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THE AGRICULTURAL JOURNAL OF INDIA.

AGRICULTURAL RESEARCH INSTITUTE, PUSA.

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PLATE I.

A. J. I.

A PLANT OF RHEA (*Boehmeria nivea*).

RHEA EXPERIMENTS IN INDIA.

By BERNARD COVENTRY,

Director, Agricultural Research Institute, Pusa.

Ramie, Rhea or China grass are the names under which this fibre is known. So much has been written about it in recent years, and success has so often eluded the grasp of the experimenter, that it is with some hesitation I am induced to add to the literature already existing. As however interest in the fibre appears to be reviving, the moment would seem opportune for an account of its position in India at the present time.

Rhea is not indigenous to India as is very commonly supposed, its native habitat being China, but it crept into India through Burma and Assam, and became established for a time in parts of East Bengal, where in certain localities near Rangpur it may still be found. It however never became an important industry, but was grown in very small patches, its use being confined to the making of fishing lines and nets. The cultivation of rhea as an indigenous industry need not, therefore, detain us.

Early Experiments.

Throughout the early half of the last century, numerous efforts were made by the East India Company to introduce rhea as a textile staple, and later the Indian Government considered the fibre of such importance that in 1869 two prizes of £5,000 and £2,000, and again in 1877 prizes of £5,000 and £1,000 were offered for machinery or processes by which the fibre could be prepared in such a way that it would meet the requirements of the market. Competitive trials were made at Saharanpur in 1872 and 1879, but no machine was found to satisfy the conditions of success. All these endeavours failed, and the Government's offer of prizes was eventually withdrawn.

Experiments were also carried out by several European planters and companies. The Madras Presidency seems to have been selected for the most important of these. Putting aside experiments carried out on a small scale with hand decortication (for it appears useless to consider this mode of operation owing to its cost), I shall confine myself to mentioning two important attempts, the one carried out by the Glenrock Company, Ltd., between the years 1884 and 1889 on their property at Pandalur in South-East Wynaad, and the other by Messrs. Finlay, Muir & Co., on their Reading Estate in Southern India from 1887 to 1894. The Glenrock Company planted some 400 acres in the forest slopes below Pandalur village, and about 100 acres at Kullar. Two methods of decortication were employed, one by the Death and Ellwood machine, another by steaming and removing the cuticle by hand, known as the Fremy system. According to Mr. Minchin, the Manager of the Company who was specially brought out from England, "the growth of the rhea was all that could be desired: as many as six cuttings of stems were obtained in the year, where assistance could be given to the plants by irrigation. Without irrigation at Pandalur, three cuttings were obtained between the months of June and November, during which months the rainfall is about 100 inches in all. The best outturn from one measured acre in 1886-87 under irrigation during the dry months was six cuttings:

1,384 lbs.	of stems	(8 stems to the lb.)	about	11,000	stems.
2,028 lbs.	,,	(8 do.)	,,	16,000	,,
4,446 lbs.	,,	(5 do.)	,,	22,000	,,
4,904 lbs.	,,	($6\frac{1}{2}$ do.)	,,	30,000	,,
3,660 lbs.	,,	($9\frac{1}{2}$ do.)	,,	25,000	,,
1,605 lbs.	,,	(15 do.)	,,	24,000	,,

18,027 lbs. (8 tons) weight of stems in the year, about 128,000 stems." The Company obtained only $3\frac{1}{2}$ per cent. ribbons by the Death and Ellwood machine, and from 5 to 6 per cent. ribbons by steam decortication according to the Fremy system. The price realised is not mentioned, but we find it recorded that "the

fibre obtained at the price ruling did not pay for the cost of production, and accordingly the cultivation was given up." On the Reading Rhea Fibre Estate, the experiment was made on a fairly extensive scale by Messrs. Finlay, Muir & Co. The highest yield of green stems was 64 cwt. 3 qrs. per acre from one cutting, from which about 7 per cent. of dry ribbons were obtained, but this was found to be an unprofitable return, and this experiment was also abandoned. These seem to be the only two attempts carried out in India on any serious scale until the more recent enterprise started at Dalsing Sarai and other Indigo concerns in Behar under the auspices of the Bengal Rhea Syndicate, Ltd., with which I shall deal later.

