RUBBER CULTIVATION IN THE EAST, AND THE CEYLON RUBBER EXHIBITION.

An exhibition of "rubber" has lately been held in the Royal Botanic Gardens at Peradeniya, in Ceylon, with the most unqualified success, and the time is opportune to see where we stand, and to sum up the work of the scientific institutions which have been engaged in starting this new, and now very prosperous, industry.

Rather more than thirty years ago it began to be evident that there was a possibility that, as in the previous case of cinchona, the natural wild rubber supplies—which were then almost solely South American—would in time be exhausted, and an expedition was sent by the Indian Government, aided by the Royal Botanic Gardens at Kew, to the valley of the Amazon, where seeds and plants of the Para rubber—*Hevea brasiliensis*—and other rubber-yielding plants were obtained and safely conveyed to Kew. From Kew they were sent to the East, and as it was fairly evident that at that time there was no place in India suitable for their growth, they were sent to the care of Dr. Thwaites, in Ceylon, the then director of the botanic gardens in that colony. A few were also sent to Singapore and elsewhere. These plants arrived in Ceylon in 1876, and were planted chiefly in the low-lying garden of Henaratgoda, which was specially opened for their reception.

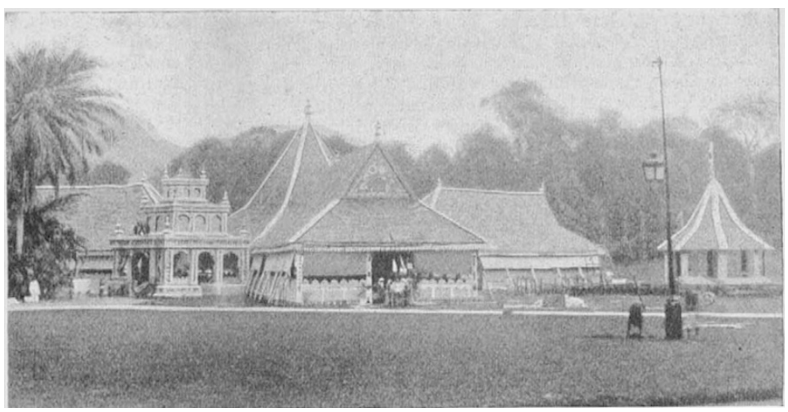
The trees began to seed about 1882, and from that time onwards practically all the seed has been used. Of the earlier crops a large part was sent to other countries, but in later years most of the seed was used in the island. In 1888 the late Dr. Trimen, Thwaites's successor, began to tap one of the original trees at Henaratgoda, and in that year, working in the rough way then practised, 1 lb. 12 oz. of dry rubber were obtained from it. V-shaped cuts were made with a chisel, and the milky latex allowed to run down into cocoanut shells and to dry naturally. The tree was given a rest in 1889, and in 1890 gave 2 lb. 10 oz. It was again tapped in every second year following, and by 1896, in which year the experiment came to an end, it had yielded 13 lb. 7 oz. in the five tappings, and was twenty-two years old. The average yield was thus about $1\frac{1}{2}$ lb. a year, but the tree was twelve years old when the experiments began, and was also, instead of being of the average size, the largest tree in the plantation. At this rate, therefore, there was but little prospect for success, especially with the price at the comparatively low figure which it then occupied.

The next stage in the work was in 1897, when the writer found that the average yield of a plantation of trees about twelve years old might be about 120 lb. an acre, and also made the very important discovery of the "wound response." It is found that the second tapping of a given area, provided it is made within about ten days, will yield a larger flow of latex than the first. Thus, in the experiments just mentioned, the average yield per tree in the first week was 0·73 oz., in the second week 1·48 oz., in the third 0·97 oz., fourth 0·80 oz., and only in the fifth did it fall below that obtained in the first week, being only 0·67 oz. This is a discovery of very great importance, and one of which a scientific explanation is very desirable. From these figures it was calculated that a rubber plantation might show a profit of 27 per cent. at the tenth year, and with this the taking up of the industry began in Ceylon, being handicapped only by the very limited supply of seed.

In the following year Mr. John Parkin came out to Peradeniya as assistant, and was at once started to work at rubber. He worked out the whole question of the wound response, and, further, worked out in detail a new method of preparing rubber in far purer condition than had previously been the case. Biffen had shown that the essential elements in the smoke used in South America were acetic acid and creosote, and Parkin applied this to the preparation of rubber in the East by collecting the latex in tins containing a little water (to prevent immediate coagulation) and mixing it with the calculated quantity of acetic acid and a little alcoholic solution of creosote. The milk being filtered before treatment, the result was to clot it into a perfectly clean "biscuit," which, when rolled out and dried, gave more than 93 per cent. of caoutchouc, a much higher proportion than had ever before been found in any sample of crude rubber. These biscuits were analysed by Messrs. Michelin and Co., of Clermont-Ferrand, and after going through the washing machine emerged 99 per cent. to 100 per cent., against about 80 per cent. for any of the best wild rubbers.

