FLAX EXPERIMENTS IN INDIA.

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CAN flax be grown and manufactured in India? This is a question which has exercised the minds of individuals and of the Government of India for over a hundred years, which is still being asked to-day, and still remains unanswered. India produces 300,000 tons of linseed per annum valued at about 3 millions sterling. The plants from which this seed is derived are either thrown away or used as fuel. It is only natural that this country should have been looked to as a source of supply by those interested in the production of flax, and the saving of the fibre from destruction has been a cause of keen speculation to many.

The earliest attempts to produce flax in India appear to have been made at the beginning of last century by Roxburgh, in a Hemp Farm established by the East India Company in the neighbourhood of Calcutta. His experiments were confined to the Indian linseed plant, and though samples were prepared and sent to England, no definite conclusions are recorded as to whether the trials were a success or not.

In the year, 1839 the matter was taken up more seriously, and a Company was formed, having as its object the growth of flax in India. Riga and Dutch seed was imported, as it was thought probable that the Indian plant, which had for centuries been grown for the production of seed only, was not as good for flax production as the Russian and Dutch varieties, grown in those countries principally for fibre. The subject was warmly taken up, and extensive experiments were carried out, principally in Bengal. Samples of fibre were valued in England at £30 to £45 per ton, and a very favourable view was taken of the probabilities of a profitable enterprise. The Agricultural Society of India, as the result of a request from Government in 1841, submitted a report of these results, and we find the Revenue Secretary to the Indian Government writing to them on the

22nd November 1841, that, "the cultivation of flax can no longer be considered a doubtful experiment, since it appears from your report to have been found in many instances successful, and where successful, to be very fairly profitable. His Lordship in Council is, therefore, much inclined to doubt whether any bounty or reward from Government is necessary or would be justifiable." Notwithstanding these favourable results, the Company did not continue the experiments, and the inference to be drawn is that the refusal of the aid, for which they applied to Government, forbade their risking any more in the venture. Indeed we find Mr. Wallace, who conducted trials for three years, stating in 1841 that the speculation must be abandoned unless the Government gave some encouragement.

In 1856 and following years, the subject was again revived, and we find experiments started in the Punjab, N.-W. P. and other parts of India with both indigenous and imported Dutch and Riga seed. In a letter addressed by the Personal Assistant of the Financial Commissioner to the Government of the Punjab, dated the 20th July, 1859, the results of the experiments in the Punjab are stated. The price realised in England for the fibre varied from £35 to £45 per ton, and the results are described as being "most encouraging and gratifying." "It has now been experimentally proved that flax grown from country seed in the Punjab can command a first class price in the European markets, leaving a large margin to cover cost of transport, &c., and for profit. The question may, therefore, be said to have passed from the stage of speculation and surmise to that of fact."

Reports of Dr. Jameson, Superintendent of the Saharanpur Botanical Gardens, written in the year 1859, give the following information. The height of the plant was 3½ to 4½ feet. The yield of seed per acre was 7 maunds, and the yield of fibre per acre was 4 maunds. The proportion of fibre to straw was 25%. He says in the reports referred to, "I found that flax might not only be made an excellent paying crop from the seeds alone, but that the stem or shove, if properly scutched, would be admirably fitted for the Home market, but before this can be brought about, it would be absolutely necessary to import good Instructors from Europe."

A Committee composed of members of the Agricultural Society of India was appointed for the purpose of investigating the question of "the cultivation and manufacture of flax in India." After reviewing the past and present history of the subject, they stated that the work in order, "to afford any hope of success . . . . must in the first instance be carried on under European supervision, as the raising of the plant for fibre is unknown to the natives, and the manipulation requires much nicety and judgment." They indicated what aids they considered were necessary, and recommended the "engagement for one, two, or three years, of persons who are well acquainted with the mode of cultivating and preparing flax after the most recent improved methods." On the 8th March 1860, we find the Secretary to the Government of the N. W. P. addressing the Secretary to the Government of India, to the following effect: "It appears that not only can an excellent paying crop be obtained from the seeds alone, but that the fibre prepared under proper management would be admirably fitted for the home market. This is found to be the case not only by the results of Dr. Jameson's experiment, but also by the results of those conducted on a larger scale in the Punjab—the flax which was there produced having been declared by competent home authorities to be even superior to the Russian flax." The letter goes on to say that "instruction from Europe is indispensably necessary before native cultivators will be able to carry out the somewhat difficult processes described by Dr. Jameson," and suggests "for the consideration of His Excellency the Viceroy that . . . . measures be authorised for the engagement of a couple of competent European Instructors, and the importation of the necessary machinery and seed." To this, the Government of India replied in a letter, dated the 3rd October 1860, that "the experience of success gained in the Punjab should ...... be sufficient to stimulate private enterprise to seek a field for its operations," and that as the practicability of cultivating flax for the English market at a good profit had been clearly established in the Punjab, which could now be left to its own progress unaided, it did not appear that the assistance of instructors was required in the N.-W. P. The Government, however, offered assistance in various other ways, such as the dissemination of literature on flax, aid in the importation of seed and machinery by passing it duty free, rewards and prizes for the production of the best flax, and the loan of the services of Belfast men from European regiments who were acquainted with the art of flax manufacture. These offers were evidently not considered to afford sufficient help, and the subject lapsed once more into oblivion.

