[such as Mr. Thomson suggests] to take up a wide area of land on the plains as well as hill-regions, to profit by divi-divi (dyes), henequen (fibre), and coconut palms, in the foreground, backed by cacao, bananas, rubber and Liberian coffee; while higher up *Coffea Arabica* could be developed in what must be one of the healthiest as well as richest parts of the American tropics

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COLOMBIA:

REPORT ON THE CULTIVATION OF CACAO, BANANAS, AND INDIARUBBER IN DISTRICTS SURROUNDING THE SIERRA NEVADA OF SANTA MARTA; ALSO COFFEE AND COCONUTS; DIVI-DIVI (DYES) AND HENEQUEN (FIBRE).

Report on an Excursion to the Sierra Nevada de Santa Marta to Investigate the Cultural Capabilities of the District.

Proceeding from the seaport town of Rio Hacha to the village of Dibulla along and in close proximity to the beach, the vegetation consists to a large extent of cacti and dwarf thorny leguminous trees, which latter at the end of the dry season are mostly devoid of foliage. The direction to Dibulla is almost due west, and the distance about 30 miles. From Rio Hacha a large plain extends some 30 miles towards the eastern extremity of the Sierra Nevada. The western extension of this plain, bounded by the Caribbean Sea and the Sierra Nevada, gradually diminishes in width to some 5 miles as it approaches Dibulla, and this contraction of the plain coincides with the rapid ascent of this system of mountains, that is, from a few hundred feet at its eastern limits to the magnificent summits near Dibulla covered with perpetual snow. Still farther westward this narrow plain extends, with the exception of several transverse ridges, about 40 miles towards Santa Marta, where the ramifications of steep mountains project into the sea.

The broad Rio Hacha plain, excepting on the lands within a few miles of the mountains, is a comparatively arid region, having a scrubby parched vegetation. Throughout this plain, it may be mentioned, 4,000 tons of divi-divi are collected annually for export, besides as much more left on the ground to rot. On this plain another plant grows wild in great profusion (many millions), viz., henequen ("agave rigida").

From Dibulla on the seaside to the base of the Cordillera the plain ascends to about 150 to 300 feet. It is covered with forest, as are the slopes of the mountains up to 8,000 and 10,000 feet, the exception being some considerable clearings between 3,000 and 8,000 feet in the Arauja Indian district. In close proximity to the sea the soil is largely composed of sand, but on receding a mile therefrom a deep loamy soil on flat swamy belt affords a congenial site for a magnificent forest of palms—an impressive scene of tropical luxuriance. From these palms to the foot of the hills the forest consists chiefly of huge exogenous trees growing somewhat widely apart for a tropical forest, together with an exceptionally thick undergrowth. Many rivers and innumerable quebradas (ravines) connected therewith cross the plain. Here, too, the soil, over which a blue limestone abounds, is extremely rich and fertile. It was here, about two miles from the base of the hills, that I first observed the cacao tree.

The important fact with regard to these trees is that they are of spontaneous growth, and therefore wild cacao, the original Theobroma cacao. Still nearer the hills I found the tree dispersed on all sides.

At another point, some half-a-dozen miles to the westward, while crossing the plain in the direction of the highest summits of the Sierra Nevada, the wild cacao I found to be a predominating, or characteristic species of the forest undergrowth. Here I traversed a zone of cacao not less than 8 miles wide, thus distributed on the plain as well as on the lower slopes to the numerous spurs of the mountains ranging from 300 to 1,300 feet above the level of the sea.

At Don Diego and still further to the west, a distance of about 40 miles from Dibulla, cacao is found in the forest under precisely the same conditions as those described. And I am assured that all along the base of the Cordillera to Trienta, where the eastern extension of the Sierra Nevada disappears, cacao equally abounds. Thus a continuous distribution from beyond Don Diego to Trienta of about 100 miles. This great cacao zone is entirely uninhabited, and the lands, though obtainable for a few reals* per hectare, "terras baldias" (unoccupied lands), are unsought for, their value being wholly unknown. Moreover, the existence of wild cacao seems to have escaped attention.