Cause of Failure.

The Glenrock Company's enterprise failed, not so much from any defect in the cultivation of the plant, but because the yield of dried ribbons obtained by the Death and Ellwood machine was only $3\frac{1}{2}$ per cent. and by the Fremy process 5 to 6 per cent. It is known that the yield of dried fibre on a given weight of green stems is 5 per cent. Present means of decortication generally give about 3 per cent., of which one-third is gum, leaving 2 per cent. of pure fibre. When we are told that the Glenrock Company only succeeded in extracting $3\frac{1}{2}$ per cent. of "ribbons," which we know to contain only 30 per cent. of fibre, the rest being cuticle and gum, it is easy to understand how the enterprise failed, for out of a possible total of 5 per cent. scarcely more than 1 per cent. was actually obtained. The yield from the Fremy system of steaming was a great deal better, for 5 to 6 per cent. of "ribbons" appear to have been got, or say 2 per cent. of fibre. This approximates more nearly to the results given by the Faure machine at Dalsing Sarai, but the expense of the Fremy system must have been great, for otherwise there seems no reason why it should not have been persevered in.

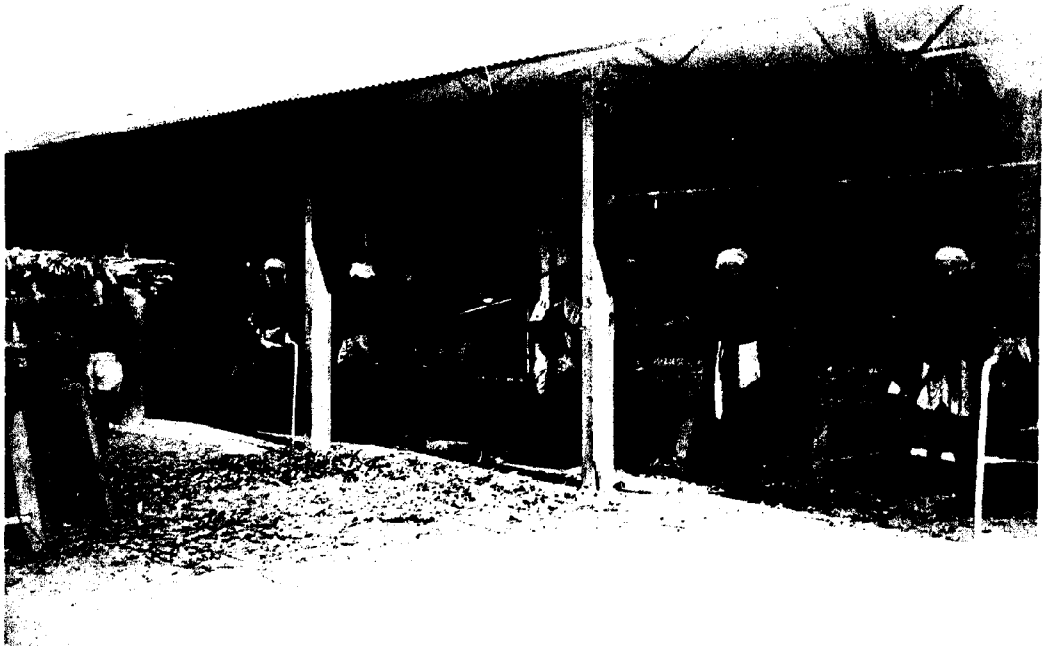
Experiments in Behar.

