agriculture*. In the meantime it may be mentioned that the jury, following the rules applicable to the other exhibits at the Exposition Universelle, awarded a gold medal to M. Favier; a gold medal to M. de Landtsheer; and a silver medal to MM. Fleury-Moriceau. These awards, it will be noticed, follow closely the results already detailed above, and they may be accepted as affording a clear indication of the relative value of the several machines and processes submitted to the jury.

To those generally interested in Ramie culture it may be mentioned that the trials of 1889 have proved much more favourable than those of 1888, and the subject is evidently ripening for solution in many directions not thought of before.

This can be best shown by a comparsion of the results as follows:—

TABLE 3.—RESULTS obtained in 1889 compared with those obtained in 1888.

Machine.	Quantity of Dry Ribbons producible in a day of 10 hours (pounds Avoir.) working on Green stems 1888.	1889.
De Landtsheer:		
Large machine	—	1,763*
Small machine	120	287
Barbier	71	96
Favier, No. 1	—	443
Fleury-Moriceau	—	161

It will be noticed that the best results obtained in 1888 were at the rate of 120 pounds of dry ribbons per day of 10 hours. This was with the De Landtsheer small machine. In 1889 this machine with improvements, produced at the rate of 287 pounds of dry ribbons (more than double the quantity) for the same period. With the large machine (make due allowance for the pith and wood lightly adhering to the wet ribbons) the returns of dry ribbons would be at the rate of over half a ton per day.

OTHER MACHINES AND PROCESSES.

Before closing this report it is desirable to pass under review a few of the machines and processes not represented at Paris which have recently come

* See note in Table 1.

into notice in this country and elsewhere. In the absence of carefully arranged public trials under the control of men thoroughly conversant with the subject, it must be understood that it is impossible to express an authoritative opinion as to the merits of such machines and processes. They are noticed here solely for the purpose of furnishing a more or less complete record of Ramie experiments which have been undertaken during the present year, and of affording information that otherwise would not be available to persons interested in the subject in India and the Colonies.

THE DOTY SYSTEM.

A system brought forward by Captain Doty (inventor of the Doty light) is based on the assumption that no decorticating machine, however meritorious, will fully meet the requirements of Ramie planters, who are obliged, with the aid of unskilled labour, to deal with a large quantity of green Ramie stems within a short time. Captain Doty is of opinion that where labour is cheap women and children might be employed to strip the fibre from the freshly cut stems by hand, and leave 80 per cent. of the weight of the crop (the wood) on the field. Under such circumstances the ribbons alone would be carried away, either to be dried for exportation or to be treated at central factories or *usines*, firstly by a process of fermentation, and subsequently by chemical cleaning and washing to produce filasse ready for spinning.

"Nothwithstanding," says Captain Doty, "the failures of all previous attempts to deal with this fibre by fermentation it is almost self-evident that a fermentive treatment is the only possible solution of the problem. No mechanical process that can be devised will ever eliminate the gum by which the fibres are cemented together, and without the elimination of the gum the division and sub-division of the fibres necessary to produce a delicate filasse can never be obtained."

A trial of the Doty system recently took place near Rome, and a report thereon was prepared by Signor G. Trombetta, Secretary to the Italian Ministry of Agriculture, and published in the *Bolletino di Notizie Commerciale*, Sept. 1st, 1889, pp. 689-690. In this report it is stated that the system is based on the disintegration to which the gummy substance in the Ramie ribbons is exposed by an acid fermentation. The ribbons are first of all tied up in bundles and placed in fermenting vats, where they remain for about a week. They are then taken out and washed. Afterwards they are boiled with certain chemical ingredients for two hours, washed in cold water, and dried and combed. The report concludes by stating that the fibre was in some cases of unequal character as regards colour and quality, due to the provisional nature of the appliances used; but the results obtained on a small scale gave hopes that with larger quantities and suitable boiling vessels properly closed, and with proper machinery to agitate the mass, the fibre would be obtained in a more satisfactory condition.

The Till Machine.

As far as can be gathered from a description privately communicated by the inventor (Mr. C. G. Till) this is a large machine, weighing nearly two tons, driven by steam-power, and costing about 150*l.* It is furnished with rollers and beaters, about 3 feet long; it has a continuous action, similar to the Favier and De Landtsheer (large) machine, and takes about

36 stems of green or dry Ramie at a time. It has not yet been fully tested for the outturn of ribbons, but the inventor estimates that it will clean between half-a-ton and a ton per day.

