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No. 97. Read the following letter from A. O. HUME, Esq., C.B., Secretary to the Government of India, Department of Revenue, Agriculture, and Commerce, (Agriculture and Horticulture,) to the Hon. D. F. CARMICHAEL, Secretary to the Government of Madras, Revenue Department, dated Simla, 9th June 1876, No. 4/224:—

I AM directed to forward, for the information of His Grace the Governor in Council and for distribution to District, Forest, and Jail Officers, copies of a Note on the subject of the cultivation of the Carob tree (*Ceratonia siliqua*). Copies of instructions in regard to the measures likely to secure its successful cultivation are also forwarded.

2. The Government of India will endeavour to procure seed for any officer who may wish to undertake the cultivation of this tree, on his showing that the locality in which it is proposed to try the experiment is favorably situated as regards soil, climate, and other conditions, and who will engage to grow the seed carefully, afford the young trees protection from the ravages of cattle, sheep, and goats, and report promptly and regularly the results of his experiment.

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ENCLOSURE No. 1.

THE CAROB TREE (*CERATONIA SILIQUA*),
WITH REFERENCE TO ITS CULTIVATION IN INDIA.

THE *Ceratonia siliqua*, a member of the natural order Leguminosæ; sub-order Cæsalpinniæ, and a rather close ally of the Indian tamarind, is extensively grown on the shores of the Levant, in Turkey in Asia and the island of Cyprus, on the Mediterranean Coasts, both African and European, in Italy, the islands of Sardinia and Malta, and Spain, its culture being particularly extended in Southern Italy and Sicily. In Cyprus it grows wild, and is very abundant. Some of the cultivated Cyprus varieties are held in great esteem as the best existing varieties of the tree. Growing in most soils, and not requiring much moisture or care, it gives but little trouble, and its cultivation is extending in the island every year. The yield of fruit, however, is affected in hot and dry seasons, the quantity being comparatively small and the quality inferior. The bean is exported from Cyprus chiefly to the Russian ports of the Black Sea. The tree also grows in great abundance in Palestine, whence the bean is exported to Alexandria and Constantinople.

2. The synonymes of the tree are: Spanish, Algarroba; Portuguese, Algorroba; Italian, Carrubio and Caruba; German, Karob-baum and Johannisbrod-baum; English, Carob, Locust bean, and St. John's bread. The German and English reference to the apostle is derived from the idea that these beans were the "locusts" on which, as the Scriptures say, he fed in the wilderness. In Greek, Balfour tells us (*Class Book of Botany*) the tree is called Keratia or Keratonia, and he adds that in Luke xv., 16, the word Keratim, which has been translated "husks," is taken to mean the fruit of the Carob tree. This conjecture of Professor Balfour is supported by the opinion of Archbishop Trench (from whom perhaps Balfour adopted the view he has expressed) in his *Notes on the Parables*, where it is said that these husks are "the fruit of the Carob tree."

3. The other name of the tree clearly comes through the Spanish from the Arabic name of the tree *Kharoub* or *al Kharoub*. In India it is known by the Arabic name, and is also sold in the bazaars under the name Kharnub Nubti and Kharnub Shâmi, or Syrian Kharnub, seemingly a corruption of the Arabic word.

4. The tree bears a thick, flat, brown curved pod, containing hard red seeds resembling those of the tamarind, embedded in a red fibrous pulp of sweet and somewhat astringent taste. These seeds are said to have been the original carat weight of jewellers. The pulp, which is

very nutritious and gently aperient, is the useful part of the tree. The crop is very abundant trees sometimes yielding from 800 to 900 lbs. of pods. In countries where the tree is grown it is used for human consumption, especially in times of scarcity,* and at all times forms a nourishing, palatable, and fattening food for horses, mules, asses, and horned cattle. "The plant, seeking its nourishment under ground, is so independent of surface irrigation and so retentive of life that, according to M. Bové, a tree supposed to be three hundred years old, which was cut down during the French invasion of Egypt, sprang up again thirty years after on wells being sunk in its neighbourhood." (Voigt. Hort. Sub. Cal.)