The decline of the indigo trade induced the indigo planters of Behar to seek new enterprises for their capital, and in 1903

eight concerns placed a portion of their lands under rhea. At the same time a company of Calcutta merchants, styled the Bengal Rhea Syndicate, Ltd., undertook to supply the Faure machine for the decortication of the plant, and to ship and sell the produce. Contracts were entered into between the company and the concerns on joint terms, the principles of which are that the company shall supply the machines, provide and erect the buildings, bale, ship and sell the fibre, while the planter undertakes to grow and manufacture the fibre at his factory, the expenses and realizations in connection with the whole enterprise being brought under a joint account. The area covered by these contracts aggregated over 3,000 acres. As the planting and cultivation progressed, it was found that many of the localities which had been selected were unsuited to the growth of rhea, so that ultimately the area actually put down did not exceed 2,000 acres. This quantity has again been reduced considerably owing to damage caused by quite recent floods. At Dalsing Sarai greater headway has been made than at other places, and it will be sufficient for the purpose of this article if my remarks are confined to these experiments alone.

Manufacture.

As already stated, the decorticator selected is that known as the Faure machine (plate II). These machines are of two kinds: one the ordinary machine used for scutching the butts of the stems; the other, similar to the first but with the addition of a counteraction, to which the stems after insertion into the machine are attached by the scutched ends, and by which the fibre is automatically withdrawn and delivered. In practice it is found that one ordinary machine will scutch the butts of enough stems for two counteraction machines, so that it is found convenient to work the machines in triplets. The decorticators consist of a set of beaters revolving at a speed of about 500 to 600 revolutions and operating on the stems against a counter-beater supported by suitable springs and india-rubber buffers, which cause a give-and-take to the action of the beaters as the stems are being drawn in and scutched. This enables the beaters to exert

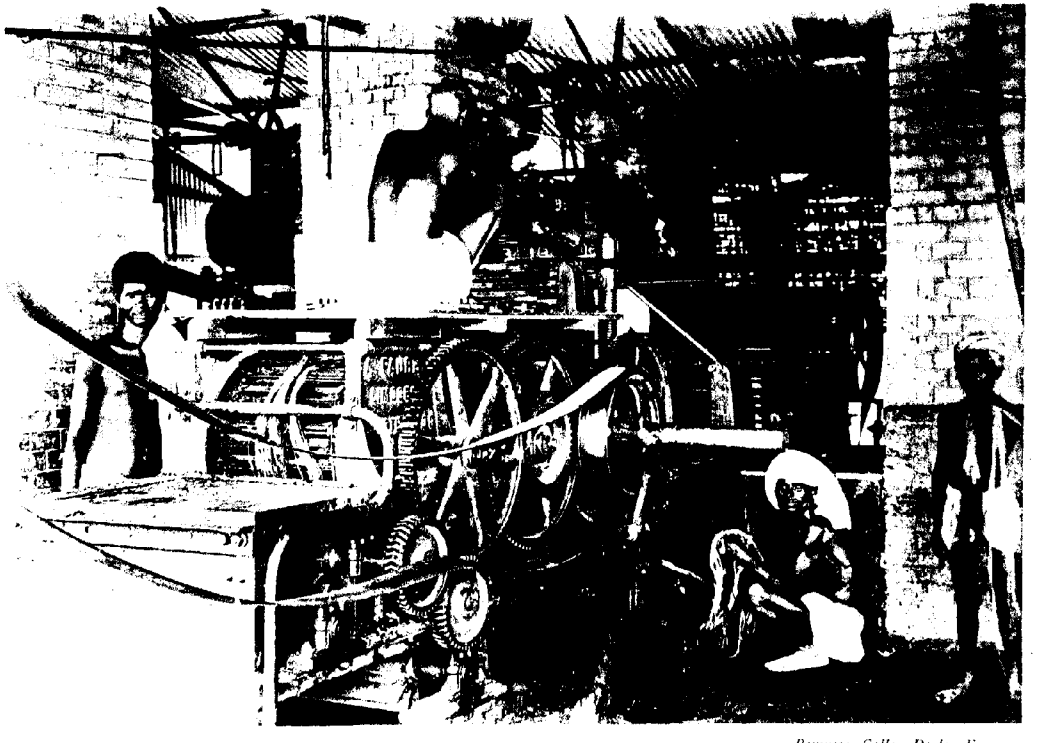


Bemrose, Collo., Derby, Eng.