PAPLEUX SYSTEM.

In consequence of letters which appeared in the *Melbourne Argus* at the time of the Centennial Exposition held at Melbourne, inquiries were addressed to Kew respecting the Papleux system for cleaning Ramie.

This system was at one time in operation by Messrs. W. H. Spencer & Co., of Hitchin, Herts, but is now abandoned. Recent experiments have been carried on with a formula invented by Messrs. Spencer themselves, and by means of this they have been successful in preparing small samples of fibre of excellent quality. It is probable that Messrs. W. H. Spencer & Co. will eventually be able to treat Ramie ribbons on a large scale and convert them by mechanical means into filasse or finished yarns. It is understood, however, that at present the process is not available to the public.

PLAISIER MACHINE.

A machine, the invention of a Dutch engineer named Plaisier, is the subject of an extended notice in *de Indische Mercuur* of the 19th January 1889, by Van Gorkom. This machine, driven by an engine of 1½ horse-power, has been successfully worked at Deli, in Sumatra, for some months, and it is stated to treat 5,000 kilos. of green stems per day, yielding 125 to 150 kilos. of ribbons.

GENERAL REMARKS.

In the Diplomatic and Consular Reports, Series 1889 (p. 37), there is given an account of an experimental planting of Ramie at a Colony in the Province of Santa Catharina, Brazil. This Colony obtained the first prize for a collection of Ramie fibres at the Antwerp Exhibition.

In the same Reports, No. 525, on the trade of Hankow, attention is drawn to the facilities which exist there for procuring and manipulating Rhea fibre on a large scale. The Consul adds, "it would give me much pleasure to know that a good business in this article could be started here. But until machinery for preparing it is perfected, exports would be premature."

On the 23rd August last a despatch was forwarded by the Foreign Office from the Acting Consul at Caracas, dated the 25th July 1889, giving an account of the formation of an Italo-Venezuelan Company to plant Ramie on a large scale. Experimental plantations had already proved so successful that machinery had been imported to begin the operation of preparing the fibre.

As described in the *Kew Bulletin*, 1888, pp. 145-149, a Ramie factory established in Spain, at Torroella de Montgri, Gerona, in the neighbourhood of large Ramie plantations, appear to have proved successful. This factory employed the Favier decorticating machines. In a letter dated the 19th October 1889, Mr. Wooldridge, Her Britannic Majesty's Consul at Barcelona, informs me that "Ramie is still being cultivated with important results near Torroella, and that they continue to use the Favier machines, which are believed to be the most perfect machines ef their kind."

It may be mentioned that these factories are being worked privately, and probably the methods and machinery are not available to the public, except under a special arrangement with M. Favier. The fibre prepared is utilised in France, and does not come into general commerce.

In British tropical possessions, both in the East and West Indies, Ramie is being grown experimentally in the hope that some machine or process will eventually be produced to enable the fibre to enter into commerce and become a regular article of trade.

The results of the Paris trials last year naturally discouraged Ramie growers, and little if any extension of Ramie planting has taken place since that time. The results of the recent trials will no doubt be closely scanned by those interested in the subject. The first aim of planters should be to produce ribbons of good quality at the lowest possible cost. In other words, planters have to solve the question how to produce Ramie ribbons, that is, to secure the complete removal of the cortex (which contains the fibre) from the green stems, at such a cost as will prove remunerative to themselves and at the same time allow sufficient margin for the cost of converting these ribbons into filasse ready for the spinners. Hitherto the want of success in the production of ribbons has apparently been the only obstacle to the development of a Ramie industry. And probably on this account the Paris trials were wholly devoted to the production of ribbons and not of filasse. The conversion of ribbons into filasse is a subject believed to be more easily dealt with. In fact there are several systems exclusively devoted to this department which appear to accomplish it. Some machines, it is true, have attempted to produce filasse by a single process from the green stems. The result has not been satisfactory, and it is very unlikely that this can be done with a plant like Ramie, in which the individual fibres are so completely immersed in gummy matter. Hence the subject has been divided into two parts. The first is concerned alone in the removal of the fibre in the form of ribbons from the green stems, either in the fields or in their immediate neighbourhood. The second is devoted to the treatment of these ribbons and in their conversion by chemical and other processes into filasse, or fine white silky fibres ready for the spinner. The first process will naturally take place where the plants are grown, in the Colonies or elsewhere, and machines like those of Favier and De Landtsheer, or processes like that of Fleury-Moriceau, may be adopted according to the special circumstances of the planter. Sufficient progress has now been made in the working of these machines and processes to justify careful trials being undertaken with them both in India and the Colonies. If these machines or any others that may be forthcoming prove entirely satisfactory, and ribbons can be produced at a low initial cost, the question of their conversion into filasse is one which will naturally come into prominence. The conversion of ribbons into filasse will very probably, at first at least, take place in Europe, where chemicals and skilled labour are the more readily available. In some countries it may be found advisable later on to establish central factories or *usines* on the spot (to save freight charges on the ribbons), and ship only the filasse to Europe. In any case once a Ramie industry is well started, there can be no doubt numerous countries will seek a share in it, and only those possessing special advantages for the growth of the plant, a supply of cheap labour, and good facilities for transport and shipment can hope to make it a success.