5. The bean is now largely imported into England, where it is made up with oil-cake into food for cattle. Morton, in his Cyclopædia of Agriculture, speaks favorably of it as cattle-food, and it is said that it forms one of the principal ingredients of the well-known "Thorley's food." The pulp is also said to be chewed by singers to improve the voice. The Turks make use of the pulp for sherbet, as the people of India do with tamarind pulp, mixing it with liquorice root and fruits. The bark is sometimes employed as a substitute for oak bark in tanning hides, and an invention has been patented at Paris for the application of the beans to the production of a species of glucose or fermentable sugar adapted to a variety of manufacturing purposes.†

6. In India it is held in repute as an astringent, and is employed in cases of cough accompanied with much expectoration. It is imported for medicinal purposes from Kabul, and is sold as high as Rs. 10 the seer in the markets. It is not as yet used for food, as indeed is sufficiently manifest from this extremely high price. In Cyprus £4-10-0 per ton is considered a high price and much above the average: the Indian price is equivalent to a rate of £1,220 per ton.

7. The history of the introduction of this tree into India greatly resembles the history of the experiments made with many other useful vegetable productions. The process has generally been somewhat as follows:—The article is first lauded as a most useful thing, and its acclimatisation declared to be most desirable. Then there is a lull. A little later, some official, or perhaps some non-official gentleman, with a taste for these matters, sees the plant growing in some favorable locality, is struck with its appearance, introduces it with more or less success, and then leaves the district or the country, and the subject drops out of sight with him. A little later, the whole process is gone through again, and so on *da capo*; the very slightest reference, if any, being made by each successive experimenter to the results of the trials made before his time. Thus the experiment, which might, if carefully watched, finally show in two or three years whether it was worth pursuing or not, drags on its weary course through thirty and forty years with indecisive results at last. The moral of the story is, that such experiments should be carried out in suitable conditions under the close supervision of a central Government department, charged especially with such business and competent to undertake it.

8. The main fields of experiment with the *Ceratonia siliqua* have been in the North-Western Provinces, the Punjab, and Madras.

In the North-Western Provinces its introduction dates as far back as 1840, having been recommended by Professor Lindley, through Dr. Royle. In that year the Superintendent of the Saharunpore Garden reported to Government that several hundred plants had been raised for eventual distribution along the dry and sandy tracts of those provinces. He stated that at that time the pods were selling in the markets at Rs. 10 the seer.‡

Apparently the experiment came to nothing after all, for twenty-two years later the Superintendent of the Gardens, Dr. Jameson, reported to Government that he had *en route* to England visited Malta, and had been much struck with the growth of this tree in the most barren, dry,

and stony places, and with its useful qualities, which he thus detailed: "It seeds immensely. By the poorer classes it is ground and mixed with grain, and when baked in the oven it is any thing but disagreeable. In seasons of scarcity it is, therefore, much used by the poorer inhabitants. It is constantly given to horses and mules in the proportion of one measure Carob beans to two measures of Barley, and on this food they both work and thrive well." Dr. Jameson accordingly brought with him a large quantity of seed, from which he raised a number of plants to test the value of the tree "in the dry places of the North-Western Provinces."*

In the following year (1863) he reported that the tree had been extensively propagated and distributed, but had not, though it flourished well, yielded pods in such quantity as in Malta and Italy. This, however, he said, might be due to the trees being too young. This remark I am unable to understand if Dr. Jameson referred to the produce of the seed of the previous year, for the tree never fruits until it is seven years old at least.

In the next year (1864) no reference was made in Dr. Jameson's report to these trees, but two cases of seeds are mentioned as having been received from the India Office, placing the Superintendent in a position to distribute the tree largely throughout the North-Western Provinces.

From this time down to 1872 official records, as far as I can ascertain, are silent on the subject of this experiment. In that year, however, we find it stated that many trees (among them the Carob) had been raised from seeds received from the India Office and naturalised in the plains of the North-Western Provinces.

9. In 1862 Mr. G. Ricketts, C.S., of Allahabad, brought seed with him to India and sowed some at Benares and Cawnpore. One of the trees grown at Benares was afterwards removed to Cawnpore, where it grew extremely well, standing the climate perfectly. In 1873, when Mr. Ricketts saw it, the tree was nearly 25 feet high and 9 inches in diameter.

