

MADRAS RECORD OFFICE.

Government of Madras.

Revenue DEPARTMENT.

G.O. No.

274

Press
Mis.

248-49

Dated 22-2-1870

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Not to be folded or roughly handled

Ans

*Proceedings of the Madras Government, Revenue Department,
22nd February 1870.*

ENCLOSURE No 1.

From the Superintendent, Government Experimental Farm, Madras, to the Honorary Secretary,
Government Farm, dated Sydapet, 3rd December 1869.

I HAVE the honour to enclose you copy of the communication addressed by Captain deBourbel
to the Right Honourable the Secretary of State for India.

2. I have examined the American Newspaper, referred to by the Board of Revenue in their
Order, dated November 4, 1869, No. 2,920, and regret that I am unable to forward anything
which bears specially on any of the questions raised by Captain deBourbel. The *American
Agriculturist* contains a large amount of valuable facts, but unlike its English contemporaries,
devotes no space to articles on any special subject.

3. Information of a valuable character will be more likely to be found in the transactions
in the agricultural bodies located in the different States, or in the publication issued by the Agri-
cultural Department of the Central Government.

4. The Government of Brazil will doubtless be in a position to give valuable information, as
they have for some time taken much interest in agricultural matters.

5. I enclose a Catalogue of American Agricultural works which contain much useful informa-
tion; they are all of recent publication.

THE Board have perused with much interest Captain deBourbel's letter, and
are of opinion that it would be advantageous to reprint the letter for circulation to
Collectors, and to communicate it to the local Presses.

2. The Acting 2nd Member of the Board is about to proceed to Europe, *via*
America, and has expressed his willingness to select a few machines likely to be
useful in this country. The Board consider this too good an opportunity to be
lost, and would suggest that a sum of Rupees 5,000 should be placed at his disposal
from the provision under "Agricultural Exhibitions" for the purchase of new
machines.

No. 249.

ORDER THEREON, 22nd February 1870, No. 274.

Miscellaneous.

THE Government are not prepared
to give effect to the recommendation
made by the Board of Revenue in pa-
graph 2 of the foregoing Proceedings; but His Lordship in Council requests
Board to convey the thanks of Government to Mr. Fane for his offer.

(signed) R. A. DALYELL,
Acting Secretary to Government.

To the Board of Revenue.

Exd. F. R. Bantleman.

2

*Proceedings of the Madras Government, Revenue Department,
22nd February 1870.*

No. 248. Read the following Proceedings of the Board of Revenue, dated 2nd February 1870, No. 731 :—

Read the following letter from the Honorary Secretary, Government Farm, Madras, to the Acting Secretary to the Board of Revenue, dated 10th December 1869, No. 75.

I HAVE the honour, with reference to the Board's Proceedings of 19th November 1869, No. 8,554, to forward copy of a letter from the Superintendent, Experimental Farm, stating that he cannot find any articles in the *American Agriculturist* bearing on the subject of Captain deBourbel's letter (herewith returned), particularly as regards labour-saving machines.

2. With regard to the latter part of the Superintendent's letter, I request the Board will be good enough to move the Government to procure, for the Farm Committee and Superintendent, the publications issued by the Agricultural Department of the Government of the United States; also papers of the same description in the Agricultural Department of the Government of Brazil. There is no doubt that much valuable information will be obtained from such works.

3. MANIOC OR CASSARA.—Captain deBourbel, in clause 1, paragraph 3, speaks of the Manioc. This plant is largely grown in Travancore, and used as food; a full description of it will be found at page 273 of Major Heber Drury's *Useful Plants of India*; also at page 423, Volume I. of Ainslie's *Materia Medica*. It is also cultivated here under the name of Maravullie. The Board could probably obtain fuller information regarding this plant by applying to the Resident of Travancore for particulars regarding cultivation, etc.

4. COCOA.—There are some cocoa trees in the Government Gardens at Courtallam in the Tinnevely District; also I believe in the garden at Buliar on the Coonoor Ghaut, the property of E. B. Thomas, Esq.

5. LABOUR-SAVING MACHINES.—I have written several times to different persons in America, asking them to send Catalogues of agricultural implements and labour-saving machines, but have as yet been unsuccessful in procuring any. About 4 weeks ago I again wrote to the Editor of the *American Agriculturist* (a paper taken in by the Farm Committee) on the subject, and hope ere long to receive Catalogues, from which a selection of the best implements and machines that promise to be useful in India will be made by the Committee.

6. RAMIE.—The Ramie plant referred to in paragraphs 16, 17, and 18, is undoubtedly the Rhea Grass referred to at page 345 of Forbes's Royle's Fibrous Plants of India. It might be advisable to procure one of the Roczls machines and one of the machines from new Orleans, mentioned in paragraph 18. The President of the Farm Committee intends shortly returning to England, via the United States, and might be commissioned to purchase and send out from Boston by an Ice ship any cheap machines which he considered would be likely to prove useful in India, particularly implements of the class referred to in the last part of paragraph 22.

Reported to England
By 10th May No 11 of 1870 Mis.

Machinery from America.—Board's
recommendation to place Rupees 5,000 at the
disposal of Mr. Fane for their purchase, negatived.

FEBRUARY.
Nos. 248-249.

Dated February, 22nd.
Recd.
G. O., 22nd February 1870, No. 274.

GOVT. of INDIA
REVENUE.
THE BOARD OF REVENUE.

Copy

No 1

TO THE
UNDER-SECRETARY OF STATE FOR INDIA,
EAST INDIA OFFICE, LONDON.

SIR,—During my recent travels through Central America and the United States, which extended over a period of ten months, I took every available opportunity of enquiring into and seeing the natural products and mechanical improvements of those countries which might be introduced into and become useful in India; and I have now the honour to submit for the attention of Her Majesty's Government some observations and suggestions of mine on this subject.