The best market for Ramie at present appears to be France. What little is imported into this country, in the form of China grass or Rhea, is bought up for the French market. In the Monthly Circular of Messrs. Ide and Christie for the 15th October 1889 China grass is quoted "quiet" at 31*s*. to 35*s*. per cwt. and Rhea, "no business," at 14*s*. to 10*s*. per cwt.

With regard to what is known in commerce as "China grass," this is hand-cleaned fibre shipped usually from Chinese ports. It arrives in this country in small parcels, the yearly importation being only about 100 tons. It is nearly all taken up by continental buyers. Rhea is the term applied to machine-cleaned fibre, generally in the form of ribbons or half-cleaned stuff. The price is much less than China grass, and in case of large shipments would probably not exceed about 7*l*. or 8*l*. per ton. It is important therefore for Ramie planters to aim at the production of ribbons at a cost not exceeding about 4*l*. or 5*l*. at the port of shipment. Important elements in such production would be to plant Ramie only in places where the soil and climate will allow of three or four crops to be reaped per annum; where labour is very cheap and abundant, and where good facilities exist for transport and shipment.

D. MORRIS.

SISAL HEMP.

Sisal Hemp is extracted in Yucatan from several plants, but the true plant (*Agave rigida*) is one nearly allied to the Koratoe (*Agava Morrisii*), a native of Jamaica.

The true Sisal Hemp plant exists under several varieties, but the one which is most largely cultivated is of a greyish-green colour with thorny spines on the edges of the leaves (*Agave rigida*, var. *elongata*)

The Department, with the aid of the Government and the British Consul at Progresso, was able to secure one dozen plants of this variety from Yucatan, but it has proved quite impossible to obtain any more, as the plants there wish to preserve the monopoly. There are now about 100 plants at Hope Gardens and they are being propagated as fast as possible.

Another variety (*Agave rigida*, var. *Sisalana*) was very freely distributed in the Bahamas by His Excellency Sir Henry Blake when he was Governor in that Colony. The inhabitants now see the great importance of this industry, and the Government has been induced to forbid the export of any plants for three years. This variety is of a dark green colour and has no spines on the edges of the leaves. The absence of spines on the edges saves trouble and expense in harvesting. There are a few of these plants in the Hope Gardens. It has been ascertained that this variety grows in the Caicos Islands, and His Excellency Sir H. A. Blake has directed that arrangements shall be made for the importation of as many as can be obtained. It is expected that these plants will arrive next February.

There is another plant wich also yields a large quantity of the Sisal Hemp exported from Yucatan, namely, Silk Grass (*Furcroea cubensis*). There is already a large quantity of this plant in Jamaica, and there ought to be no difficulty in planting out a large area. However, it only yields from 2 to 3 per cent. of fibre, whereas the true Sisal Hemp plant yields 4 per cent. Another species (*Furcroea gigantea*) is the Mauritius Hemp of commerce.

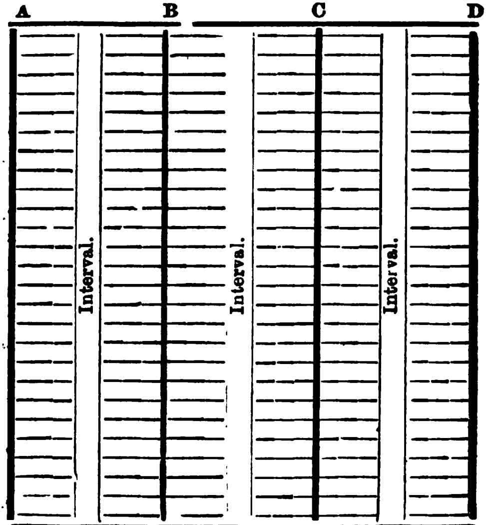
Mr. D. J. Stoddart wrote a pamphlet in the year 1886, on the cultivation of Sisal Hemp, which was printed at the Government Printing Establishment but is now out of print. Mr. G. Preston was sent as a Special Commissioner to Yucatan by the Government of the Bahamas to enquire into the working of the Fibre Industry, and his Report was published during the present year.