10. The latest experiment in the North-Western Provinces was tried with some seed presented to the local Government in August 1874 by Mr. W. S. Halsey, C.S.; most of the seed was sent to the Superintendent of the Botanical Gardens at Saharunpore, with instructions to give the plant all possible chances of successful growth. Of the progress of this experiment we have no account.

Some of the seed was also sent to the Commissioner of Kumaun for trial, and by him was distributed to gentlemen whom he thought likely to take an interest in the experiment. Some of the seed, the Commissioner reported, germinated freely at Haldwani, and he proposes to try whether the tree will mature in the severer climate of the Bhabur. This is unlikely, for, as the Secretary remarks, the climate of Kumaun is too cold for it. This is clear from the fact reported by the Commissioner that some plants which germinated in 1873 were in March last only a foot high. Kumaun is not a good locality for this tree.

11. In the Punjab the tree seems to have been introduced by Mr. Charles Gubbins, C.S., between 1842 and 1844. He imported considerable quantities of seed from Italy, and sowed it in the districts of Panipat, Gurgaon, Rohtak, and Delhi, also distributing seed to natives. In 1849 many of the trees thus planted were alive about Delhi, but all trace of them seems to have disappeared, and no record of the experiments exists, all Government documents at Delhi having been destroyed by the rebels in 1857. An unsuccessful attempt seems to have been recently made to grow the tree in the Queen's Gardens, Delhi.

The tree was reintroduced into the Punjab by Mr. George Ricketts, some of the seed imported by that gentleman in 1862 having been sown at Lahore and Ferozepore. In 1866 Dr. George Henderson stated to the Agricultural and Horticultural Society of the Punjab that there were then four large trees in Lahore in the gardens of gentlemen,—one which was measured was three feet in girth at the ground, and they were all about the same size. One of them was in fruit when Dr. Henderson mentioned the subject. These were the produce of the seed brought out in 1862 by Mr. Ricketts. Trees produced from this seed were still growing at Lahore and Ferozepore in 1873, and in that year Mr. Ricketts sent the Agricultural and Horti-

* Letter to the Government of the North-Western Provinces, No. 318, dated 26th May 1862.

* In his Commercial Report on Cyprus for 1873, a year of great distress in the island, the British Consul writes:—"Great numbers of the quasi-starving peasants were obliged to subsist on the edible roots of such indigenous plants as they could dig up in the fields, using also locust beans to a large extent in lieu of cereals."

† Ore's Dictionary of Arts, Manufactures, and Mines, Ed. 1872.
‡ This statement I find repeated in various successive papers, including that most useful book, Mr. Baden-Powell's Punjab Products. Apparently the import of the article as a drug is small, and the price is not subject to great variation.

Botanical Society of India some seed obtained from the trees at Ferozepore. Mr. Ricketts says it has been proved that the tree will thrive in the Punjab and the North-Western Provinces.

The seeds, he says, should be well soaked before planting, and the trees, when planted out, should not be too far from each other to ensure their fruiting.

The explanation of this suggestion will be found in paragraph 13 in Dr. Henderson's Memorandum, which is the completest account on this subject which the Government possesses.

Dr. J. L. Stewart in his *Punjab Plants* (Ed. 1869) stated that the tree had been introduced into the Punjab some years, and in some parts had thriven, and was spreading though it did not grow rapidly, and had not yet ripened its seed, or indeed produced pods, except in rare instances. "One or two female trees existed, Dr. Stewart says, in one of the Lahore gardens, and were cut down by the owner, Vandal-like, probably because he did not care to be bothered by questions from the Agri-Horticultural Society as to their progress. It is curious that in the bazaars the pods are sold as an astringent medicine under the name *Kharnub Nabli*, probably finding their way from Syria by devious routes."

In a letter, dated the 3rd January 1876, the Financial Commissioner of the Punjab reports that of the Carob trees in Lahore, those in the garden of Mr. Ludlam have grown well and produced seed freely; these trees are supposed to have been planted about 1858. The largest is now four feet in girth, a yard from the ground, and 25 feet in height.