Under the dense shade of the great forest trees 80 feet high, with trunks 5 and 6 feet in diameter, the cacao, presents an aspect totally unlike its cultivated congener. The matured cacao trees attain a height of from 35 to 45 feet, with slender trunks devoid of branches to within a few feet of the top; and these trunks are as straight as those of a palm tree. All the mazorcas (pods), with few exceptions, are borne among the sparsely, foliaged branches at the summit. Besides the full-grown trees, others exist in all stages of growth, hundreds being scattered over a hectare of land. The excessive shade has imparted a weird and ill-proportioned appearance to these trees, many of which, drawn up towards the gleams of light, are not thicker than a walking-stick though 20 feet high. Not only have these cacao trees to struggle under the unpropitious shade of gigantic trees, they have also to contend with numerous minor rivals—an aggregation of species which constitute a tropical under-growth.

The productive capacity of these trees is very variable; some, more favourably situated, yield as much as 10 and 12 lb. of cured cacao, but the great majority yield insignificant returns. It is to be regretted that trees with good crops of fruit are very frequently cut down, this being the easist means for securing the crop.

Among the cacao trees there is no variation whatever in the general from and size of the fruit. The predominating colour is yellow, though mazorcas (pods) of a reddish hue are not uncommon. It is interesting to note that the seeds on section are perfectly white. All are undoubtedly one true specific type, a fact of great interest to cacao planters, for apart from the advantages of identity in the process of fermentation, new varieties must eventually evolve either by variation or by cross-fertilisation.

Several attempts have been made to bring these wild trees to a state of cultivation. I understand that the first effort in this direction orginated at La Loma many years ago. This attempted cultivation has been confined to the removal of the thick undergrowth which surrounds the cacao tree, and afterwards, at intervals of a year or more, cutting down the weeds that spring up The result of these operations, though effecting some improvement in the production of fruit cannot be considered satisfactory, for the great obstacle to the development of the plant, namely, excessive shade, remains intact. However, by the operations in question, some relief has supervened; but the advantage gained is immaterial when it is remembered that 10,000 full-grown trees yield only 1,200 lb. of cacao per annum. Though some of these trees yield excellent results, the great majority of them are practically non-productive.

At a distance of about 2 miles from La Loma an industrious Frenchman has taken up the reclamation of the wild cacao on the lines adopted on that property. He has during two years cleared the undergrowth over more than 100 hectares, leaving the large forest trees; thus the cacao trees, which formed a part of this undergrowth, have been carefully preserved; and, moreover, one or two experiments are being initated, such as supplying vacancies where the wild cacao plants were wanting, and topping trees of moderate size in order to induce them to branch at a convenient height. Notwithstanding these trials, it seems impossible to conceive trees which have emerged from

* At the present exchange a real is worth about 2*d*.

the conditions of forest life accomodating themselves to the changed habits requisite to bring them into a state of remunerative productiveness as is the case with systematically cultivated cacao, for cultivated trees from the outset are made to flourish. Having been particularly requested to give my opinion as to the prospects of this enterprise, my reply was not encouraging. I, however, suggested as a remedial measure the destruction of some of the large forest trees at given intervals, so as to command more light. With a more abundant admission of light no doubt some benefit would accure, but the advantages attendant upon the establishment of scientifically-formed plantations would far out-weigh that derived from such partial improvements.

It is well known that cacao under cultivation is a shade-loving plant. Neverthless, in many instances protection from the sun is not absolutely necessary. A medium well-regulated shade is what the cacao planter should carefully establish. In Trinidad, whence more than 20,000,000 lb. of cacao are exported annually, two species of the genus "erythrina" are employed for this purpose. These are planted widely apart among the cacao, trees, and answer the purpose well.

In addition to the attempts at cultivation already referred to, similar trials are being made on a considerable scale at Don Diego, and by another party elsewhere.

The form of the pod, besides being smaller, is quite distinct from the more elongated types of criollo and forestero, the most prized varieties under cultivation in Trinidad and Venezuela.

Though the pods in the wild type are considerably smaller than those of the best cultivated forms, it is noteworthy that in the former the seeds are larger and the pods more economically filled; thus 10 and 11 pods yield 1 lb. of cured cacao. This result will be best exemplified by the following comparison with Trinidad cacao.