Notes have been drawn up from these Reports for the benefit of those who have not the means of consulting them:—

Soil.—Any dry, poor land will suit Sisal Hemp, but rocky, gravelly soil is the best for the production of the finest fibre. Moist land is not suitable, nor rich land, like old Sugar Estates, for though the leaves grow well and fast, the fibre is poor and small in quantity. Shade is prejudicial, even to the young plants.

Planting.—Young plants are the best for planting out, and they should not exceed two feet in height. If the plants have to be carried a long distance, the roots should not be trimmed, but when they are planted out, the roots should be cut off down to the trunk, and the dry leaves pulled off. The plants are put out in straight rows: the distance between the rows being 12 feet, and between the plants 6 feet in the rows. There will then be about 600 plants to the acre. Roads, running perpendicular to the rows, may be formed at intervals of 10 chains. It is necessary to keep the plants at this distance apart, for if they are too close, the leaves may be damaged in high winds, resulting in great loss of fibre. Great care is taken in Yucatan to put out the plants quite upright, and stones are even placed to support them in a proper position, for they grow as they are planted. The rainy season is the best time for planting.

Stoddart gives the accompanying plan for laying out a field:—



The field is divided into three sections, each of which measures 1 chain as and is represented as follows:—

A to B first section, B to C second section, C to D third section; in the middle of each runs an interval of proper width having a depth on either side within each section of about five chains. The short lines drawn across indicate the rows of hemp between which the cutter works, and therefore has—while cutting in any section—a distance of not more than five chains to carry the leaves to the interval, where the cart gets loaded. Each section has its boundary line as is shown from B to E.

Culture.—The culture is extremely simple. No shade of any kind is allowed, bush is cut down, and trees taken up by the roots. The young suckers are taken off, and if they are not required for planting out, they are burnt. Any plant of quite low growth may be planted between the young plants to give "catch crops." When the plants are about two years old, cattle may be turned in to keep the grass low, and to prevent bush springing up. Sisal Hemp plants thrive better without either hoeing or ploughing. Various estimates have been formed of the duration of these plants, but at any rate they last from 12 to 20 years. When they show signs of dying off, new suckers are planted between and thus there need never be a vacant spot in the plantation.

Harvesting.—When the leaf is ready for cutting, it will have inclined downwards to a horizontal position, and its colour will have become darker. Cutting should commence from the bottom, and the leaf must be taken off clean and as close as possible to the trunk. As soon as the leaf is cut, the prickles on the edges and point should be trimmed off. The leaves are then made up point and base alternately, into bundles of fifties for delivery at the works. Thirty such bundles are a day's work but of course more can be done, if the variety is cultivated without the prickles on the sides of the leaves. The bundles are placed on the edge of the cart-road, 30 bundles being a load for a dray. The workmen are paid so much per 1,000 leaves.

The time required for the leaves to ripen after planting varies, according to soil and situation, from 2 to 3 years.

Extraction of Fibre.—The fibre should be extracted from the leaves as soon as they are brought in. If left for more than 2 or 3 days after cutting, the fibre is spotted.

When the fibre is extracted by passing the leaf through the machine, it is hung on drying stands in the sun for about 2 hours until it is quite dry. If rain comes on, the fibre must be hung up under cover, or it will become discoloured. In wet weather a fire is kindled to warm the drying house, or operations are suspended.

The fibre is often bleached by leaving it on the drying stand for 54 hours after being dried, but it requires to be constantly turned. The fibre is improved in appearance, but weighs less.

The drying stand is made by erecting posts 4 feet high and fastening rails or wire on the top from one to another.

The refuse from the leaves is dried in the sun and burnt.

Particular attention is paid in Yucatan to the operation of baling, and all discoloured fibre is separated and packed as a second quality. Even the cordage used to cord the bales of first quality must be of the same kind. The bales are passed either by a screw or a hydraulic press, and great care is taken to make the bales neat-looking and of uniform weight.

Machinery.—One fibre machine is required for every hundred acres of plants.