At Madhopur some trees were planted about eight years ago (1868) in the church grounds. These seeded freely for the first time in 1874, and again in 1875, and five hundred seedlings have been raised. Captain Garstin, Executive Engineer in charge of the Bari Doab Canal at Madhopur, proposes to form a plantation of young trees on the bank of the canal where they can be irrigated. A few trees were planted out on the canal, and were alive at the end of the year. Captain Garstin says that they ought to be planted tolerably close together, to admit of fertilisation, and that they should be protected from cattle, which are very partial to the leaves, browsing on them freely. Seedlings and seeds are now available at Madhopur for distribution.

The Financial Commissioner further reports that "there are many Carob trees in the Shahpur District in the church compound, and the Government garden at Sodi, in the Salt Range. The former are apparently, or were in 1872, all of one size, and did not fruit. Those at Sodi fruited freely, and Mr. Egerton has received seed from the Shahpur District, which has germinated in England."

12. The latest experiment in the Punjab, as in the North-Western Provinces, is due to Mr. W. S. Halsey, who last year presented to the Government of the Punjab a quantity of seed obtained by him while in Italy during that year accompanying the gift with the following memorandum on the cultivation of the plant prepared by the Italian Department of Agriculture and Commerce:—

"The Carob is an evergreen; it belongs to the order of Leguminosæ, and resembles the Tamarind in some of its characteristics.

"The size of the tree varies with the climate and the soil where it is cultivated. In Central Italy, where it is difficult to make it fruit, it seldom grows above 20 to 25 feet. In Southern Italy it reaches 36 to 40 feet and possibly higher. It is easily cultivated by sowing in the open ground or in suitable pots, and the young trees need not be finally planted out for four or five years."

"The habit of the plant is to grow very bushy near the roots, but provided the shoots at the base are taken off, it will grow large and thick above, and will require a space of 15 to 16 feet between each tree.

"The climate best suited to the Carob must be hot, and to a certain extent dry; and with these qualities it is immaterial whether the land be level or hilly.

"It bears its first fruit when it is about ten years old, and gives its largest crop between the ages of fifteen and twenty years, but it goes on yielding for many years, as it lives to a great age.

* In this case it would be advisable to shift the plant each year.

"The cultivation is very much restricted to the south of Italy, with the exception of the provinces of Savona and San Remo in Northern and Portoferraio in Central Italy. It is grown also in the provinces of Cagliari and Sappari in Sardinia,—not, however, to any very great extent.

"The cultivation is very important in Sicily, especially at Modica and Noto.

"The annual produce in these two districts is estimated at 52,500 tons, of which a large portion is exported to England.

"The districts in Southern Italy, which cultivate the largest quantity of Carob, are in the plain of Puglia; in fact, the neighbourhood of Bari produces annually 8,750 tons, which are generally exported to foreign parts, and the neighbourhood of Foggia 150 tons ordinarily exported to Venice and Trieste.

"In Italy the Carob is used as food for beasts, especially for mules and horses, particularly for horses, because they feed the mules, which they work very hard, on Oats and Barley, and in some places with beans.

"Horses which are let on hire are generally fed all the year round on Carob seed mixed with bean in the proportion of one-third to one-fourth.

"In some places the poorer classes use it as food, but this is to an insignificant extent.

"The income derived from a hectare of land cultivated with the Carob is, according to Professor Ottari, larger and more certain than that of the better kinds of forage, because the tree can bear the heat better than green crops.

"The produce of the Carob tree, well manured and deeply trenched during the first year (because in after years the roots become too superficial), is at least about 9 tons the hectare; that is, equivalent, as regards nourishment, to 44 tons of green food.

"The foliage also of the tree serves as food for the beasts. Alcohol is distilled from the seed, and an excellent oil for burning is also extracted from them. The bark is used for tanning.

"At Naples they use the wood for constructing wheels with teeth and also for furniture.

"The annual production of the Carob in Italy Proper is calculated at 79,750 tons, and, though large quantities are exported annually, an equivalent amount is imported from Turkey, Greece, Egypt, &c."

13. Dr. Henderson having been asked for his opinion, wrote the Note referred to in paragraph 11. The substance of this Note is as follows:—

"The value of this tree for the Punjab depends on the fact that it will grow and thrive in the most arid tracts; that it requires almost no cultivation; and that it prefers excessive heat and a soil containing lime: kunkar soil seems to suit it well.

