

INDIGO.

(*Indigofera tinctoria.*)

The following paper read before the Ceylon Agricultural Society on the possibility of producing natural Indigo to compete with the synthetic dye is of especial interest for its latent possibilities.

Synthetic Indigo is a bye-product of coal-tar and although extensively used it has not entirely replaced the natural indigo.

For silks and high class textile goods the natural dye is still preferred for its durability as a fast dye.

As the indigotine, or blue colouring matter, varies with cultivation and preparation from 20 to 90% there does appear an opportunity for producing an improved standard dye. It is very probable too, that in preparing the Indigo in the form of paste there is considerable saving over solid or cube Indigo which is the result of sterilizing. (Singularly, some years ago, great efforts were made in Singapore to produce solid or stick Indigo which failed).

Locally, the plant is grown from cuttings and not seeds, so that it may improve the cultivated product if seeds were tried instead of cuttings.

Formerly the cultivation was extensive but has gradually dwindled to almost nil, possibly due to a combination of causes.

When Indigo was extensively cultivated in Java and Sumatra it was known that its cultivation improved the soil for tobacco, sugar and other crops.

It certainly deserves careful experimental trials for green soiling with rubber, but if intended as a Catch-crop, a good water supply is essential and prospective crops assured before embarking on the apparatus necessary for its preparations.

R. D.

Ceylon as an Indigo Country.

Interesting Paper.

Baron Schrottky—then read an excellent paper entitled, "The cultivation of Indigo in Ceylon," in which he said:—

The object of the paper on Indigo, which you have permitted me to read to you to-day, is to arouse interest in an industry which, for some time past, has been considered moribund, if not dead.

The natural indigo industry, at one time one of the most prosperous industries in the East, has been practically ruined by the competition of a synthetic dye.

Adolf von Bayer discovered in 1880 a method of producing from coal tar products a substance identical in every respect with indigotine, the chief dyeing principle in the indigo of commerce, in which it is found to the extent of about 60 per cent.

The Badische Soda and aniline Fabrick acquired Bayer's patents, and in 1897 brought into the market a synthetic indigotine at a price

low enough to compete with the natural dye. The Badische Company was able to sell their product at a profit at the cost price of natural indigo, which was then about Rs. 120 to Rs. 150 per maund of 74 lb.

This competition naturally resulted in the closing of most indigo factories in Bengal and Northern India which were dependent for financial assistance on Calcutta houses and only those planters who had land of their own, on which they could very profitably utilize the excellent manure which indigo refuse yields, were able to keep their heads above water.

The export of indigo, which in 1896 was 187,337 cwt, valued at nearly 4 million pounds sterling, had fallen in 1910 to 18,061 cwt. valued at a little over 200,000 pounds sterling.

Indigo continued to be grown in Behar and elsewhere in India, but chiefly for the sake of manure it yields, the dye coming to be looked upon almost as a by-product. It was at the darkest period of the Indian indigo industry that Sir Edward Law, Finance Member of the Indian Council, in his Budget speech, March, 1904, spoke hopefully of a possible revival of the industry, if planters would only put their factories on a sounder financial basis, practise economy in the management of their estates, select the best yielding variety of the indigo plant, and adopt more scientific methods of manufacture. It is due to a few of the more enterprising planters of Behar that progress has been made in these directions.

The great increase in the yield of dye obtained by the latest developments of the industry will be more fully realised by comparing a maximum outturn of $\frac{1}{4}$ lb. of dry from 100 lb. green plant in 1887, which was then spoken of as "marvellous," with the $\frac{3}{4}$ lb. of dry dye which 100 lb. of green plant can be made to yield now, an increased outturn which, 20 years ago, would have been regarded as impossible. But quite as important has been the advance in the marketing of the dye in the more convenient form of a paste of such qualities and of such an atomically fine division of the dye that—speaking from practical experience—as much yarn can be dyed a certain shade with one pound of Indigotine in the Standard Natural Indigo paste than can be dyed with $1\frac{1}{2}$ lb. of Indigotine in the synthetic dye.

We arrive now at the question of how this development of the indigo industry affects Ceylon, where it has never been considered profitable to grow the plant, even at the flood tide of prosperity in that industry. In those days the yearly outlay of an indigo factory—for supervision, rent of land, cultivation, manufacture, and the marketing of the dye—used to be in Behar about Rs. 36 per acre, and the outturn was 24 lb. of the dye per acre, selling at Rs. 3 per lb. This gave a cent. per cent. profit.