Preston says:—"The first farm I visited, "Chenkj," was running 6 of Death's fibre machines or wheels 50 inches in diameter, 8 inch face and 8 knives or scrapers, driven by No. 7281 10 h. p. Marshall, Sons & Co.'s stationary engine, and each wheel was cleaning the leaves at the rate of 20 to the minute or 8,000 per wheel for a day's work. Two men at each wheel, standing between the wheel and rack containing the leaves, feed the machines as fast as their hands can move—one coy to two wheels supplies the feeders, and three others carry away the fibre to the drying ground adjoining. It is the most simple thing possible, requiring no skilled labour. There is no water used either for soaking the leaves or washing the fibre, which after exposure to the sun for two hours, is fit for baling. The engine is driven by an Indian.

"Many of the engines are supplied by Brown and May and the wheels are all from Death and Ellwood, Leicester. There are in the State of Yucatan very many machines and many engines, but no hand power machines. The machines or wheels at present in use have been working ever since they were first introduced 20 years ago: the knives or scrapers require renewing occassionally.

"The working hours at this farm were from 4 a.m., to 12 noon, or earlier, if the 8,000 leaves to each machine were cleaned with an interval for breakfast. The fibre is all housed the same day, the machine men in the afternoon lending a hand in gathering it in from the drying ground. If the farm has a press it is properly baled; if not, it is hand-baled and sent to Merida at once, 8 bales on a dray drawn by six mules, or by road and railway from the more distant farms and there re-baled or sold as it is.

"Here was a farm cleaning daily 48,000 leaves or 72,000 lbs., of the crude material yielding 3,600 lbs., (5 o/o fibre) costing at the farm 2½ cents per pound Mexican silver (33⅓ below gold) worth in Merida 10¾ cents gold. . . . There are in Yucatan some 200 henequen farms of all sizes, the largest running 30 machines and employing 500 hands, and several others of 20 wheels or more. Many farmers' daily incomes are $500 to $2,000 clear profit." *

Yield.—Each plant should produce 30 leaves in the year. If there are 600 plants to the acre, this gives 18,000 leaves per acre per annum. One thousand leaves weigh about 1,500 lb., and, yielding about 4 per cent. of dry fibre, give 60 lb. of hemp. Thus, each acre should yield about half a ton of hemp per annum.

The following quotations are taken from a recent number of the "British Journal of Commerce."—

Fibre.—Algerian, curled, green,	℔ ton	£7 0 0		
" " black	"	11 0 0		
Aloe "	"	15 0 0	to	£18 0 0
China Grass "	"	33 0 0	to	36 0 0
China jute "	"	22 0 0	to	23 0 0
Mexican "	"	34 0 0	to	38 0 0
Raffia "	"	25 0 0	to	26 0 0
Rhea "	"	9 0 0	to	18 0 0
Kitool "	per lb.	0 0 3	to	0 1 0
Hemp.—Polish	per ton	24 0 0	to	31 0 0
Italian	"	33 0 0	to	50 0 0
Sunn	"	6 0 0	to	15 0 0
Other East India	"	6 10 0	to	22 0 0
Manilla, brown, etc.	"	45 0 0	to	50 0 0
" fair	"	51 0 0	to	52 0 0
" good	"	53 0 0	to	55 0 0
" Quilot	"	55 0 0	to	66 0 0
Mauritius	"	36 0 0	to	43 0 0
New Zealand	"	30 0 0	to	36 0 0
Sisal	"	53 0 0		

The following is of importance in connection with this subject:—

* Mr. Kennedy, of the Railway Work Shop, is engaged in the improvement of his Fibre Machine, and it is hoped that it may turn out a great success.

Washington, Sept. 27.—A copy of resolutions, adopted at the Republican Convention of Pratt County, Kan., on September 7, will be presented to President Harrison tomorrow. The resolutions substantially say that the duty levied on imported fibres, suitable for making binding twine, has failed in its protective features to develope or give the farmers a home product to take the place of the foreign fibres, and that American grain-growers are compelled to rely on imported fibres of which to make binding twine suitable for binding grain. To continue collecting a duty on such imports is working a hardship on the grain grower by increasing the cost of their binding materials.

Congressman S. R. Peters was requested to frame and introduce a bill into Congress to place all raw fibres that are used and are suitable for making binding twine on the free list, and to use every means in his power to have the bill passed at the earliest possible date. The President was petitioned to call the attention of Congress to the matter, asking immediate relief.