"*Habit of the tree, climate, Soil, &c.*—The Carob grows to a height of 25 to 35 feet. There are now many trees in Lahore quite 25 feet high. As far back as June 1866, I find in the Proceedings of the Agri-Horticultural Society of the Punjab (page xxxvi.) a Note of my own regarding a tree in a private garden in Lahore, which had then a stem three feet in girth at the ground.

"The Carob is evergreen; it is readily propagated by seed; but I have failed to get either cuttings or layers to strike.

"In the Punjab the seed should be sown towards the end of the cold weather,—say in January or February,—in a seed-bed where it can be watered, or in pots. Most of it will germinate in April and May.

"I find that saline soil or saline well-water kills the young plants. Canal water and soil without *reh* should, therefore, be selected. There is a peculiarity about the germination of Carob seed which, no doubt, has something to do with the fact that it is a tree of dry and parched countries. It is this, that of a pound of seed sown in February, three-fourths will germinate within a month or two, more will come up when the rains set in, and some will lie dormant in the ground for one or two years. To cause the seed to germinate quickly, I always soak them in a vessel of water hung up in the hot sun and make the gardener examine them every other day and pick out all those for immediate sowing which have swollen by imbibing

er. I have now a quantity of seed gathered last June in Lahore which have been soaked in water exposed to the hot sun daily for 45 days, and, although they have been examined every day, I do not think that a dozen have yet shown signs of germinating.

"The Carob is dioecious, in other words the male, or stamiferous, flowers are found on one plant, and the female, or pistilliferous (fertile), flowers on another. This necessitates grafting to render a solitary tree fertile, but in any case grafting is to be recommended because, just as in the case of the Mango and most other fruit-trees, varieties don't come true from seed. Several bushels of fruit ripened in gardens about Lahore in June last, but most of the beans were only about half the size of those I have seen in Italy and Malta. They were also much less sweet and very much more astringent, and though I believe they would have been valuable as food for cattle, I found them too astringent to be very palatable.

"This convinces me that if the tree is to be extensively grown here a few good grafted trees must be obtained, and I shall undertake to get them out from Italy if necessary.

"In grafting the usual mode of proceeding is to preserve on each plant in the nursery three shoots only; on two of these female grafts are put, and on the third a graft off a male tree; afterwards the male branch is allowed to grow only just sufficiently to produce enough pollen to fertilise the flowers on the other two or female branches. Where trees are plentiful they fertilise each other by pollen being blown from a considerable distance by the wind, and I have found isolated female trees in Lahore produce abundance of fruit, although no male tree was within several hundred yards as far as I could ascertain.

"The Carob likes a dry soil containing lime, but will grow and thrive on almost any soil that is not marshy. In damp marshy ground it dies; it does not thrive either in Saharunpore or Calcutta. The climate cannot be too hot. I never saw even very young seedlings killed by the hot wind (140° to 160° F.), except where there was saline matter in the water, or soil, or where too much water was given.

"As to the other limit, I believe it is found that wherever the orange will ripen its fruit without artificial protection, the climate is not too cold for the Carob. At Lahore on the worst soil about the Central Jail it thrives well, in fact, all over Lahore. On the Salt Range it thrives even better, and grows very much more rapidly.

"I believe it has most chance of turning out to be valuable where the Olive (Kow) grows wild. Carobs, Olives, and Vines are usually found growing together, and often on ground unsuitable for grain crops. They would all thrive equally well here on what district officers now call unculturable land, and what the people call "bungar." This I have proved at the Central Jail. I have now French Olives as large as walnuts; the only two trees I have bore fruit abundantly last year and this year, and of twenty sorts of the best European Vines not one has degenerated in the least. These have all been grown on soil which seven years ago was unculturable. I planted it with thousands of Farash cuttings, but in spite of every exertion all died except one. Now it is covered with Vines, which bear as good fruit as I ever saw or ate out of an English hot-house.

"This is the third or fourth attempt which, within my knowledge, has been made to introduce the Carob into the Punjab, and, unless the experiment is now carried on in a less desultory way than former ones, I doubt if it will have any better results.