This work caused a still further demand for rubber seed, but it was still only in limited supply, though the older trees upon private estates were now beginning to come into bearing, and by 1902 there was almost unlimited seed available. At the same time a demand was also springing up in the Malay Peninsula, stimulated by the action of the director of the botanic gardens at Singapore (Mr. H. N. Ridley), who has steadily pushed rubber for many years.

For the next three or four years planting went on slowly, and then about the latter half of 1902 began to be rapid, with the increasing supply of seed. By the middle of the present year, 1906, there were in Ceylon alone more than 104,000 acres of land planted in rubber, almost solely the Para variety. Of the other South American rubbers, the Ceara sort, *Manihot Glaziovii*, was largely planted in Ceylon in the early 'eighties, but never quite realised expectations, and has never been more than a minor crop, though the export has never actually ceased. The other, *Castilloa elastica*, is a very puzzling tree as yet. It grows with great rapidity at first, and then slows down, and though it yields very freely at first tapping, it has no wound response, and dies if too severely handled. It has only, consequently, been planted on a very small scale as yet. Para rubber, on the other hand, seems to grow freely up to a small elevation in any part of "wet" Ceylon, and can be very roughly handled without, so far as can be seen, suffering any serious injury. None of the other rubber-yielding trees has given remunerative returns.



Buildings of the Rubber Exhibition held at Peradeniya, Ceylon, on September 13–27.

Not only are there already so many acres in Ceylon, but the Malay Peninsula has about 50,000 or 60,000 acres, and many other eastern countries have also considerable areas, all practically under Para rubber only, while in the west, Mexico has, it is said, about 20 millions of trees of Castilloa planted, or, allowing 200 trees to the acre, an area of about 100,000 acres. This we believe to be an overestimate, but at any rate there is a very large area in that country. Altogether it is probable that at the present time there are about 275,000 or more acres planted to rubber. Allowing that the Para rubber yields twice as much as the Castilloa, this will represent about

230,000 acres, upon which, taking the present Ceylon figures, the eventual yield will be about 400,000 cwt., or 20,000 tons, about a quarter of the probable world's consumption at that date; and planting is going on at a very rapid rate.

The market for a short time looked askance at the biscuits, but they speedily came into favour, and have for a considerable time been receiving a higher price per lb. than the best wild rubber of the Amazon. But this must by no means be taken to mean, as it often is taken, that the plantation rubber is better than the "wild," for the latter contains about 20 per cent. of moisture, while the former is dry, so that in reality the wild rubber is getting about 16 per cent. more in price. Examination of the two qualities will at once show the reason for this difference; the plantation rubber is not quite so elastic, and when much stretched does not at once return, as does the wild rubber, to its exact pristine shape. What the reason for this difference may be is the great problem now before the scientific institutions working at the chemistry and botany of rubber in the tropics.

During the last four years the prices of rubber have continued to rise until they have now reached a height previously undreamt of. The result has been that the early pioneers of rubber cultivation have reaped enormous profits, amounting to as much, in some cases, as 60*l.* per acre per annum, and this has still further stimulated the rush into rubber planting.

The one topic of conversation in planting circles in the East is now rubber, and almost everyone, whether a planter or not, has invested in the industry, with the result that shares have risen very considerably, being, in the case of companies owning bearing rubber, now from three to eight times their par value. With this degree of interest excited in it, it is hardly surprising that a proposal was made that Ceylon, the country in which most rubber was cultivated, should hold a rubber exhibition, and this was actually held in the famous Royal Botanic Gardens at Peradeniya from September 13 to 27.

Buildings upon a fairly extensive scale were erected in Kandyan or mountain-Sinhalese style, and a large display of every kind of rubber was obtained, mainly, of course, from Ceylon and Malaya. There were also exhibits of tapping knives of every kind, and two large sheds were filled with the machinery that is rapidly coming into use upon rubber plantations. A very successful feature of the exhibition was the series of lectures upon every branch of rubber cultivation, shipment, and manufacture that was given during its progress, and which will shortly appear in a book, which should be at the hand of everyone interested in rubber.