2. It may be as well to mention beforehand that, during my service in India, five years were spent as Deputy and Consulting Engineer to the Government of the North-Western Provinces in the Railway Department; two years of the same period as Under-Secretary to the same Government in the Forest Department; and two years afterwards, as Superintending Engineer of Public Works in the North-Eastern Provinces of Bengal. This occupation has made me acquainted with a large portion of Central, Northern, and Eastern India, of our Himalayan frontier and Eastern borders; besides which I have been in Burmah, Madras, Singapore, and the Straits settlements, China, Japan, &c.

Former occupation
and pursuits in
India.

Much of my leisure time has been devoted to the acclimatisation of plants and trees, to the study of soils for culture and of machinery to save hand labour. I mention this merely to show how I was led to take an interest in, and to acquire some practical knowledge of these subjects, which are somewhat out of the ordinary line of an engineer's profession.

3. The remarks which follow are brief and imperfect; for a traveller in visiting a new country for the first time, and one which is of such vast extent and abounds in so many new objects of interest like America, has very little time to spare at any one place for collecting information on any special point. All that I can say is, that my attention was strongly arrested by certain objects which seemed to me to be particularly adapted to India; and in this view I endeavoured to ascertain, while passing by, their practical value, and in what manner they might be brought into use in India. Among the natural products which I thus noticed were—

Enquiries limited.

A

Manioc or Cassava.

I. The Manioc or Cassava root, of which there are two kinds, one sweet and the other bitter, the latter poisonous if eaten raw. Cassava bread, arrow-root, tapioca, and starch are obtained from these roots.

The sweet cassava has a small brown root, half a pound in weight, with a tough and fibrous heart.

The bitter cassava has a large black root many pounds in weight, without any woody heart, but the juice is highly poisonous, narcotic, and antiseptic, and must be carefully expressed or be driven off by strong heat.

The cassava is planted in the rains, will thrive on a poor, dry, and loose soil, arrives at maturity in nine months, and yields abundantly, an acre sometimes producing 15 to 20 tons of green roots, but is an exhausting crop.

To obtain cassava bread, the roots are dried, peeled, and well washed, then grated or ground between millstones to paste. The latter is put into canvas bags and strongly pressed to squeeze out the noxious juice and then thoroughly dried, when it becomes hard and friable and easily converted into flour. The flour is kneaded into thin cakes, placed on thin circular iron plates and baked. These cakes keep well, form wholesome nutritious food, half a pound being sufficient for the daily support of an adult.

When the juice has been expressed, a white fecula is deposited, which is well washed and dried in the air, and forms the Brazilian arrow-root of commerce; but when dried upon hot plates it becomes granular and forms tapioca.

The green bitter cassava yields one-fifth of its weight of starch.

The manioc or cassava is largely cultivated in America in the warm latitudes, between the tropics, and up to an elevation of 3,000 feet above the sea. It is chiefly found in the Brazils, on the Spanish main, in Peru, in Mexico, and in the West India islands. It is now grown in portions of Madras, Tenasserim, and Penang, to produce tapioca, but is not used as bread.

Its adoption throughout India for this purpose as an article of common food would be highly beneficial: an acre of ground planted with cassava is said to yield as much nourishment as six acres planted with wheat.

4. II. The Cochineal, an insect producing a crimson juice which is used as a scarlet dye and for the manufacture of carmine. It is bred on the Nopal or prickly pear-tree, a species of cactus with a white flower, but it also thrives on other shrubs of the same kind.

There are two kinds of cochineal; the smaller is found wild, and is sometimes used for propagation.

The larger is cultivated of two varieties, silver and black; the former, covered with a whitish down, and grey in colour, is the most valuable; the latter is without bloom, dark red in colour, and of inferior quality.

The silver grain cochineal used formerly to be produced extensively in Mexico and Guatemala, though its export is said to be diminishing in consequence of the introduction of lac dye and of the mineral dyes. It is, however, superior to them all. The cultivation is expensive, and requires much labour and attention.

Cassava bread.

Arrow-root and tapioca.

Use as bread in India advocated.

Cochineal.

The Nopal grows luxuriantly at an elevation of from 2,000 to 4,000 feet above the sea level, on a moist alluvial soil, in a volcanic region, especially along the reclaimed borders of the Mountain Lakes. Culture of the Nopal.

The shrubs are planted in parallel rows, on land kept quite clear of weeds and trees, grow to an height of three feet, and can bear insects in the third year.

The young insects are usually placed upon them in April, lay eggs twice, and are collected in September. Only the female insects are gathered: there are two, sometimes three harvests annually. The insects are thrown into boiling water, or steamed as soon as picked, and one pound of young insects will usually produce from 12 to 24 lbs. in one year. The culture of the Nopal requires much labour; the leaves and stalks must be kept clean, or the insects will not thrive. The young insects can be kept alive on cut branches of the Nopal—if the latter be suspended in a shady and damp place, and kept moistened—for as long as three or four months, and the most esteemed kinds are thus transported from one place to another. Treatment of insects.

Some cochineal were imported into Madras many years ago and throve well. Unfortunately they proved to be of an inferior description, and their low price in the market led to the cultivation being abandoned. It would be worth while to try an experiment with the best kinds procurable in Guatemala or Mexico; the difficulty would be to select the best varieties fitted for India, and that could only be done by sending a person to the spot to study the culture. Importation into India of the best varieties proposed.

5. III. The Cocoa, or Cacao Plant, from which chocolate is made. I was much struck with the utility of this plant in providing an excellent article of food in a tropical climate, and with the probable advantages that might be derived by its introduction and adoption in India. Cocoa or cacao.

The cheap common beverage of the people in Central America, called 'chocolate,' is obtained from the seed of the Cocoa Plant, 'Theobroma Cacao,' which grows freely in the hot moist climate of the country, between the tropics, at an elevation ranging from 50 to 3,000 feet above the sea level, and one kind is found even at an higher altitude in favourable situations. The Indians, Whites, and Creoles throughout that region are very fond of chocolate, and find it an wholesome, nutritious, fattening, and cooling drink. It is said not to be so heating as coffee, and not to act on the nerves like tea. The oil extracted from the seed has a soothing and calming effect when applied to sores and bruises, and the butter of cocoa is also good for sore lips and chapped hands, and makes a good ointment. Uses of cacao.