"Thirteen years ago I urged on the Agri-Horticultural Society here the advantage of getting a large experiment made with the Carob tree. Some bushels of seed were then obtained from Europe, and were distributed. I did not then know that the same thing had been done five or six years before. Almost every year since I came to the Province seeds have been sown in the Agri-Horticultural Society's Garden and plants distributed, and we now know, for certain, not only that it will live and thrive, but that it will fruit freely six or seven years after planting. I therefore trust that an experiment will be made to form a plantation of 50 or 60 acres on some of the waste land about Lahore, where it would be within half an hour's ride of all the

The British Consul in the island of Cyprus, however, says that a too hot and dry season injuriously affects the quantity and quality of produce.—C.C.

Government officers. If put away in the desert, it will be lost sight of and forgotten within five years, until some energetic officer rediscovers it.

"I merely mention this to show that the plantation should be close to headquarters, so as to excite and keep up an interest in it. Had Government seen fit to encourage the starting of the jail farm proposed by me four years ago, such an experiment could have been carried out without almost any expenditure beyond the labor of ticket-of-leave men, and in eight years the actual money value of the tree would have been thoroughly tested once for all. If a quantity of the seed is now made over to me at the jail, I can raise plants in large pots. They will not cost, pots and all, above Rs. 250 per 10,000. If afterwards it is decided to form a plantation of these and of European Olives, the waste ground can at any time be purchased for a trifle.

"The Punjab now abounds in corn. I doubt if it ever will abound in Vine, unless it be grown in Kashmir; but oil is now very scarce and of very inferior quality, and, as pasture land gets encroached on by grain crop, the supply of butter will probably get less and less up to a certain limit when green crops will become more extensively grown; but there can be no doubt that in many submontane districts the Olive would yield an enormous amount of oil fit for human food; and if the introduction of the Carob is to be carried out systematically, as in the case of Tea and Cinchona, the Olive should be introduced along with it, or rather multiplied, for the plants introduced by me in 1867 have now increased to thousands I believe.

"I should mention that ten days ago I received from the Assistant Secretary to Government several pounds of the Carob seed lately sent out by Mr. Halsey. I sowed it all the day after I received it, having soaked it a night in tepid water. I did not expect much of it to germinate till Spring, but I am happy to say every single seed has come up and most of them have opened their seed leaves."

The result of Dr. Henderson's paper was, that the Financial Commissioner recommended that the experiment suggested should be tried on suitable ground near Lahore, and in compliance with this suggestion 35 acres of land near Government House were made available for the purpose. The Conservator of Forests was then supplied with five seers of seed, and told to form a plantation. In June last year operations were commenced and a considerable portion of the land sown with seed.

14. In Madras the introduction of the tree as food for cattle was suggested by Sir Gaspard le Marchant, Commander-in-Chief of the Madras Army, in 1866. At that time there were some plants in the garden of the local Agri-Horticultural Society, raised from seed brought from Cairo in the previous year by Dr. G. Bidie. A further supply was obtained in 1866 from Malta, and packets were distributed, through the Board of Revenue, to the Collectors of various districts. Dr. Bidie also said that as the Society was in a position to give the plant, which promised to be so useful, a fair trial, no pains would be spared to render the experiment successful. The result of the Society's experiments is thus reported in a letter from the Honorary Secretary, dated 13th August 1875: "From that date [viz., October 25, 1866] nothing further appears in the records of the Society, but from report it is ascertained that the seed germinated and several healthy plants were raised which subsequently died." And I will note in this place that of all unsatisfactory experiments conducted in India, those conducted under the direct supervision of Agricultural and Horticultural Societies have been the most unsatisfactory.

The seed distributed by the Board of Revenue was sent to Nellore, Bellary, Kurnool, North Arcot, Cuddapah, Salem, Trichinopoly, Coimbatore, Tinnevely, Madura, South Canara, Oosoor, and Sydapet. The results were reported on in 1867 and 1868, and are as follow:—

In Trichinopoly no record remained of what had been done with the seed, except that about three dozen had been made over to one of the residents and sown by him. They germinated, but soon died off or were eaten by insects. Five were still alive in 1867, but in a bad way, and no further record of these exists.