According to a treatise on cacao cultivation and curing recently issued by the Botanical Department of Trindad, the entire contents (seeds, pulp, &c.) within the forest pod as cultivated in that island, when weighed, amount to just about 4 ounces, and "the pulp surrounding the seed, with the placenta, weighs nearly the same as the cleaned kernel." Thus in the Trinidad pod the seeds weighed 2 ounces, whereas the wild cacao seeds, similarly divested of the extraneous matter, weighed 8 ounces, the waste matter surrounding the seeds being considerably less than that appertaining to the Trinidad seeds.

We have, then, in the wild cacao not only smaller pods, but also an enhanced productive capacity. Besides, the superfluous pulp in the cultivated varieties is a source of inconvenience to the planter: "The pulp cannot be removed by washing before fermentation, and even after the decomposition caused by fermentation it is somewhat hard to remove." Under the favourable circumstances referred, to namely, smaller pods, and these more economically filled, consequent on the diminution of the waste matter, the wild plant, not only on practical grounds, but also on physiological principles, is capable of yielding larger crops than are obtained from the varieties in cultivation. Hence the importance of the propagation and establishment of plantations of this the original type.

In Trinidad and other cacao-growing countries great importance is attached to fermentation, as this operation imparts the requisite colour and consistence to the article. On the other hand, the method of curing the insignificant crops gathered on the plains of the Sierra Nevada is primitive in the extreme. Sometimes the pods unopened are simply put to dry in the shade until the seeds become fit for use, sometimes the seeds are wrapped in large leaves for a week and then dried in the sun, and sometimes the seeds when extracted from the mazorcas are placed in a barrel for three days and then dried, the barrel containing the cacao being placed under a roof without side-walls.

Notwithstanding these elaborate preparations the wild cacao, as has been demonstrated by frequent exports of several quintals, holds its ground, for it was classed in the Paris market with the best Caracas brands.

In two reports of mine, published by the Colombian Government, I strongly advocated the introduction of cacao seeds from Trinidad with the view of ameliorating the degenerated plantations of the interior. The result of my excursion to the Sierra Nevada, as reviewed in this report, completely nullifies my former impressions as to the advisability of importing this seed; now the conditions are reversed, the wild cacao being "par excellence" the kind for cultivation throughout the republic.

In those countries in which this product has become a staple the yield per tree hardly averages 1½ lbs. With our wild cacao I feel sure that under careful cultivation that average can be doubled, though in making an estimate of returns I prefer to curtail this prospective average. The cacao planters of Tolima, where millions of lb. are cropped, annually obtain an average of little more than ½ lb. per tree. Hence the replanting of the degenerated fields of the interior, as well as the extension of this cultivation, with seeds from the Sierra Nevada, is a measure the importance of which cannot be overrated. Arrangements could be made for the acquisition of these precious seeds on a large scale. On this point I may add that, on my recommendation, a gentleman who is planting cacao largely among his highly cultivated banana plantations near Santa Marta has already taken steps to obtain a supply of seeds of the wild type.

During my sojourn on the Sierra Nevada I visited a roza (cultivated field), on which a few trees of the wild type were under cultivation. These are old trees, growing at the considerable altitude of 3,100 feet above the sea, and they are fully exposed to the sun. The owner assured me that he frequently obtains a crop of 12 lb. cured cacao from a tree. Unlike their congeners in the forest the cultivated plants are well furnished with branches from the lower part of the trunks.

The cacao planter at the coast directs his attention exclusively to the production of this commodity for export, whilst the cacao planter of Tolima and other interior provinces finds a ready market on the spot in consequence of the large domestic consumption. The latter planter, indeed, commands an abnormally high price owing to the supply not adequately meeting the demand; thus prices actually rule higher than in Europe. The planter at the coast, however, posesses the great advantage of cheap transport to the markets of Europe, an advantage equivalent to some three 3 pesos (about 5s) per arroba (25 lbs.)

From the foregoing observations it will be seen that my convictions are in no way favourable to the irregular and ungenial attempts at cultivation being pursued with the wild cacao in the forest. No doubt some improvement could be effected by cutting down large forest trees at given intervals, but even in this case I cannot anticipate results at all comparable to those obtainable from well-devised practical methods involving the clearance of the entire forest so as to form new plantations, and this, too, not with the natural seedlings of the forest but with specially propagated plants obtained from the wild stock.