According to Dr. Johnson, in the 'Chemistry of Common Life,' the seeds contain a large amount of oil and butter, as much as 51 per cent. of the weight of the bean; also a large proportion of starch and gum 22 per cent., of gluten 20 per cent., and of theobromine 2 per cent.: the latter a peculiar principle, resembling the theine of tea and coffee, though richer in nitrogen, and producing the same exhilarating, sustaining, and soothing effects. This composition.

tion is one of the richest and most nutritive forms of vegetable food, and has the closest resemblance to milk. Cocoa unites in itself the exhilarating properties of tea with the strengthening and ordinary body-supporting qualities of milk, and was fitly named by Linnæus, Theobroma, or food of the gods.

Exports.

The countries which exported cocoa to Europe in 1866, according to Captain Pim, R.N., were—

	lbs.
Ecuador (Guayaquil)	22,000,000
Brazil	8,121,182
Venezuela, New Granada	4,000,000
Trinidad	3,000,000
Cuba and Porto Rico	3,000,000
French West Indies, Guiana	720,000
English West Indies, Philippine Islands, and others	1,358,868

Total 42,200,000

Besides which Mexico harvests 4,000,000

consuming nearly all within her borders; while Guatemala, Honduras, Hayti, and some other countries do not rank as exporters, absorbing all they grow for their own consumption. Of the total exported to Europe, 1½ million pounds are consumed in the United Kingdom, 9 millions in France, 13 millions in Germany, and the remainder in Spain, Italy, and the South.

Description of plant.

6. The cocoa is a small tree with dark green leaves, growing to an height of 20 feet, and producing an elongated fruit, yellow or purple when ripe, like a thick, short cucumber. Every pod contains from 20 to 30 beans or seeds, as large as almonds or olives, embedded in rows in a pulpy substance, which is sometimes eaten by the Indians as food.

Culture.

The plant grows best on a rich black surface soil, formed from the detritus of tropical forest vegetation, a minimum thickness of three feet being necessary, the tap root usually descending to this depth, and the roots spreading out 4½ feet from the stem. An alluvial soil in a volcanic region is also favourable to the growth of cocoa. The latter requires much moisture at regular periods, but also free drainage to prevent the rain water from lodging about the roots, and sufficient shade to protect it from the rays of the sun during the hot season.

The seedling is delicate, and some labour and care are necessary in clearing the nursery ground of weeds and roots, in sowing the cocoa seed at the proper time, in watering and sheltering the germinating shoots, and in attending to their growth during the first four to six months.

The seedlings are transplanted into the field at the beginning of the rains; the young plant soon becomes hardy, begins to bear fruit in four years, yields a good return in seven years, and arrives at maturity in ten years. In clearing a tract of tree forest, the higher shade-bearing trees and shrubs should be preserved, the felled logs removed, though their stumps and roots may be left.

The surface of the ground is burnt over, in the first instance, to clear it of weeds and underwood; no ploughing or turning over is necessary, but large holes must be dug in rows, so as to form equilateral triangles of sides 16 to 30 feet long for the reception of the young seedlings, with sufficient earth round their roots. After this the only labour required is to weed the surface of the plantation four times a year, to clean or prune the cocoa shrubs of superfluous branches in every fall, to keep up enough shade over the growing cocoa by planting bananas or plantains, bucaras, and other leafy shrubs for the purpose, and to collect the pods.

7. The cocoa ripens and produces fruit all the year round, but is most productive in January to March, and in June to August. The ripe pods are gathered usually at the wane of the moon, are shelled by hand, and the grain exposed to and dried in the sun a few hours, until the malicula or white bloom on the skin covering the almond is seen to shrivel up and to become brown in colour. The grain is then removed into a store and allowed to sweat or ferment from 24 to 36 hours, to take away all the acidity. It is then spread out in the open yards to dry slowly, and when easily broken between the fingers is in a state fit for market and export. After fermentation the grains should be naturally of a dark brown colour; the light red colour is obtained artificially by mixing pulverised red earth or ochre during the process of sweating, an objectionable practice.

There are two principal kinds of cocoa cultivated for export; a third kind grows wild in the forests of Guiana; a fourth kind is found in Brazil, and there may be others as yet unknown to me.

Of the exported cocoas, the inferior quality called Semillara is a hardier plant, produces in abundance, has larger pods and larger grains, but the latter contain less oil and sugar and are very cheap. The superior cocoa called Bacao is a more delicate plant, produces less fruit, the grain is smaller but is richer in oil and sweeter, is of finer flavour, and fetches double the price. The finest cocoa grown is said to be at Soconusco in Mexico, in Guatemala, and at Caraccas. The yield per tree varies considerably. In a plantation of several thousand trees each tree should, on an average, produce one pound of dried cocoa annually on moderate soil, one and a half pounds annually on good soil; but there are trees which will yield as much as 10 to 12 lbs. annually.

The value of cocoas also varies. In Guayaquil the Semillara is worth from 8 to 10 dollars per fanega of 110 lbs. avoirdupois, while on the Spanish main it is worth 15 dollars per fanega. In Venezuela the Caraccas cocoa is worth 40 dollars per fanega, and generally the cost of production is said to range from 40 to 50 per cent. of the local market price. A small cocoa estate of 6,000 bearing plants would fetch now, near Caraccas, 4,000 dollars, including the land, and ought to yield 60 fanegas of superior grain yearly, on which the annual cost of production would be 900 dollars, the receipts 1,800 dollars, leaving a net profit of 900 dollars. These figures must be taken with every reservation—it was most difficult to gain any definite or reliable information on this point; but when cultivated for the sake of profit, and under favourable conditions, the superior kind of cocoa seemed to yield an annual surplus of at least 20 per cent. on the capital outlay.