In Bellary the seed was distributed to the Tehsildars and to a European gentleman. The result was a failure. The seed either did not germinate, or the seedlings soon died off.

In Coimbatore and Nellore the seed was given to ryots, and none of it germinated.

In Tinnevely and Cuddapah none of the seed germinated.

In Madura the seed either did not germinate, or the seedlings died off at once.

In North Arcot sixteen healthy young plants were obtained. Of these six were lost "from the attacks of white-ants and other mischances." The remainder looked healthy and vigorous, and had attained six feet in height in December 1868. These trees were then in the Government Garden at Chittoor, and had been seen a month previously by Dr. Cleghorn, who "thought very highly" of them. No further record of these is to be found in the papers.

In Kurnool the seed was sown by an officer, and the seedlings were coming on well, when he was suddenly ordered to Abyssinia, and forgot in the hurry of leaving to recommend them to somebody's care. The result, of course, was that they came to grief. Two were still alive when the officer returned, although they had been completely neglected. He was confident that the seedlings would have thriven if ordinary care had been given to them, and that they would succeed in that district.

In South Canara (Mangalore) the seedlings soon died off, "being apparently unable to penetrate the hard laterite soil."

In Salem (Oosoor) only one seed germinated, and that soon died off.

15. Of the other experiments there appears to be no record. The most recent papers on the subject inform us that—

(1)—There are ten young trees on the Pulneys raised from Italian seed, but the elevation at which they are growing (6,000 and 7,000 feet) is against their success.

(2)—In North Arcot an experiment conducted by the Collector failed, the seedlings dying off.

(3)—At Aska, in Ganjam, Mr. Minchin, the owner of a sugar factory and distillery, has sown some seed in his garden, with apparent success so far.

(4)—There are upwards of two dozen plants in the Government Gardens at Burliar, on the Nilgiris, "all of which are healthy and making vigorous growth." Some of these are nearly four feet high. There are also twenty-seven small plants in the coffee estate of Colonel Scott, at Thymullay, on the southern slopes of the hills. Some of these on the upper part of the estate are not very vigorous, and being at too great an altitude their ultimate success is doubtful. The others lower down are reported very healthy. The Superintendent of the Botanical Gardens thinks the tree could be grown in the coffee districts of Wynad and Mysore.

No experiments seem to have been tried in any of the other districts from which reports have been furnished by the forest officers. One of these officers (a Deputy Conservator) says: "I am unable to identify the tree by the botanical name given [*Ceratonia siliqua*]. Neither Drury's nor Balfour's works contain the name, so far as I can observe, and these are the only books of reference in this Office." (The tree is noticed in Balfour's Cyclopaedia, 2nd Ed., Vol. I., page 111.)

16. In the Central Provinces an experiment appears to have been made by the Deputy Commissioner of Narsinghpur in 1873 with seed supplied to him by the Agricultural and Horticultural Society of India which the Society had received from Mr. Ricketts. From this seed seventeen plants were raised, but not more than three survived, the others having been destroyed by white-ants, "which are very numerous and destructive at Narsinghpur." The survivors are healthy and likely to prosper. One is six and the two others more than four feet high. The Deputy Commissioner believes that the tree would grow freely in that district, and that the experiment would have been completely successful, but for the white-ants. No experiments appear to have been tried elsewhere in the Central Provinces.

17. In Bengal the experiment appears to have been repeated two or three times. In September 1873 Mr. Ricketts presented the Agricultural and Horticultural Society with some seed, but what came of it, except that some was sent to the Deputy Commissioner of Narsinghpur in the Central Provinces, does not appear.

In March of the present year Mr. Ricketts presented the Society with thirty seedlings of the tree. These, I have ascertained, are in the garden of the Society at Alipore in a more or less unhealthy condition.

The tree will probably not succeed in the water-logged soil of the Lower Provinces of Bengal, and it would be well if these plants could be transferred to the North-Western Provinces.