I have been careful to quote at some length from the reports and correspondence on past trials, because it is generally assumed in the present day that, experiments having been so repeatedly made and no practical results having emanated from them, the growth and manufacture of flax in India has never been and is never likely to be a success. The object of this article is to show on the contrary that there is no warrant for such a conclusion and that past efforts so far as they went pointed to success. In other words it would appear most probable that flax can be properly grown and manufactured in India, and that if the Government in 1860 had provided European Instructors and aided the birth of the undertaking one step further than for one, two, or three years, of persons who are well acquainted with the mode of cultivating and preparing flax after the most recent improved methods." On the 8th March 1860, we find the Secretary to the Government of the N. W. P. addressing the Secretary to the Government of India, to the following effect: "It appears that not only can an excellent paying crop be obtained from the seeds alone, but that the fibre prepared under proper management would be admirably fitted for the home market. This is found to be the case not only by the results of Dr. Jameson's experiment, but also by the results of those conducted on a larger scale in the Punjab—the flax which was there produced having been declared by competent home authorities to be even superior to the Russian flax." The letter goes on to say that "instruction from Europe is indispensably necessary before native cultivators will be able to carry out the somewhat difficult processes described by Dr. Jameson," and suggests "for the consideration of His Excellency the Viceroy that . . . . measures be authorised for the engagement of a couple of competent European Instructors, and the importation of the necessary machinery and seed." To this, the Government of India replied in a letter, dated the 3rd October 1860, that "the experience of success gained in the Punjab should ...... be sufficient to stimulate private enterprise to seek a field for its operations," and that as the practicability of cultivating flax for the English market at a good profit had been clearly established in the Punjab, which could now be left to its own progress unaided, it did not appear that the assistance of instructors was required in the N.-W. P. The Government, however, offered assistance in various other ways, such as the dissemination of literature on flax, aid in the importation of seed and machinery by passing it duty free, rewards and prizes for the production of the best flax, and the loan of the services of Belfast men from European regiments who were acquainted with the art of flax manufacture. These offers were evidently not considered to afford sufficient help, and the subject lapsed once more into oblivion.

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"I have begun my holiday well, as you will I think agree with me, when I tell you that I have spent yesterday in studying a new process of flax retting which seems to me to offer great advantages and is likely to be a success. It is the outcome of the ideas of a practical mechanic, a Mr. Legrand of (Lille) Antwerp, and a man whose name I could not catch, but whose family from father to son have been for generations engaged in steeping and retting flax in the River Lys, and who has, I understand, been also employed in flax spinning.

"I was allowed to see the whole installation in consequence of my connection with Indian flax-growing, as the patentees came to the conclusion that this process might be very advantageous for India, their idea being that their process will be set up in districts where flax suitable for fibre purposes can be grown.

"Their contention is that they can produce fibre quite equal to the Courtrai steeped in the Lys *and at much less cost*, the Lys process being very costly from the amount of handling, etc., and liable to be interrupted from the state of the river (for instance no flax is at present being treated in the Lys, which is too much in flood) and now and again flax in process is destroyed.

"By this new process, steeping and retting goes on all the year round and the amount of labour required is trifling, but that labour must be intelligent.

"The installation is at a small village called Beerghem about ten minutes by rail from Bruges, or say, half an hour from Ostend. It was started in November last year and up to now 400--500,000 kilos of flax straw have been treated, say 4—500 tons. The installation is set up on the side of a small stream, a mere 'burn' over which you could stride or certainly jump, of sluggish running, not over-clean looking water, probably yesterday with a depth of a foot to a foot and a half, but falling in summer to an inch or two. (I give these details to show that no great volume of water is necessary in this process.)