Cheapness of labour and cheapness of land were then the essential elements in the profitable cultivation of indigo, and on this basis Ceylon could not hope to compete with India. But now these items are not of such importance, since the industry has developed on lines

which make it necessary to treble the outlay, so that the cost of labour and land is now proportionately much smaller. It is this change which enables Ceylon planters to take up indigo cultivation with every chance of success and profit. The increased outlay is chiefly due to the cost of scientific methods of manufacture, and the very large additional outturn of dye obtained thereby has reduced the cost of natural indigo of average quality (60 per cent. indigotine) to 1s. per lb. whereas the synthetic dye costs 1s. 6d. to manufacture, and is sold at present at 8d. per lb. of 20 per cent paste equal to 2s. per lb. of 60 per cent. indigotine.

The way is, therefore, open for a revival of the natural indigo industry on a better basis than ever before, for it is well-known that the cost of the synthetic dye cannot be further reduced. It is generally acknowledged that natural indigo has better dyeing properties than the synthetic product, and dyers will give preference to the natural dye if they can get it at the same price of a standard quality and in the more convenient form of a paste. Such a standard natural indigo paste of keeping qualities has now been produced; it has been tested by practical dyers, it has met with the approval of Mincing Lane brokers, and it finds a ready demand and sale at a remunerative price.

It will, of course, take some time before an indigo industry on these up-to-date lines is established even in Behar. But a beginning has been made there and it is to be hoped Ceylon will follow suit, for here there is no lack of enterprising men with a command of credit and ready money, which is essential. The climate is favourable, the soil is suitable, and, in short, we have here all the elements that should ensure success.

The indigo plant grows better in Ceylon than in Behar. It grows wild in the low-country and at high altitudes, it is found up to 5,000 feet, it grows in the dry districts and in the wet districts, and there are some sixteen varieties of *Indigofera* indigenous to the Island. The plant grows in Ceylon for the greater part of the year (excepting the very dry districts), and will yield three to four cuttings in the twelve months; whereas in Northern India, where there are four months of cold weather and three months of drought, only one good cutting can be obtained, the second cutting depending much on the season, and, at the best, yielding only a half crop.

Mr. Teixeira de Mottos, General Secretary of the Midden Java Planters' Association, has given me the crop outturn of *Indigofera arrecta* in Java as amounting per acre to 32,000 lb. per year for three cuttings, the yearly outlay being Rs. 100 per acre. This crop outturn of green could, I feel certain, be reached here also in Ceylon, wherever the rainfall is over 60 inches for the year, and where the fall is well divided between the south-west and north-east monsoons.

In the dry districts of the Island, with only one monsoon, and a rainfall of only about 40 inches spread over four to five months of the year, we can only expect two cuttings, which might be estimated to yield about 20,000 lb. of crop per acre, for in Behar I have the

statistics of a crop of *Indigofera arrecta* sown on March 20, and yielding before the middle of September, within a period of six months two cuttings amounting to 21,600 lb. per acre.

If we take for Ceylon a rather higher outlay per acre than in Java, say Rs. 120 per acre, and add to this the expenditure in working according to scientific methods of manufacture (say Re. 1 for every 400 lb. of crop treated) we arrive at a total outlay, for a yield of 32,000 lb. per acre of Rs. 200 per acre, and for a yield of 20,000 lb. crop Rs. 170 per acre. The outturn of dye for Ceylon may be safely estimated at about the same as that obtained in Behar by scientific methods of manufacture, *i.e.*, $2\frac{1}{2}$ lb. of standard indigo paste per 100 lb. of green plant, though actual manufacture from plants grown in Ceylon has shown that the yield of dye is higher than in Behar. Arrangements have been made with a Mincing Lane firm to take over this standard paste at the rate of 50 cents per lb. c.i.f. Colombo.

The outturn of standard paste per acre yielding 32,000 lb. green plant may therefore be estimated at 800 lb. of paste, value Rs. 400, plus Rs. 148, the estimated value of the residual manure which the decomposed plant yields after the dye has been extracted, making a total of Rs. 548 against an expenditure of Rs. 200. In the districts where only 20,000 lb. of green plant can be cut per acre, the outturn of standard paste will be 500 lb., value Rs. 250, plus Rs. 100, the value of the manure, or a total of Rs. 350, against an expenditure of Rs. 170.

There must further be deducted rent of the land (or interest on the capital represented by it) and also the interest on the capital invested in the building of a factory and depreciation.

With the assistance of a few enterprising men in Colombo, this question of the possibility of successfully pioneering in Ceylon an indigo industry on up-to-date lines has been brought nearer to realisation. *Indigofera arrecta* and *Indigofera sumatrana* have been experimentally cultivated during the last six months in gardens within Colombo city, as well as at higher elevations on coconut and rubber estates. The plants have grown satisfactorily, as could not otherwise have been expected, for indigo is a weed which will flourish well with ordinary cultivation in all tropical and semi-tropical countries. Even where it was sown broadcast on totally unprepared hard laterite soil a crop has been obtained, though the growth is irregular.