The altitude of this wild cacao zone is just over 11 degrees. Consequently the following extract from "Humboldt's Personal Narrative of Travels" is peculiarly interesting:—"The tree which produces the cacao is not at present found wild in the forests of Terra Firma to the north of the Orinoco; we began to find it only beyond the cataracts of Atura and Maypure. It abounds particularly near the banks of the Ventuari, and on the Upper Orinoco, between the Padoma and the Gehette. This scarcity (? absence) of wild cacao trees in South America, north of the latitude of 6 degrees, is a very curious phenomenon of botanical geography and yet little known. This phenomenon appears the more surprising, as, according to the annual produce of the harvest, the number of trees in full bearing in the cacao plantations of Caracas, Nueva Barcelona, Venezuela, Varinas, and Maracaibo is estimated at more than

16,000,000. The wild cacao tree has many branches, and is covered with a tufted and dark foliage. It bears a very small fruit, like that variety which the ancient Maxicans called "thalcacahualtl." Transplanted into the Conucos of the Indians of Cassiquiare and the Rio Negro, the wild tree preserves for several generations that force of vegetable life which makes it bear fruit in the fourth year."

The question of selecting to afford shade to the cacao plantations is extremely important. As we have seen, a useless tree is planted for this purpose in Trinidad and elsewhere. In the earlier stages of the plantations maize, bananas, &c., suffice for shade. Later on, a tree of rapid growth with a semiumbrageous habit is required. In Colombia there are various species of indigenous caucho (rubber) which merit the attention of cacao planters. I understand that a valuable species easily propagated grows on the banks of the Rio Sinu. This, as well as other kinds of caucho, should be tried. Zarrapia ("dipterix odorata"), indigenous in the llanos, is another tree worthy of attention. The establishment of economic shade trees, destined to yield important subsidiary crops, is a matter of the utmost consequence to the progressive development of the cacao enterprise in this country. I may here mention that I called the attention of several of the gentleman engaged in banana and cacao cultivation near Santa Marta, to the utility of substituting such shade for the ill adapted trees they have chosen, one of which being "Pithecolobium saman."

Reference has been made to the cultivation of cacao in conjunction or intermixed with the banana. This latter has now become an established industry at Rio Frio, where the plantations are being constantly extended with commendable enthusiasm. Though the industry is in its initial stage a steamship is despatched fortnightly from Santa Marta with a full cargo comprising from 13,000 to 15,000 bunches. The plantations present a most luxuriant aspect, the result of admirable cultivation—a cultivation in which irrigation plays an important part. Throughout hundreds of hectares of these plantations cacao has been planted contemporaneously with the banana. The overpowering growth of the latter, however has checked to some extent its less exuberant companion, which has consequently suffered. Besides, in the hurry of cropping the banana, cutting them down, &c., the cacao is often injured. The progress made by much of this cacao in the course of four years is hardly greater than should be attained in two years were the plant grown under congenial circumstances. As a means of alleviating the cacao I have made the suggestion to establish the plants in nurseries, there to be transplanted several times until they become vigorous and several feet high, at which stage they can be safely transferred to the plantation; also for the general welfare of the cacao I recommend that the bananas be set at greater distances apart so as to ensure more adequate light and free circulation of air.

It will thus be seen that the establishment of the two products conjointly presents some difficulties. Both are planted equidistantly. At Rio Frio a modification of the present system would no doubt prove a preventive to the injury sustained by the young cacao trees. At the same time it must not be assumed that cacao will flourish with its wonted vigour when cultivated conjointly with a plant that is in some degree antagonistic; in other words, the cacao is suppressed in the shadow of a stately mass of great banana leaves. On this account probably the cultivation of the banana among cacao should be limited to three years.

Report on the Cultural Capabilities of the Sierra Nevada of Santa Marta.

With reference to my visit to the Sierra Nevada of Santa Marta in the month of May last, I now furnish another report on its cultural capabilities, especially with regard to the banana and caucho (rubber) cultivation on the plains, and coffee on the hills.