"The installation consists of a range of light brick buildings, the central feature of which is a long hall containing or rather consisting of a long tank divided into five sections and with a factory along the side. Over these tanks is a sort of travelling crane. In No. 1 tank, next the door, the process begins. The tank is filled with water which has been taken from the 'burn,' and first of all passed through a filtering pit from which it is pumped into the tanks by a system of connecting pipes, by an engine which supplies the power for the whole installation. The water in No. 1 tank is heated to a temperature of 30—31 degrees centigrade (86—88 degrees Fahrenheit) and into this water which is pure and *has no chemicals whatever*, the flax, which is put up in small sheaves and placed in crates standing on its end, is placed or plunged until it is quite submerged and is kept down by a very simple arrangement. Each tank holds three of these crates of flax and the crates are lifted from the trolley by the travelling crane and dropped into the tanks. In the first tank, the flax remains for one day, during which, however, it is lifted in the crate by the travelling crane and held over the tank a few minutes to allow the water to drip through the sheaves, two or three times in the day and then replunged into the tank so that the water rises right through the sheaves, so that you may say every straw gets the full benefit and the steeping is pretty even all through the crate of flax. You see the gums rising in a scum to the surface of the tank and the stench is horrible. After a day in No. 1 tank, the crates are lifted into No. 2, and remain there, with these occasional liftings, until the retting process is completed. This takes from $2\frac{1}{2}$ days with poor straw up to $3\frac{1}{2}$ to 4 days *outside* for heavy good straw. The process has to be watched *narrowly*, in fact day and night, and the flax lifted from the steep just at the right time, when the process of retting is complete; but two men are all that are necessary to handle the flax from the tanks. Taken from the tanks, the crates are put on trolleys and stand for a day or a couple of days to *harden*, after which the trolleys are run out on a light line of rails to a meadow, where the flax is taken out of the crates, the bundles opened, and the flax is set up in big handfuls on end, three or four of the handfuls being twisted together at the crop end to make them stand, and here it is left to dry and further harden for such a time as is considered necessary, depending very much on the character of the straw, and lasting 3 to 7 days, after which it is ready to be broken and scutched.

"To break it, it is passed through quite a small machine with fluted rollers and then it is worked on the usual scutching mill.

"The yield got from the straw varies from 15—16 per cent. for poor straw, up to 19—23 per cent. for good straw. One object of leaving it on the meadow so long is to give colour.

"The water in the tanks has not to be changed with each fresh crate of flax put into it, but can be used repeatedly until it becomes too dirty and likely to affect the colour of the flax. The water is heated by steam pipes in the tanks I understand. When the water is discharged from the tanks, it flows into a pit next to the filtering pond, through which pit the pipes conveying the fresh water are led, so that by the time the fresh water reaches the steeping tanks its temperature has risen considerably, and there is less steam wasted in bringing it up to 30—31° Centigrade.

"I forgot to mention that the seed has been taken off the flax before it was put into the steep; this is done by a machine which these people have brought out, which does not destroy the fibre. I send you small samples of straw retted by the process and of the flax produced and also of dressed lint and tow, produced by a new system of hackling which Legrand has also patented, but which I won't attempt to describe to you, but by it he claims to get 12—20 per cent. more yield and to produce much better tows than by the old system of machine hackling.

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"I believe, it is the very thing for Behar, and as the indigo planters have already their indigo vats, I daresay these could be utilised for the steeping tanks without any great expenditure of money. The installation at Beerghem has cost about £2,400, but a good deal has been wasted, as it was entirely experimental, which would be saved in putting down a new place now after experience has been gained."

As regards the cultivation of the plant, there is no doubt that some of the lands in Behar are admirably suited to the growth of flax. In well-selected land a crop grown from imported seed attains an average height of 3 feet. The amount of seed sown per acre is 2 maunds (160 lbs.), but it is considered better by some to sow two and a half maunds (200 lbs.). Sowing thickly on strong land is said to produce a higher percentage of fibre, for a number of thin stems having the weight of one thick one will have a greater surface and consequently more fibre. The land requires careful preparation. It should be ploughed to a depth of ten to twelve inches, and then carefully worked so as to secure a firm seed bed and a fine surface. Careful broadcast sowing by hand produces a more uniform thick crop than sowing in drills. Some of the best foreign varieties of seed are under trial at the Pusa Experimental Station. It has yet to be ascertained whether the seed will maintain its quality with acclimatization or whether it will be necessary to import fresh seed at regular intervals. It is well known that linseed cannot be grown continuously on the same land, which becomes "flax-sick." In Belgium, the rotation is as long as a five or seven years' course.