Manufacture.

8. For consumption, the cocoa grains are toasted slightly on a thin circular iron plate to make the skin come off the almond easily, and are then shaken in a wooden bowl until the husks are taken off and the almonds are quite clean. The latter are then ground between two stones, or in a small mill with some hot ashes underneath, when the oily substance ground becomes a soft paste.

For drinking cocoa make a thin syrup of boiling water, or milk and Muscovado, and when once boiled, add so much of this soft cocoa paste to make it either thick or thin according to taste; stirring the whole over a slow fire until there is an inch of froth on the surface.

For drinking chocolate, take some soft cocoa paste, add one-third to one-half part of white loaf-sugar with a little pulverised cinnamon, mix the whole thoroughly, repress it in the mill or between the stones, and put the new mixture into any small or finger-mould; let it dry, and use when required. This chocolate paste is put into boiling water or milk as may be desired, and should be heated over a slow fire until the froth comes up three times.

For eating chocolate, take equal parts of the soft cocoa paste and of white loaf-sugar, add a little vanilla or any other spicy ingredient according to flavour wanted, mix well together, repress in the mill, and put into moulds, which dry in the air until ready for use.

General use as food.

9. The foregoing brief description will show that the culture and manufacture of cocoa is simple and easy, and requires little labour. It is grown in gardens for home consumption, or in regular plantations for sale in the market; one necessary condition being that the poor man should possess some suitable land, and be able to spare some of the labour of himself and family for culture during seven years, and that the rich man should have capital enough to purchase the land, and to employ the labour and superintendence required for his plantation during the same period, before any good returns can be obtained. But, however the cocoa may be grown, its cheapness in the market places it within reach of the common labourer, in a country where wages and prices of provisions are very low, and where people have chiefly to depend upon farinaceous and vegetable substances for their food. The poor man looks upon cocoa as his necessary luxury, like tobacco or tea in other countries, and usually drinks it at supper with a cake of Indian corn well ground.

Adapted to India.

With similar conditions prevailing in India, I often wondered whether the cocoa plant could be indigenous, or be introduced into that country. I learn from Dr. Forbes Watson that it was formerly tried in Mysore under the auspices of General Cullen, then Commissioner of that province, but that the produce was inferior, and the plant in consequence became neglected. I may be wrong in my idea, but it seems to me that there are some parts of India where the cocoa might be grown with success, viz. in Burmah, in Chittagong, and Arracan, in Assam, Sylhet, and Cachar, along the foot of the Himalayas, the Khasia and Neilgherry Hills, in fact, wherever there is yet found a rich surface deposit from tropical vegetation, where there are regular tropical rains, and where there are facilities for drainage and obtaining shade, so as to avoid too much wet or

drought. Salt and frost are also said to be fatal to the growth of the shrub. Plantains, yams, cassava, palm-trees, bucaras (white and red), cane reeds, cactus, tobacco, indigo, are said to thrive on the same soil as cocoa. Indian corn or maize will grow on the same ground in the dry season, while rice will produce abundantly in the wet season.

10. Like tea, coffee, and chinchona, the cocoa does not come into full bearing for several years, and if its introduction into India be considered a thing likely to prove useful and beneficial to the country in course of time, as providing an article of food adapted to the people and climate, a careful experiment must first be made to show whether it can be grown there with success, and what circumstances are essential to its favourable growth. Experiment in India proposed.

It would not suffice to send for a load of cocoa grain, even if the latter could be imported from Central America unfermented and in a fit state for sowing, and to hand it over to any native Zemindars or European planters in different parts of India, with instructions for culture. However willingly they might commence, they could not reasonably be expected to have the patience or to undergo the trouble and expense necessary to conduct fairly a trial of this sort to its end during so many years; and any failure on their part would raise a prejudice against the plant, which might perhaps be quite undeserved and which might prevent its adoption for a long period. A few seeds might, of course, be tried in this way, though it would not do to depend wholly upon this source for the success of the experiment.

Nor would it be sufficient to distribute parcels of cocoa seeds among the District Officers of Government for the same object, who are employed in various civil duties throughout India. But few of these officers take an active interest in such pursuits, and they so seldom remain in any one place for more than two years that there would be no security for a continuous experiment of this sort. A garden fairly commenced by one officer would probably be neglected by his successor.

The Superintendents of the Botanical Gardens in India, however, might be safely entrusted with a trial of this kind. Their special avocation being the culture and domestication of plants, they have the knowledge requisite, may be expected to take a lively interest in the experiment, and have already succeeded in the similar cases of tea and chinchona.

11. The introduction of the latter into India was effected by sending out an agent to the country most famed for the growth of the plant, to study its culture, to select seeds and seedlings of the best varieties, to send them over to India in the most approved manner, to indicate the localities, soils, and seasons most suited for the plant, and to impart directly to the local botanical officers entrusted with the experiment all the information collected. Mode of introducing the best varieties.

The experience thus gained in the collection and transmission of seeds and seedlings, and afterwards in the culture of tea and chinchona, ought to go a long way in simplifying and facilitating the introduction of cocoa into India;

and it may be a question how far the agency of the British Consuls in Central America could be resorted to for this purpose. Her Majesty's Government already possess in these officers a ready agency for obtaining and despatching any articles ordered; but however clear and detailed the instructions given may be, it is obvious that gentlemen who are fully engaged in mercantile business, resident in one spot, and obliged, therefore, to employ other people to make the requisite enquiries and to select the specimens from the interior, and to carry out the extraneous work required, could not be expected to perform it so well as a responsible agent sent to visit Central America with a special mission. Such an agent, in passing through the countries which produce the best cocoa, would inspect in person the various plantations, would make his own enquiries on the spot regarding mode and expense of culture, propagation, manufacture, &c.; would be able to compare the various kinds of cocoa grown in the several countries, and the different practices followed, so as to arrive at the qualities and varieties most fitted for India; and having made his selection, he could arrange in person first with the proprietors of the cocoa plantations to have the particular seeds and seedlings picked or packed at the right time and in the proper way, and afterwards with the British Consuls to receive them and have them despatched without delay by steamer.