What was sown in Colombo in July last has already yielded two cuttings (the second cutting at the rate of 14,500 lb. per acre), and the plants are shooting out well for a third cutting.

Plant grown in the Kalatara district has been manufactured in a miniature factory according to scientific methods and has yielded well, the outturn of dye being much greater than the Behar plant yields, and was equal to $3\frac{3}{4}$ lb. of standard paste for 100 lb. of green leaf.

You will have noted that I have added to the value of the dye the estimated value of the manure, which is a by-product of indigo manufacture. This is a most valuable asset, especially for Ceylon, where the soil cries out for manure more and more every year. The

fact that indigo cultivation and manufacture will yield as a by-product one of the most valuable of natural manures is one pregnant with the greatest possibility for this Colony.

We know from the experience gained in India and Java that this manurial matter trebles the outturn of tobacco; that it doubles the outturn of paddy, in grain as well as in straw; and it will also be found very suitable for coconut cultivation, for cacao, and for tea.

The manure, consisting of the fermented green leaves and stalks, is put into heaps and kept in pits, and can be further improved in value by running the waste liquid after fermentation over it. The bacterial life, set going by the fermentation, helps to decompose the plant, and turns the whole mass into a brown friable mould. Sir George Watt, in his *Dictionary of the Economic Products of India*, specially refers to the great value of this manure, and you will find the fact mentioned there that experience has shown that land cultivated in indigo is greatly benefited thereby.

Indigo is one of the few plants which enrich the soil on which it is grown, (1) by the exudation into the soil of nitrogenous matter from peculiar root-nodules in which through bacterial action the inert nitrogen of the air is worked up into assimilable nitrogenous products; (2) by the fall of leaf; and (3) by the droppings of the millions of insect life which an Indigo field harbours, while the long tap roots of the plant draw nourishment from strata of soil not reached by ordinary crops.

This Indigo refuse is called "seet," and closely approximates in its general composition good English Farmyard manure, though it is decidedly richer in its chief constituent—nitrogen. From 100 maunds of green plant about 80 maunds, or about 3 tons, of well-rotted "seet" are obtained. Mr. Pawson, from whose report to the Behar Planters' Association, pages 9-12, I quote, says that without taking into consideration the very valuable manurial qualities of the decomposed organic matter in the "seet," its principal plant food constituents per ton would be equivalent to 103 lb. sulphate of ammonia, 36 lb., sulphate of potash and 13 lbs., tribasic phosphate of lime.

Compared with oil cake, which contains only 14 per cent. of moisture, while "seet" contains 70 per cent., one ton of "seet" is equivalent in manurial value to about 5 cwt. of castor cake. The actual results are, however, even greater in the case of "seet," as the plant food there is in a more assimilable and subdivided form than in either farmyard manure or oil cake. Composition of Indigo refuse or "seet":—

	Per cent
Water	... 72'56
Organic matter	... 22'88
Mineral matter	... 4'56†
	100'00

Containing nitrogen	...	0.98	
Equal to ammonia	...	1.19	
†Containing—			
Silica	...	1.04	
Lime	...	1.09	
Magnesia	...	0.21	
Potash	...	0.89	
Phosphoric acid	...	0.27	
Phosphoric acid equal to tri- basic phosphate of lime		0.58	(Rawson)

Rawson gives the actual money value of the "seet" from 100 maunds (=8,000 lb.) of green plant as amounting to Rs. 37.

From an outturn of 32,000 lb. of green plant per acre we may therefore expect, in addition to the dye, a residual manure worth Rs. 148. The amelioration of the soil, as a concomitant of indigo cultivation, has been recognised as one of the most important elements of the industry in India, and should receive the same recognition in Ceylon.

I trust that the data I have given will draw the attention of Ceylon planters to the cultivation of a product which, even grown as a subsidiary crop, opens such large possibilities for the more successful cultivation of the present staple products of the Island.—*Ceylon Observer*, March 7, 1912.

PRUNING.

Pruning consists in removing any part of a tree, either stem, branches or root with a view to repressing its growth in one direction, and directing the course of sap towards other parts of the tree or shrub, etc., which are better situated and constituted for performing the natural functions.

In this country, trees and shrubs generally, produce an overabundance of branches, half of which are sufficient for all purposes required, decorative or otherwise. It is therefore essential that pruning be resorted to. By pruning I do not mean to infer that in the case of such trees as *Cassia fistula*, etc., wholesale, ruthless cutting out of branches is required, far from it, but if a few of the weaker branches were removed, the sap which would have been utilised by the removed branches, is directed into the remaining branches, strengthening and enlarging them so that they are better able to continue the satisfactory growth of the tree.

In fruit trees generally, pruning has a most beneficial effect on the yield of crop, enlargement of the fruit, general productiveness of branches hitherto barren, and admission of more light and air to the remaining branches are some of the immediate results attained.