If grown in this way, experience shows that there is as much fibre in the plant grown in India as at home, namely, about 20 per cent. of dried straw. The average yield of retted and dried straw at Dooriah from sowing at the rate of 2 maunds of seed, was 40 maunds per acre, and the percentage of fibre obtained from the straw was 15 per cent. or 6 maunds of fibre per acre. This should have given 4½ maunds good fibre and 1½ maund of tow, that is to say the proportion of good fibre to tow should have been as 3 to 1, but in point of fact it was only half good fibre and half tow. This defect was due to a want of skilfulness in manufacture. This point has an important bearing on the whole question, for the total money value of the yield depends very greatly upon skilful manufacture in order to create a good quality of flax with a low proportion of tow. The flax from the first year's experiments fetched £30 a ton, the second year £35, and this year it is expected to fetch £40 a ton owing to its better quality. The price of tow was about £10 a ton. The cost of production including cultivation, seed, manufacture, shipping, insurance, and other outlay expenditure, amounts to Rs. 62 per acre. Taking the 6 maunds of fibre to have sold at £25 a ton including tow, equal to say Rs. 13 per maund, we have a gross return of Rs. 78 per acre and a profit of Rs. 16.

This figure would appear to justify a continuation of the experiments and a moderate increase in the area under cultivation. Indeed Mr. Cameron, the manager, has stated that the experiments have paid almost from the beginning. It is, however, to be observed that the process of flax manufacture is a difficult one, involving a large amount of expert knowledge. It is evident from what was to be seen at Dooriah and from the figures supplied by the manager that the reason for such a low profit as Rs. 16 per acre is want of skilful manufacture. The question of cultivation can well be left to the planter and the native cultivators, for it has been found that the plant can be grown satisfactorily. But the process of manufacture, that is to say the retting, the 'breaking' and 'scutching,' the assortment and packing for the market, cannot be performed properly by unskilled labour, and the difference between success or failure lies almost entirely in these operations. It is as cheap to manufacture well as badly, but the difference in the value of the results is very great. Badly made fibre will fetch only £25 to £30 a ton; well made fibre from £50 to £60. At the latter price the profit of Rs. 16 per acre would become Rs. 70 to Rs. 80, reckoning $4\frac{1}{2}$ maunds of good quality fibre out of the 6 maunds per acre.

Reviewing the results of these experiments and those of the past 100 years, at what conclusion are we able to arrive? It would seem that flax can be grown and manufactured in India, but in order to make it a commercial success, the complicated and technical nature of the manufacturing process should not be left to amateurs, and the employment of instructors in the manufacture of the fibre is called for. We find the experiments of to-day giving as great a promise as those of the past hundred years; we find too in 1859 that Dr. Jameson, who so successfully carried on his experiments in the N.-W. P., wrote as follows :—"All that is required to market a useful crop in India are some good Instructors to show how the fibre is to be prepared and fitted for the market, and good seed and machinery. To encourage flax cultivation in Ireland, the Home Government annually allow the Royal Flax Society Rs. 10,000, and by this society upwards of £10,000 has been spent in twelve years in salaries to instructors, &c. If, therefore, the cultivators and preparers of flax in Ireland, where all the finest kinds of machinery are available, require instructors, how much more so is it necessary that means be adopted by the Indian Government to procure some expert Europeans from Europe to teach natives how to prepare fibre. Until this is done, it is in my opinion a useless waste of money to attempt to carry on the process with success . . . . but the experiment which was then going on so successfully, has been relinquished at the very time when it ought to have been prosecuted with renewed vigour."

History is again repeating itself in regard to the first portion of this statement. It would seem that the results of all these experiments, if they do not call for large undertakings, certainly engender the belief that the culture of flax in India would be a success if only instructors were on the spot to teach the skilful handling of the fibre, which seems to be the most important of all the conditions of success, and yet appears never to have been attempted on a reasonable scale. It should be observed also that the prospects of success now are greater than they were in those days. The demand for fibre all over the world has increased enormously, and the prices of to-day are in every way more promising. There are two separate but closely connected problems for investigation ; *first,* the possibility of establishing a new industry for the growth of flax as a fibre crop for the production of high-grade fibre alone ; *second,* the possibility of introducing a system whereby fibre, probably of a lower quality, could be produced in combination with the existing large cultivation of linseed for oilseeds. The account given above shows that the first problem is being investigated in Behar ; the second problem has already received some attention at the Manjri (Poona) Government Farm, but without definite results. A more promising field for such trials is the Saugor-Nerbudda territory of the Central Provinces, where linseed naturally grows luxuriantly with a considerable length of stalk, much better than in the Bombay Deccan.