Barranco.—This large property, the cultural resources of which indicate those of the entire plain, is situated midway between Rio Hacha and Dibulla. It extends from the sea, by which it is bounded, towards the foot of the Cordillera. The Rio Enea forms the western boundary along about 9 miles of its course. This river is navigable for small craft throughout the year. The area of the property amounts to 18,092 fanegados—more than 26,000 acres. For general cultural purposes the best lands on this property are located several miles distant from the sea where many thousands of acres are well adapted for cacao, banana, rubber and other valuable products.

In proximity to the sea, the characteristic feature of the Barranco lands answers the description conveyed in my letter of June 26:—"The Rio Hacha plain, with the exception of the lands within a few miles of the mountains, is a comparatively arid region, having a scrubby parched vegetation."

The cultivation of bananas on a commercial scale is a new Industry in Colombia. Costa Rica and Jamaica are the principal sources whence the United States is supplied with this fruit. In Jamaica it is now the most important article of export, having in recent years outstripped the former great staple industry—sugar. In 1889-90 the value of the bananas exported from that island was 446,974*l.*, the number of bunches being 4,729,037. In the following year 1890-91, the value increased to 638,974*l.*, the area under cultivation amounting to 9,097 acres. Now that this industry has been fairly inaugurated in Colombia, the rich soil on the plains of the Sierra Nevada may well vie with Jamaica, indeed, judging from the large extent of cultivation already established at Rio Frio, this new enterprise claims a position amongst competitors. At Rio Frio irrigation is resorted to the locality being subject to prolonged droughts, but the influence of irrigation is abundantly demonstrated by the remarkably luxuriant aspect of the plantations, and the splendid crops of fruit. Already some 13,000 bunches are being exported fortnightly, and this number will be greatly increased shortly.

As to the fertile lands of the inland portions of Barranco, no more eligible region for the cultivation of bananas is conceivable. Here, near the base of the mountains covered with forest the climate is humid, consequently irrigation is unnecessary. In the event, however, of exceptional droughts the fine Rio Enea can be turned to account with the utmost facility. It is essentially requisite that a sufficient area be planted with bananas so as to maintain a steamship service fortnightly, as is the case at Santa Marta, for it is found that crops of this fruit are fit for cutting every fortnight, and if not accordingly cut, great loss ensues. A steamer carries from 13,000 to 20,000 bunches. To maintain a fortnightly service some 300 hectares of bananas would have to be established. This extent of cultivation (750 acres) represents one-twelfth of the total area under cultivation in Jamaica, and correspondingly, one-twelfth of the value of the Jamaica crop, viz., 53,248*l.* This latter sum is, therefore the value of the banana crop obtainable from 300 hectares, 177*l.* per hectare, in that island. This estimate of returns may safely be taken as a criterion for the productive capacity of the Barranco lands.

At Rio Frio the estimate for preparing the land and cultivation, including irrigation, until the plant becomes productive at about the end of a year, is from 150 pesos to 200 pesos* per hectare.

In my previous report I referred to the cultivation of rubber as a shade tree for cacao in lieu of the useless tree everywhere employed for this purpose. Under this system of cultivation the rubber is distinctly a subsidiary product, cacao being the primary object. For the purpose of affording shade the rubber trees are set widely asunder, some twenty to the acre, thus on a cacao plantation of, say, 302 hectares (750 acres), 15,000 rubber trees.

* 12*l.* to 16*l.* at present exchange.

The importance of rubber cultivation is universally admitted. I will therefore propound a scheme for its cultivation on a principle that will ensure the production of rubber under the most advantageous circumstances. My proposal is to form systematically planted rubber and banana plantations both to occupy the same land, and to be duly interplanted in accordance with the requirements of the respective plants. No difficulty stands in the way of carrying out this dual cultivation, neither plant possessing any predominant influence injurious to the other, at any rate during the first 5 years, after which smaller crops amounting to from 10 per cent to 20 per cent may be placed against the bananas.

The rubber tree is set much wider apart than cacao is among bananas, and after 3 years' cultivation it will have attained a height exceeding the bananas.