FAURE RHEA DECORTICATOR.

sufficient action on the stems to break the wood and scrape the cuticle, without snapping the fibre. This has been the chief aim and object of the inventor, and is a great improvement on the rigid counter-plate of other machines, which causes such a loss in fibre by cutting. But it should be mentioned that the Faure machine, although the best of its kind in this respect in the market, still causes a very considerable loss by cutting. In order to obviate this defect, the inventor has quite recently introduced a New Improved Decorticator (plate III) which is still undergoing its trial at Dalsing Sarai. Instead of the fibre being drawn back in the process of scutching by the automatic counter-action, it is carried straight through a set of beaters which merely break and distintegrate the wood and bark, and is then deposited on to a carrying chain, when it is presently caught at one of the ends by a comb and fixed tight on to this chain. In its progress the opposite ends are quietly dropped between the blades of a couple of drums of quick revolving beaters, and on the return journey of the chain are withdrawn. The action of these beaters is so adjusted as to cause a combined hitting and scraping motion, and is yet so regulated that the tension exerted on the fibre is not enough to break it. In this way the inventor expects to save entirely the loss by cutting experienced with the old machine. The installation put up at Dalsing Sarai consists of three sets or triplets of the old machines, and two new and improved machines. The whole is worked from a counter-shaft driven by a 20-horse power engine. Tanks at a high level for the supply of water under pressure to the machines for washing purposes have been erected, and two hydro-extractors for the preliminary drying of the fibre. A sirocco fan for finally drying the fibre in wet and cloudy weather, and a baling machine with suitable rooms for storage, have also been added. After the stems have been decorticated, the fibre is taken by coolies and washed in running water, or, if found more convenient, a jet of water is allowed to play on the beaters of the machine in the process of scutching. The action of the water is to remove a large proportion of the gum surrounding the individual fibres, which is at that,

time in a soluble state and can be removed by water, but would harden and become insoluble if allowed to dry. The fibre is then placed in the hydro-extractor for five minutes, and from there it is either hung out to dry in the sun (plate IV), or if the weather is wet or cloudy, is dried by means of the sirocco fan. It is then conveyed to the store-room where the pieces of wood which may still adhere to it are hand picked, the fibre pressed into bales in which condition it is despatched to market (plate V). The quality of the fibre thus produced is variable and cannot be said to be equal to China-grass. The latter is very carefully decorticated by hand, the outer cuticle and the wood entirely removed, and the parallelism of the fibres kept intact. In other words, hand decortication as practised by the Chinese is well nigh perfect, and no machine has yet been able completely to emulate it. On the other hand, a percentage of wood and bark is always to be found in machine-decorticated rhea, and the parallelism of the fibres is impaired. In spite of this, however, spinners have expressed themselves satisfied with the quality of the produce as prepared by the Faure machine, and are prepared to take it over in any quantities. The defects referred to are easily removed in the subsequent processes of degumming, cleaning and combing, but must of necessity add to the cost. It is outside the scope of this article to discuss at length the details of these operations, and it will be sufficient to say that the spinner first sorts the produce into two or three lengths, after which it is transferred to the degumming bath where it is submitted to a combined treatment of steam and chemicals with the object of entirely removing the gum. This operation is of an extremely delicate nature, for the chemicals used to dissolve the gum would, if allowed to do so, also attack the fibre. Many processes have been invented for this purpose, some of which are patents, but others again have been kept strictly secret. Spinners at present prefer to degum, not entirely because there is an element of profit in the process, but chiefly because it is such an important part of the preparation of the fibre, and the probabilities of injury are so great, that they



Bemrose, Collo., Derby, Eng.