12. Among the minor natural products observed were—

Minor products.

IV. The Guaco and Cedron plants, which yield antidotes to snake bites. The root of the former is considered a great specific and safeguard along the Pacific coast; every planter and labourer going on a journey, or to work in the field, is in the habit of taking a small piece of the root in his pocket. The root is applied externally to the place bitten, and is also chewed and the juice rubbed on to the wound. The cedron bean is not so well known, but is used by the Indians for the same purpose. These remedies are said to be astringent, and to promote the circulation of the blood.

V. The Balsam Nigra, held in much repute by the Indians of Guatemala, as a febrifuge and salve for wounds.

VI. The Ubillo, or Vegetable Ink, being the juice of the black berry. The latter is dried and reduced to powder, which, with water added, forms an excellent durable ink.

13. Among the mechanical improvements seen in the United States were—

Portable machines.

VII. The Small Labour-saving Machines.—The ingenuity and practical energy displayed by the Americans in the invention and application of simple machines to save labour, time, and money, in all ordinary kinds of work, is truly wonderful, and we have much to learn from them in this respect on the score of promptitude and economy.

Probable advantages in India.

In many parts of India common labour is plentiful, and can be collected without much trouble for executing earthwork on canals, railways, roads, &c.; but skilled labour or artisans, such as blacksmiths, masons, carpenters, quarry-

men, miners, brickmakers, sawyers, &c., are rare, and can only be obtained with great difficulty and delay; the latter have to be imported at great expense from a distance, or the engineer is obliged to create and supply this class of labour by teaching the common labourers to become artisans, with the inevitable result of loss of time and money and imperfect work. Any machines, therefore, which would save the use of skilled labour, or which would aid or enable the common labourer to perform the work of skilled labour in a satisfactory manner, would be particularly valuable in India.

In my journey through California and Texas, along the Central and Union Pacific Railway, then under construction over the Rocky Mountains, and in the great manufacturing towns of New York, Baltimore, Boston, Philadelphia, St. Louis, Chicago, Pittsburg, &c. I frequently observed various small machines of this description at work among the people. I regret that I can only mention some of these here in a general way; for to describe them in detail, and intelligibly, would have required a close inspection, which I had no time to make.

Such were machines for making doors (panel and Venetian) and door-frames, making bricks and tiles, sawing wood or stone, cutting and heading nails, cutting shingles, boring soils, hoisting coal, washing and wringing clothes, churning butter, paring or peeling potatoes, apples, &c., expressing juices, such as oil, wine, sugar, &c., making bread and biscuit, shelling peas and beans, preserving fruit and vegetables, cutting and washing roots and vegetables, transplanting seedlings, &c., sowing seeds, &c., extracting weeds, filtering water, pumping water, &c., breaking up and rolling roads, watering roads, earth excavators, hand and horse carts, stoves for cooking, ovens for baking, steam fire-engines, wool, cotton, or hay presses, agricultural implements of every kind, hydraulic pumps, &c. &c. Enumeration.

14. VIII. Iron windmills, for raising water, sawing wood, turning flour mills, grindstones, &c. Iron windmills.

I saw many of these erected at the watering-stations along the great Pacific Railway under construction across this Continent, especially on the high table-lands. They pack up in a small compass, and are portable, easily put together, strong, and work uniformly, are self-regulating, and vary from 10 to 20 feet in diameter.

They are used for a variety of purposes, but chiefly for raising water; and on the plains of India, where there is much wind throughout the year, these light windmills might be turned to account for irrigating lands from wells, canals, &c.

IX. Rock-drilling machines, made of iron and steel, can be adjusted to work at any angle, to regulate the force of the blow, and, being worked by two persons, can do the work of six men in the same time. It can drill through hard granite, and might be improved, if required, so as to make two or three holes at once on the same level plane. Rock drills.

X. Double turbine water-wheels, are made from 6 to 60 inches in diameter, Turbine water-wheels.

according to the volume and head of water available and power required. They are the cheapest and best means of turning water power to account yet discovered, and are used in cotton mills, saw mills, flour mills, &c. &c.

They are made of iron, are compact in form, and occupy a small space. The small wheels are light and portable, work smoothly, and there is no waste of water. This description of wheel is already known in India, but the American form is superior to any other at present in use.

Track Layer.

XL Track-laying machine.—This is a new invention, which I saw experimentally at work on the railway under construction from Vallejo to Sacramento in California. A locomotive works the apparatus, which carries forward and drops the wooden ties or sleepers, and the iron rails nearly into position upon the formation level of the line, a gang of platelayers following to adjust them to true gauge, and fix the plates, bolts, and spikes. The locomotive runs upon the rails thus laid, can work up and down any ordinary gradient, and the machine can be guided correctly round the curves. One-and-a-half miles have been laid in one day, at a saving, it is said, in working of at least one-third of the cost of ordinary track-laying. The machine is complicated, but may be simplified and improved.

Examples of rapid construction.

15. The appliances for the rapid construction of temporary railways, and the organisation and management shown in the prompt repair and renewal of the broken railroads during the military operations at the close of the late Civil War, and afterwards in the advance of the Great Pacific Railway at the rate of two to four miles a day, were a perfect study. A few days only were required for the construction of piled viaducts, covered ways, large bridges, turntables, water pumps, engine and goods sheds, and other structures of wood and iron, for the laying out of towns in the wilderness, for the erection of whole streets of new houses, and for the supply of water through long wooden aqueducts or flumes.