The two plants may be cultivated in companionship for some 10 years until the rubber begins to yield crops. We have thus a great plantation of rubber resulting from banana cultivation, a plantation ready to yield a precious commercial substance just at the time when the bananas may be said to have run its full course of productiveness. With the different important species which it is advisable to establish, an average of about 90 trees per acre will result, consequently a plantation having an area of 300 hectares would contain 67,500 trees.

Between the tenth and twelfth years the rubber trees would yield returns sufficient to cover the then current cost of their cultivation.

Between the twelfth and twentieth years each tree would yield at least 2 lb.* per tree annually. Subsequently, and for more than half a century, it is quite safe to estimate the returns at double the foregoing, that is, 4 lb. per tree. From 67,500 trees, or better to say 60,000—allowing for unsatisfactory specimens—2 lb. per tree would be harvested annually, or 4 lb. bi-annually. From the twelfth to the twentieth years, therefore, we have an annual crop from 60,000 trees of not less than 120,000 lb., which at 2s. per lb., or 4s. per tree yearly, amounts to 12,000*l*. Deduct from this for working expenses, say, 3,000*l*. Hence a net profit of 9,000*l*. per year. From the twentieth year onwards, 24,000*l*. per year would be realised from the crops, less for working expenses, &c., 6,000*l*., thus a net profit of 18,000*l* per year.

Colombia has made a beginning with a valuable indigenous species planted near Chaparral at a height of about 6,000 feet above the sea; and it grows with remarkable rapidity.

The following extracts relative to rubber and its cultivation are culled from the most reliable sources:—

As previously mentioned in these reports extensive tracts of this large plain (including Barranco) are distinguished by a scrubby parched vegetation. This is exactly the condition applicable to the requirements of the Ceara rubber tree, and it would be impossible to secure a more eligible district. In this connection I may mention that I have had opportunities of practically knowing the habits of this species, having many years ago introduced a few plants of it to Jamaica where I grew it in both humid and arid localities. I also introduced it to Colombia and planted it at Chaparral, in the wet soil and climate of which it perished. I may further mention that I introduced the Para and the Castilloa rubber trees to Jamaica; now these are but denizens of the Botanic Garden.

The important point as regards this district is, that the "parched scrubby vegetation" covers the country so scantily that the Ceara rubber can be planted without the necessity of clearing the existing growth, that is to say, the seeds of this tree have merely to be set in the ground among the scrubs without any other preparation than sometimes chopping down with a cutlass a bush or two that may be in the way of sowing the seed. In this way the cost of planting an acre (200 to the acre) need not exceed 2 dol. The seeds germinate under certain conditions immediately, and spring up with wonderful rapidity, that is, in the course of a year they grow 6 feet to 10 feet. And for their subsequent cultivation, 2 dol. per acre per annum—a liberal allowance—would suffice. A thousand acres would contain 200,000 plants, and after 10 or 12 years, 1 lb. of rubber per tree would be harvested annually, or, say, only 150,000 lb., a return that would be greatly enhanced later on.

The three species of rubber I have referred to, comprise the most valuable commercial kinds of tropical America, and America stands pre-eminent in all that relates to rubber. The other best known kinds are Ficus elastica of India, and the Landolphias of Africa, species of secondary importance. Colombia possesses in the remote regions bounding the head waters of the Amazon and the Orinoco valuable, and at present scientifically unknown, species of rubber. In the territory of Caquetá, for instance, a highly valuable kind abounds. Hundreds of arrobas of this have been extracted from the locality, and this notwithstanding the extraordinary difficulty of transport. The high prices obtained for this rubber in New York sufficiently determine its quality. From what I have ascertained it is in all probability the produce of a Hevea, the Para rubber genus. There is another important rubber tree found in large quantities on the llanos of San Martin. This sort is being exported to a considerable extent, roads or tracts having been made through the forest to facilitate its transport; this may be another species of Hevea, but from the description I have had of it is probably not identical with the Para species. Writing to the Secretary of State for India, a gentleman who has penetrated to the head waters of the Orinoco, says "I found it (Hevea) very abundant high up on the Orinoco above the junction of the Guayare." This points to the Hevea being indigenous to Colombia. Another species is found on the banks of the Rio Sinu; this is probably the Castilloa. Seeds of all these kinds can do doubt be obtained in abundance. These brief allusions to the rubber species of Colombia, and there is another important kind that grows on the high mountains, point in a manner not to be mistaken to the unequalled, or, at least, unsurpassed resources of this country for rubber cultivation. In this connection it may not be amiss to add that it behoves tropical America to repel the following prediction of an eminent writer on tropical agriculture:—"Indeed there is every probability that in the long run, as with cinchona so with caoutchouc, it is upon systematic plantations in the Old World that we shall have to depend for our supply." This writer does not venture to reclaim coffee, which is a triumph of the New World. But even in the case of cinchona barks of the Old World cannot grow them like the New; for those cultivated in Colombia are the richest in the world, notwithstanding that one of the species thus distinguished has actually been grown from poor East India seed. As to rubber no doubt the best quality will continuously come from tropical America.