NEW FAURE RHEA DECORTICATOR.

cannot take the risks of badly degummed or injured fibre. For these reasons it is not at present possible, as many suppose, for the manufacturer of the raw product to degum at the factory, for he would run the risk of the whole of his produce being rejected for improper treatment. And even if we were able to degum satisfactorily, it would not be advisable for him to attempt it in the present condition of the trade. Rhea is in demand for a great variety of purposes, many of which do not require degummed fibre. He would, therefore, be narrowing his market, if he produced degummed rhea alone. After the degumming process is completed, the fibre has to be thoroughly washed until all trace of the chemicals is removed. It is then combed and made into "sliver." It is in this process that the want of parallelism in machine-decorticated rhea is felt. If the fibres are mixed, there is a greater likelihood of breaking in the combing, causing a large production of tow. Tow, however, is not waste, and unlike most other fibres, owing to the very long staple which rhea possesses, it can be worked up again and spun into yarn. The subsequent operations for spinning rhea fibre require special machinery. The writer in 1903 visited the spinning factory at Emmendingen in Germany, which at this moment absorbs probably two-thirds of the total of the world's output of the raw product. The machinery used for spinning was the invention of the proprietor, Herr Baumgartner, and had been specially constructed for him in England, to meet the peculiar requirements of the fibre. The intelligence and resource with which this work is being carried on deserves the highest praise, for it is probably far ahead of any other similar undertaking. The samples of yarn and finished product which were exhibited show the numerous uses to which the fibre can be applied. Hosiery and under clothing, brocades, pongees, damask linens and lace, gas mantles, sewing and crochet threads, light and heavy plushes, knitted shawls, and even the latest fashionable straw hats for ladies, are a few of the materials into which it can be converted. The strength and yet lightness of the fibre, and the fineness to which it can be spun, together with the fastness

and brightness with which colours cling to it, are not among the least important of its remarkable qualities.

Cultivation.

It is now necessary to say a few words about the cultivation of rhea. The plant belongs to the family of nettles *(Urticæ)* and to the subdivision *Bæhmeria*. There are many varieties, but two only are considered the best for fibre purposes, namely, *Bæhmeria nivea* and *Bæhmeria tenacissima*. The latter grows in tropical countries such as Java, Sumatra, Borneo, Malacca and Mexico, but will not grow well in Behar, the climate being too dry. On the other hand, *B. nivea* flourishes in temperate and semi-tropical countries, and is the variety to cultivate in Behar. The difference between the two is easily distinguished by the white woolly appearance underneath the leaf of *B. nivea*, which is absent from *B. tenacissima*.

Rhea demands that the richest lands should be selected for its growth, and they should be free from any suspicion of flooding or water-logging. If it is planted in inferior lands, disappointment is sure to follow. The object in the cultivation of rhea is to obtain a quick and vigorous growth. The stems in well established plants should be as tall as possible, from 4 to 6 feet, but never less than 3 feet. Four good cuttings should be secured per annum if it is to pay, and the total weight of these 4 cuttings of green stems should not be less than 30,000 lbs. per acre or say 15 tons. The yield of dry fibre from these stems should not be less than 2½ per cent., making 750 lbs. per acre per annum. This amount will vary with the efficiency of the decorticating machine. The possible amount of fibre to be obtained from the stems is believed to be 5 per cent., but owing to the large amount which is broken and cut away in the rough process of decortication, only 2½ per cent. can be relied on for an average yield with existing machinery, and this is given by the Faure machine.

The best and surest mode of propagation is from the root, though it can be grown, but with less certainty of success, from seed or cuttings. The bush intended to be used for

DECORTICATED RHEA DRYING.

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