The same rapid march may be seen in the mining districts of California, Nevada, Missouri, and the Eastern States, and also in the older towns, where entire houses of wood or brick are removed from one street to another, where the repair and renewal of roads, the laying of drains and pipes, and other works of city improvement are taken up and executed in a few days.

Enquiry advocated.

This short notice, however imperfect, may convey some idea of the vigour and progress attained in America with the aid of machines saving labour, time, and money, and how much improvement might be effected by the introduction of the latter into India. What we want in the latter country are light portable machines for common purposes which can be understood and worked by the unskilled natives, and a special enquiry on this subject, conducted in America and also in England by an engineer of some Indian experience, would, I am sure, be fruitful of good results.

Flax-cleaning machines.

16. XII. Flax-cleaning machines. — While travelling in Texas and Louisiana, I heard a good deal of the Ramié, a new species of flax recently introduced into those States with much success, and of the processes required to clean the fibre and to render it fit for spinning.

The Ramié, called the *Boehmeria tenacissima*, belongs to the order of the Ramié, *Urticaceæ* or nettle family, and to the sub-order of the *Urticea* or true nettles. According to Dr. Forbès Royle, in the 'Fibrous Plants of India,' the famous China grass is the fibre of the *Urtica nivea* or *Boehmeria nivea*, and is called by the Chinese Tchou ma. The Caloce of Sumatra and the Ramee of the Malays are probably identical, and termed *Urtica tenacissima*. The Rheea of Assam and Khunkoor or Khunkami of Rungpore are also very similar, and are termed *Urtica tenuissima*.

These plants all produce excellent fibres of different degrees of fineness, according as they are taken from the later or the earlier crops; the one exceeding Russian hemp in strength, the other rivalling the softest flax in fineness.

The Ramié was first transplanted from Java to the Paris Jardin des Plantes by Blume, in 1844, when it was reared in a hothouse, and introduced into Mexico by Roezl, formerly head of the Horticultural Institute of Belgium, between 1853 and 1859. He first went to Java, spending a year there in studying the culture of the plant, and emigrated to Mexico with a store of the roots. On his way to the capital, he was robbed by Mexican banditti of the roots, and wrote to Europe for a new supply from Java. This at length was procured through the good offices of the British navy, but unfortunately perished on the voyage to England. Again it was attempted, and again the plants were killed. A third attempt succeeded, though the plants had to be placed in a hothouse in England to give them strength for the next voyage, and then arrived half dead in 1859. Monsieur Roezl, however, after six years of perseverance, finally succeeded in rearing the plants, and in two years found himself the owner of a thriving plantation; and in 1865 he exported over 5,000 lbs. of the staple to England, and sold it at double the price of the best quality of cotton.

Imported into America.

17. The plant was brought over thence into Texas, into Louisiana, and into Cuba, where it has flourished and increased remarkably; it is now extensively grown instead of cotton, and its fibre is expected to supersede the latter for many purposes.

Extension, growth, and yield.

It grows freely on sandy land or in any good loose soil, excepting low, wet, or cold clays. It is usually propagated by layers, cuttings, and divisions of the root, even at the rate of twenty to one in the year. The plant grows continuously, requires much less labour and expense in cultivation than cotton, is more abundant and certain in its yield, and need not be renewed for a long period. It is not subject to the ravages of worms, does not suffer from excess of rain, can withstand drought without injury, and is not liable to destruction by frost. The plant grows from 6 to 10 feet in height, and is ready to cut when the stalk begins to turn brown 3 or 4 inches from the ground. If left longer, the fibre will become coarser and more difficult to clean. Three or four crops may be produced annually, each crop after the first year yielding more pounds to the acre than cotton.

Cleaning fibre.

18. The fibre of the Ramié used to be beaten out by the simple process of a hammer on a board, and then, in order to take out the stain imparted by the green bark, was soaked in lye or boiled with soft soap, or any alkaline substance, when it becomes white and is often two feet in length.

Machines in use.

Roczi's machine is now in use for separating the fibre from the stalk, and converts the latter, twenty-four hours after cutting, into long skeins of pure white and silk-like fibre ready for spinning.

The fibre contains much gum, and some good process, chemical or mechanical, for the thorough extraction of this gum from the fibre of the plant is wanted. A new machine invented in America for this purpose was highly spoken of when I was passing through New Orleans, but I could not succeed in seeing it during my limited stay. It claimed, however, to clean the fibre thoroughly, cheaply, and without injuring its texture or strength.

A similar difficulty has hitherto been felt in New Zealand with respect to cleaning the fibre of the *Phormium tenax*, which also contains a good deal of gum; and I am informed that a new machine has recently been invented in that colony, and is now working successfully, the fibres thus cleaned being approved of and fetching a good price in the London market. Another machine for this purpose, I am told, has also been recently invented in England, and is said to answer well.

Cheap process wanted.

The expense of cleaning the fibre has hitherto been the main drawback to the more general culture and adoption of the Ramié and other like plants for purposes of linen manufacture. These fibrous substances have usually been exported in a rough state to Europe, where they are cleaned and dressed by the flax-dressers, but their transport is always liable to much risk from combustion, in consequence of the difficulty of having the green flax thoroughly dried before being pressed into bales and shipped.

The fibres can also be more easily broken and cleansed while the stalks and straw &c. are yet green, and a cheap, portable machine and process for local use is therefore a great desideratum.

Once this difficulty overcome—and we are now, apparently, on the eve of its solution—there is no doubt but that the soft, white, and silky fibres produced by the Ramié, the Telou ma, the Caloce or Ramce, the Rheea or Khunkoora &c., will come extensively into use, and will supersede cotton for many purposes.

Nettle fibres found in India.

All these plants are indigenous to India, are of easy culture, of rapid growth, and very productive; their fibres exceed the best hemp in strength, rival the superior kinds of flax in softness, beauty, and fineness, and the cloth made is fine, strong in texture and durable.

Early enquiry recommended.