There is one acknowledged difficulty that stands in the way of rubber cultivation, I refer to the long lapse of years before the crops are assured. From the point of view of a tropical planter, 10 or 12 years to wait for returns involves hesitation. On secondary thoughts this should be no real difficulty. Be this as it may, I have in this report planned a method calculated to overcome this objection, that is to say, the intervention of banana cultivation.

It has been shown that in the midst of a large banana plantation another great plantation can be simultaneously established, a plantation comprising various species of rubber, and this is practically exclusive of cost after their propagation. Also intimately associated with this latter undertaking another great plantation of rubber (Ceará) can be created on adjacent waste lands at a minimum cost. Thus rubber plantations, respectively consisting of 67,500 and 200,000 trees, both of which are estimated to produce when 12 years old rubber valued at 17,000*l*. a year. And 8 years later 26,000*l*. These estimates have been arrived at after careful consideration, always keeping in mind moderate estimates.

* Mr. Morris, the Assistant-Director of Kew Gardens, says the Castilloa trees at 10 years old yield 4 lb. to 7 lb. of rubber.

As these rubber plantations are to spring from the banana enterprise, the first step to be taken is to inaugurate this latter, cultivation. 300 hectares being a large area, at least two years would be necessary for clearing and planting same. In these operations 200 dol. per hectare should be estimated, and subsequently for maintaining the plantations 100 dol. per hectare per annum. Also for superintendence &c., 10,000 dol.*

A steam launch with barges would be required to carry the fruit down the river to the steamer lying off the land. And a few miles of light tramways should be constructed in parallel sections through the plantation so as to facilitate the carriage of the fruit to the river.

The value of the crops, taking the Jamaica average before referred to, would be 177*l.* per hectare per annum; for 300 hectares, 53,248*l.*

Nearly all the work in connection with the plantations can be performed on the contract system, but as labour is not available on the spot a liberal rate of wages will have to be fixed in order to induce peons to settle on the property.

During the last few years coffee has become the most important article of export from Colombia, and its cultivation is rapidly assuming large dimensions. But the expansion of this cultivation is mostly confined to districts remote from the coast. In this important movement the Sierra Nevada with all its advantages of situation has taken no part, except perhaps at the point where this system of mountains is severed from the Andes. The slopes of the Cordillera as compared with those of the Andes are steep and precipitous in many parts. But numerous sites, in point of adaptability, equal to those available on the Andes may the selected here. Here coffee is placed in similar climatic conditions at 1,000 feet nearer the sea level to which it is on the mountains of the interior, from 5 to 7 degrees nearer the equator. At the foot of the Sierra Nevada where one or two small plantations are being formed, I observed at a height of only 200 feet above the sea one of these plantations yielding a fine crop to be harvested just when two years old.

Selections for sites should be made on the slopes of the mountains, not on the hot plains, at from 1,500 to 4,000 and 5,000 feet above the sea.

At a short distance from Barranco, but separated by the tractless forest, is situated Cueva, the mountain property appertaining to the former. Here some excellent sites rising to 5,000 feet are available for coffee. This cultivation in connection with the projected great plantations on the plains merits special consideration. Among other advantages that of locality is most favourable when it is remembered that 5 pesos per quintal (about 8s. per cwt.) is no uncommon price paid for the transport of coffee from the interior to the coast. Moreover, it is both interesting and useful to have in connection with and in the immediate vicinity of the hot plains another culvation established in the genial temperature of the mountains.