The bulk of the Ceylon exhibits were in the form of biscuits, the form originally adopted by Mr. Parkin in the laboratory having been long adhered to. The Malayan were in the form of sheets of larger size; but the most conspicuous things in the show, from this point of view, were some large blocks of rubber exhibited by the Lanadron Estate, in Jahore, made by pressing what is known as crepe rubber (obtained by aid of a washing machine) into solid blocks by powerful hydraulic pressure. Not only does this form offer less surface to oxidation, but it packs more closely and thus saves freight, and it also sells for more upon the market.

The tapping knives for Para rubber exhibited much ingenuity, but not those for the other rubbers. It is worth pointing out here that persons interested—and who is not?—in introducing rubber cultivation into other countries should keep a sharp eye upon the development of the tapping knife in Ceylon and Malaya. Recent experiments in the West Indies, for instance, were carried out with a knife long since discarded in Ceylon, and the verdict was against this knife and in favour of the hammer and chisel, which form a very primitive tool indeed.

Some of the most interesting exhibits in the whole show were the samples of vulcanised and coloured rubbers, rubber and fibre mixtures, and other things shown by Mr. M. Kelway Bamber, Government chemist in Ceylon. These were referred to by Prof. Dunstan at the meeting of the British Association at York, and have aroused universal interest. Several technical papers have already given vent to the view that they can never be put to practical use, because each manufacturer has his own processes, which he will keep secret, for mixing and otherwise treating the rubber, apparently assuming that it is hopeless for the mere scientific man to find out such matters, or even to improve on them, or for one company, old or new, to take up the new process. Others, going on insufficient knowledge, have said that it is not possible to work with chloride of sulphur, or to mix other substances with the latex. In actual fact, the process is very simple, so simple that it seems a marvel that no one has found it out before. Instead of first drying the rubber into lumps or sheets, then macerating it, and mixing it with sulphur or other vulcanising material and colouring matters, these things are done *in the milk*, when the sulphur compounds will, of course, mix with the caoutchouc in a way that it is hopeless for any other method to equal, and when anything that can be wetted can also be easily incorporated, more especially colouring matters. In this way, by subsequent coagulation, a rubber is produced containing the vulcanising, colouring, and mixing reagents or substances in complete admixture. This can then be worked up in the ordinary way into any article that may be required, and finally heated, when it becomes vulcanised. Some of the most interesting exhibits shown by Mr. Bamber were the mixtures of rubber and fibre. The fibre is mixed with the milk in large quantity, the milk being previously sulphurised, and the mass is then dried, compressed under very great hydraulic pressure, and heated, resulting in a solid brick or tile containing but a very small proportion of rubber, and yet strong and elastic enough for the purposes of tiling or other uses.

This method of vulcanising will doubtless have to be modified in detail, but in principle is absolutely new, and is much simpler, and also much cheaper, than the present one.

Taking it altogether, the creation of the now great rubber industry, and its rapid progress from very rough and crude methods to a highly progressive and scientific spirit, is entirely the work of the botanical departments of Ceylon and Singapore, and they may justly pride themselves upon the result.

Recent Important Literature of Rubber.

"Para Rubber." By W. H. Johnson. (London.) Price 7*s.* 6*d.* A very good account of the industry as it was in Ceylon a few years ago, but already more or less out of date.

"Para Rubber." By Herbert Wright. Second edition. (Colombo: A. M. and J. Ferguson.) The best and most up-to-date account of the industry.

"The Book of the Rubber Exhibition of 1906." By J. C. Willis, M. K. Bamber, and E. B. Denham. (London: Dulau and Co.) Price 7*s.* 6*d.* To appear shortly. This book will contain the lectures given at the exhibition by numerous specialists, carefully revised and edited, many pictures, reports of judges, and other valuable features.

J. C. WILLIS.

METEOROLOGICAL NOTES.

"COLD Waves and Frosts in the United States" is the title of an important bulletin recently issued by the chief of the U.S. Weather Bureau. The work was prepared by Prof. E. B. Garriott; it includes a chronological account of historical cold periods in the United States since 1717, but deals more especially with the frosts that occurred from 1888 to 1902 inclusive, the conditions of which are illustrated by 328 charts. We have occasionally very cold spells in our own country, but these can scarcely be compared with those frequently experienced in the United States; as Prof. Moore has elsewhere pointed out, the area and intensity of cold waves depend upon the size of continents and their distance from the tropics. The author of the paper considers that the cold of the northern interior of the American continent is chiefly due to air that flows over that region from the northern Rocky Mountains, where its moisture has been precipitated, and to the process of radiation in its passage over Canada. The high barometer caused by the stagnant state of the air in this locality is one of the conditions that produce cold waves, another