The only obstacle to their adoption and extension in India is the want of a fit machine and process for cleaning and bleaching the fibre cheaply for the market; and it seems worth while, therefore, for Her Majesty's Government to have early and special enquiries made regarding the new machines recently invented in America and elsewhere for this purpose, with a view to the introduction in India of any cheap and satisfactory method which may have been arrived at.

19. Turning now to the several suggestions herein made for the introduction into India of the cacao plant, of labour-saving machines of small motive power, and of a cheap machine and process for cleansing flax, through the agency of an officer of some Indian experience, to be deputed to Central America and to the United States on this special enquiry, the following remarks on the best mode of carrying out this object, and on the expense to be incurred, are now submitted for the consideration of Her Majesty's Government.

Proposal for a special mission.

The proper season for travelling in Central America so as to avoid the yellow fever is from November to March inclusive; and as one cocoa crop occurs in January to March, and the seeds are usually sown early in the year, a traveller has then a good opportunity of witnessing the most important operations in the culture of cocoa, and of learning the different processes employed from the planters on the spot.

Proper season for enquiry.

To make a complete study of the subject, an agent ought to spend at least a year in travelling through Mexico, New Granada, Ecuador, Venezuela, Trinidad, Guiana, and the Brazils, which are the principal countries where cocoa is cultivated; but a visit of six months to Guatemala, Guayaquil, and Venezuela, where the finest quality of cocoa is said to be grown, according to present information, would probably suffice for the purpose in view.

Time required.

There are two routes from the Isthmus of Panama by steamer to India, and the time taken, inclusive of probable detentions, is—

Routes available.

From Panama to San Francisco	2 weeks
San Francisco to Shanghai	5 weeks
Shanghai to Hongkong	1 week
Hongkong to Calcutta	2 weeks

Total 10 weeks

From Panama to Southampton	4 weeks
Southampton to Calcutta	6 weeks

Total 10 weeks;

and allowing 2 weeks for packing and transporting the cocoa seed and seedlings from the plantations in the interior to the seaport, and two weeks from the latter to Panama or Aspinwall, inclusive of probable delays, and also 2 weeks for transmission of the packages from Calcutta to the locality in India selected for the experiment, the entire time taken in transit by either route is not likely to be less than 16 weeks or 4½ months. From Guatemala and Guayaquil the route by Panama and China would perhaps be best, while from Venezuela the route by Aspinwall and Southampton would be preferable. There is one change of steamers less on the latter, and more care of the packages is likely to be taken; but the passage through the Red Sea in summer must be avoided, and in selecting the route therefore much will depend upon the season of the year at which the seeds and seedlings may be despatched.

20. The transplanting from the seedling bed to the garden in India must

Proper season for

transmission of seeds
and seedlings.

take place early in the rains, or towards the end of June or beginning of July, and it is not advisable to sow in India during the dry season, March to June. The seeds therefore, if picked in Central America during January and despatched at once, would arrive in India during June, so as to be sown during the rains, and would in this case remain in the nursery bed and not be transplanted until June of the following year; or if picked in Central America in June and despatched at once, would arrive in India during November, would be sown in December at the beginning of the cool season, but would have to be carefully watered and tended during the dry season until June, and be transplanted as soon as the rains have fairly set in.

If seedlings are forwarded in Wardian cases the seeds should be sown in the open cases in November; the cases, closed and despatched in January, would arrive in India and be opened in June, and the seedlings might be transplanted in August. Or the seeds might be sown in Central America in the open cases in May; the cases, closed and despatched in July, would arrive in India and be opened in December, and the seedlings would be left in the cases and be carefully watered and tended until June, and be transplanted as soon as the rains have set in.

Mode of packing
the seeds.

The cocoa grain obtained in the market is usually fermented and will not therefore germinate: the usual practice is to take the seed fresh from the pod, and to put it while yet green into the earth. The seed is said to be of low vitality and to be therefore very delicate; it must be kept green, or in the same state as when taken out of the pod if possible, and must not be allowed to become wet or heated, or to dry up while in transit. The best mode of packing the seed would probably be in glass or stoneware jars, filled with powdered charcoal, and carefully closed and sealed. These jars should not be placed in the hold of the vessel, but should be kept in some cabin or saloon where they would get fresh air and shelter.

Localities proposed
for the experiments.

Assuming the safe arrival of some of the seeds and seedlings in Madras and Calcutta, the packages and cases would be addressed to the care of the Superintendent of the Botanical Gardens at those places, and would be by them distributed and forwarded to the four localities selected for the experiment, viz. at the foot of the Neilgherry hills, in Burmah, in the Dehra Dhoon, and at Calcutta; also to the Presidents of the various Horticultural Societies in India, and to any coffee and chinchona planters that may be selected in Madras, and any tea planters in Assam, Cachar, Chittagong, &c. If these experiments should succeed, seeds might then at first be distributed gratis to any native landholders or to any others likely to be interested, in order to bring the cocoa gradually into cultivation.

21. The expense of this measure will consist—

Estimate of cost.

I. In the deputation of an Agent for six months. Now the actual expenses of living and travelling in America may be set down at £2 per diem for a single person, and £3 per diem if with a servant; and a consolidated salary of £100 per month, or of £600 for the six months, to include all personal and travelling charges, would be a fair allowance to an officer so deputed.

II. In the collection, packing, and transmission of the seeds and seedlings. The owners of cocoa plantations, at any rate those whom I have met and spoken to on the subject, expressed their readiness to further any public object of this kind, by giving the seeds and aiding to pack them; all expenses of labour, material, and transport incurred being, of course, defrayed. £250 would, I think, cover the latter, as the jars for seeds and Wardian cases for seedlings would have to be taken out from England. The British Consuls would, no doubt, give their aid and influence in shipping the goods and in having them looked after on board, and probably £150 would cover the expenses of freight &c.