On the lower sides as well as on the hot plains a different species of coffee, namely, the Liberian, would find a fitting home. This species is well worthy of extensive patronage.

Having dealt in this report with the utility of embarking upon the cultivation of some of the most valuable of tropical products, it should be also noted that other specific elements of wealth await development in this district, for instance, cattle farming has always been one of the most profitable investments in Colombia. Other precious products also claim attention, such as the extensive planting of coconuts, which after being planted take care of themselves.

In conclusion it may be observed that this region, the resources of which have been so favourably reviewed in this and in my previous report, is in itself phenomenally rich in spontaneously distributed vegetable products. If we turn to the large West India islands, with which in some respects it may be compared, for, presumably, it must have narrowly escaped becoming an island, being completely isolated from the Andes on the one side, and bounded by the ocean on the other, none of these has ever exhibited such expansive spontaneous indigenous wealth of vegetable commodities valuable to commerce. Thus apart from products of minor importance may be mentioned the occurrence of wild cacao in great profusion, divi-divi spread over the plains and yielding many thousands of tons of its legumes for annual export, and henequen (Avage rigida) capable of yielding fibre also to the extent of many thousands tons annually. These islands (plantation colonies) were first of all made prosperous by slavery, and by the almost exclusive productions of sugar for which this slavery was begotten. But sugar-cane cultivation can no longer be pronounced the privileged product for adoption by these regions. Instead of that, cultivation for more lucrative objects to meet the demands of commerce are now allotted to this new region, the Sierra Nevada; the physical features of which, moreover, offer great contrasts to and throw into the shade all the Antilles.—*Kew Bulletin.*

* These sums indicate Colombian paper currency, at present 12½ dol. to the 1*l.*

COFFEE CULTIVATION IN ANGOLA.

In a Foreign Office Report (No. 1,333, Annual Series, 1894) Mr. W. Clayton Pickersgill, C.B., Her Majesty's Consul at Loanda, gives a descriptive account of the Portuguese Colony of Angola, on the south-west coast of Africa. The interior of this Colony, rising in a succession of terraces from the sea, consists of large tracts of fertile and well-watered country, and roads, somewhat rough, it is true, reach inland stations nearly 200 miles from the capital. Coffee plantations appear to flourish here on a large scale. It is not clear what kind of coffee is cultivated. The estates are said to have been established "by the appropriation of forest in which coffee was growing wild or by uniting patches already cleared by the natives." There are several species of coffee indigenous to West Africa. One of these, with very narrow leaves, *Coffea tenophylla* (see *Kew Bulletin*, 1893, p. 167), is cultivated to some extent on the hills at Sierra Leone. The Liberian coffee (*C. liberica*), also West African, is cultivated chiefly on coast lands. It is unlikely to flourish in the hilly districts of Angola. On the other hand, the Arabian coffee (*C. arabica*) may have been introduced long ago by Portuguese settlers and become naturalized in the country. In any case Mr. Pickersgill's description of the coffee estates and their circumstances at the present time will be read with interest:—

Crossing the Lucalla in a canoe, the traveller finds his path ascending to a seeming chaos of volcanic hills, and almost immediately he enters a fair, wild, wooded land of towering heights and echoing glens—the garden of Angola, and a veritable Eden compared with the dreary seaboard. A climbing ramble of three or four hours, amid scenes of refreshing beauty, carries him up to the valley of the highest crater—the loveliest of all—watered by a perennial stream.

On his way he has seen coffee in blossom and berry, growing in jungle luxuriance, and has had glimpses of white plantation buildings hidden amongst the green. Here he discovers a similar homestead—the storehouses, shop and dwellings, drying-grounds, engine-room, and distillery of an estate which is managed by two energetic young Englishmen. From a neighbouring summit—part of the crater's dizzy rampart—can be seen the headquarters of other properties in the valleys of Cazengo, which fall off east and west, while to the north extends Golungo Alto, a second volcanic jumble swathed in forest, concealing many more. Beyond again, in the same direction, lies the greater coffee district of Encoji; but that for the present is left unnoticed, as not being included in the strip of Angola, bounded by the Quanza and the Bengo, which is under survey.