III. In the labour and subordinate establishment employed upon the experiments in India. This would be the heaviest item of expense, for it would last seven years or more, though the annual charges would not be high. Four under-gardeners, each at 25 rupees a month, and eight labourers at monthly wages of 8 rupees each during the seven years, would probably suffice for the four localities chosen; besides which, 40 rupees per annum might be set down for contingencies. Total annual charge, £245.

22. To carry out the enquiry proposed regarding light machines of small motive power and for cleaning flax, the Officer deputed should visit the large manufacturing towns, the mining districts, agricultural colleges and exhibitions, and any great railways or other public works in progress, to see the various machines in actual use. It would take him six months to make a thorough inspection, to compare the various forms and modes of working, to select the best, and to collect information regarding prices, dues, freights, and mode of transit.

Such data might be compiled into a report to serve as an index to English and American machines adapted for common use in India. The report should contain a description of each machine recommended, should note the mode and cost of working, the results and saving effected, and the price with freight &c., where and how procurable, so that the Engineer in India, in applying by indent to the Home Authorities, should be able to specify the particular machine required, and the storekeeper in England should understand what is wanted, and know the best kind procurable.

An enquiry of this nature might be limited in a general way to light machines of small motive power for engineering, household, and agricultural purposes, for cleaning flax &c. This need not debar the Engineer so deputed from including in his report any other machine, like the iron windmills, or turbine water-wheels, which he might consider to be generally useful; but to extend the enquiry to large machines worked by steam power would open a wide field, beyond my present intention.

I have expressly included the small class of agricultural implements in the enquiry, as there is now a demand for them in some parts of India. The expense of fuel in India for raising steam is so great that it will be a long while before the large agricultural steam-machines can be worked with profit; but

the small implements to be worked by hand or animal power are now gradually coming into use. This portion of the enquiry would have to be carried out in England as well as in the United States.

Probable cost.

The expenses to be incurred would consist in the deputation of an Officer for six months on a salary of £100 per month, to include all personal and travelling charges: total £600.

Selection of Officer.

23. If the measure thus proposed for the deputation of an Officer to Central America and to the United States to enquire into, select, and forward the best varieties of cacao to India; to enquire into and report upon the labour-saving machines of small motive power, and to enquire into the new machines and processes for cleaning the nettle fibres, be approved by Her Majesty's Government, and my services can be spared for the purpose, I should be glad to be entrusted with the mission, and to undertake the task in any way that may be ordered.

Probable time and cost.

The combined enquiry would take me one year to carry out, viz.—six months for the cacao and six months for the machines and flax-cleaning process; while the expense to be incurred, so far as I am concerned, would be £1,200 for one year's salary, including every charge, and £400 for the collection and transmission of the cocoa seeds and seedlings.

Should it be desired to add the study and importation of the cassava root and of the cochineal into India, another year would probably be necessary at the same expense; and, on the whole, perhaps it would be as well to consider two years as a possible eventuality for the entire enquiry; for, as in the case of the ramié roots imported from Java into Mexico, the first two attempts failed through the seedlings perishing during the voyage.

Prospects of aid.

During my travels through Central America I met everywhere the greatest civility, and I feel confident that the several local Governments would be ready to assist and to further any public mission deputed with this object, in the hope of meeting a similar return in the introduction of some of the natural products of India into their country at some future time. In the United States the Americans have a strong pride in their mechanical genius, and are always willing and ready to show and explain their improvements to strangers, provided the latter come to learn, and not to criticise.

Details suggested.

My extension of leave on medical certificate expires at the end of this year; and if my proposal be approved, I would request permission to start for New York about the middle of September next, so as to travel to the South and New Orleans to see the flax-cleaning process in October; thence to cross over to Venezuela in November, to New Granada in December, to Guayaquil in January and half-February, to Guatemala and south of Mexico in half-February, March, and half-April, and to reach San Francisco, California, by the end of April. The next five months (May to September inclusive) to be spent in visiting the great manufacturing towns, the mining districts, and the great public works in progress in the United States; the next two months (October and November) for the same purpose in England, and then to return to India

at the close of 1870. The year thus spent on this mission to count as regular service in India.

The salary to reckon from the 1st October 1869; but an advance of £100 before departure would be requisite to defray the preliminary expenses of personal equipment and purchase of jars, Wardian cases &c. A journal and daily cash-book to be kept and submitted monthly, in order to show progress and expenditure.

I have the honour to be, Sir,

Your most obedient servant,

11th August 1869 (Signed) A. B. Cunningham

No 17
Copy Letter, dated 11th August 1869,
from Captain de Boubel. R.E.

R 38/69

Recd. 14/8/70.
Am 20th July 1869. L. 248.

Refered to in Revenue Letter to
Friedrich, N. 30, dated 11th Apr. 1869.

In G. R. No 2931/69

For 700

REVENUE DEPARTMENT. 12

No. 146

From Proceedings of the Bd of Revenue
Dated 2nd February 1870.

FOR ORDERS.

I have read, as has the Board of
Revenue, Captain de Boubel's report,
with much interest - If any practical
result is to follow. The best plan would
be to employ that Officer.
From para 22 of Captain de Boubel's
report, a commission would be
granted to select the best machines

likely to be of use in India. Captain
de Brouck says six months.

Which it would be waste of money
to spend 500 £ in the manner pro-
posed by the Board. Mr. Fane
is making a rapid journey over
the American continent and could
not spare the time required for enquiry
& inspection prior to purchase. -

I would thank Mr. Fane for

Inf

his offer and say that the fact are
not prepared to give effect to the Board's
recommendation.

P.H.

Agree V. A.A.

FOR ORDERS

14 July/90 R18

18-274-

14

222 July/70

The Govt. are not
prepared to give effect
to the recommendation
made by the Board
of Revenue in para
2 of the foregoing Rep't,
but His Lordship in
Council reports the
Board to convey to
Mr. Lane his thanks for
the thanks of Govt to
his offer
Mr. Lane for his offer
M.H.

14 July/90 R18

14 July/90 R18