Dr. King, Superintendent of the Botanical Gardens, reports, in reply to a reference made to the Government of Bengal, that "private attempts are said to have been made to introduce the tree in this province. There is at present one small tree in this garden, and within the past year I have sown a good many seeds. The tree is of slow growth, so that it will be years before any result can be got from these. I do not, however, think it likely that the Carob will thrive in the Gangetic delta, of which the climate and soil are so totally different from those of the countries where the Carob flourishes." And he mentions Oudh, the Punjab, and the North-Western Provinces as much more likely to suit the Carob than Bengal.

18. In Oudh the tree seems to have done remarkably well at Lucknow. In his report for 1871-72, Dr. Bonavia stated that he had an avenue of 33 of these trees raised from seed imported many years ago. Some of them were 18 and 20 feet high, and in very healthy condition. Eleven fruited during the year, and again more abundantly during the following year. Dr. Bonavia tried to propagate the tree by layers, but found, as has been found by everybody, that the only efficacious mode of propagation is to raise it from seed. In his report for 1873-74, Dr. Bonavia records that the tree stands frost better than was supposed. On the morning of the 8th January, when the minimum thermometer on the grass indicated 5° 3' below the freezing point, and vast damage had been done to other plants, not a leaf of the Carob trees was touched by the frost.

19. On the 20th October last, Her Majesty's Secretary of State for India was asked to obtain from Southern Italy and send out to this country one hundred pounds of fresh seed. This seed is intended for the Government of the North-Western Provinces, which proposes to grow the tree in Kumaun. It seems doubtful, however, whether the tree has a fair chance of success there, and it may be advisable to consider now what had best be done with the seed when it comes. I would venture to suggest that some should be sown in various parts of the North-West and Punjab, the Central Provinces, and Madras. In this last province the failure of the experiments already made undoubtedly resulted from carelessness and ignorance. No seed given to Tehsildars and cultivators anywhere has the least chance of success. Over and over again it has been demonstrated that seed entrusted to "intelligent ryots" might just as well have been thrown into the sea. It is unnecessary to discuss the reason of this result; it is sufficient for the present to say that the result is almost invariably the same. I would venture to suggest that no seed should be distributed to anybody, European or Native, but that it should all be sown carefully in pots in some central spot or spots under careful professional supervision, and that the seedlings should be distributed in due time when properly established. This course would, no doubt, be at first more expensive than that which has been hitherto adopted, but ultimately it would, I believe, be found more economical. The seed might be sown at Lahore, Allahabad, Saharunpore, Nagpore, and Burliar (the Government Gardens), and the seedlings be distributed thence from time to time. I would also suggest that good use might be made of the agency of station masters on the lines of railway, both State and guaranteed. The country all along the north-eastern extension of the Madras Railway, from Madras to Raichore, seems well adapted for the growth of the Carob, and much in want of a tree of the kind. It is a dry, stony country where water is scarce, and is mostly only to be had from tanks (which are chiefly natural hollows embanked at the lowest end). In this tract failure more or less complete of the crops is of not unfrequent occurrence, and the cattle are the first and principal sufferers. Groves of trees here which would provide them and their owners with food in times of scarcity would be a great blessing. If the seedlings were planted about the stations, where there is always sufficient water, and where they would be subject to frequent inspection by officers of the district and of the Railway

*Proceedings of the Madras Government, Revenue Department,
10th July 1876.*

passing to and fro, they would be much more favorably situated than if planted in some out-of-the-way taluq where they would languish, neglected, and out of sight. Some little inducement to station masters, of the nature of that which has resulted in the embellishment of the stations of the Great Indian Peninsula Railway, would probably ensure unintermitting attention from the station authorities. In such places, too, forming points of resort for Natives from all parts of the district, a general acquaintance with the qualities of the tree would soon be formed and spread through the country.

These remarks may also be held to apply to the State lines of Railway in the Punjab, the North-Western Provinces, and Rajputana, which afford even greater opportunities for success in this undertaking. Canal and Forest officers also might be entrusted with seedlings, and held personally responsible that due care is given to them.

SIMLA,
10th April 1876.

J. E. O'CONNOR.

Instructions for the Cultivation of the Carob Tree.

THE tree grows readily from seed, which should be well soaked before sowing. It is fit to sow when it shows by swelling that it has imbibed the water. Soaking may sometimes continue for a month or even more before the seed swells, but fresh seed will not want soaking for more than ten or twelve hours.

2. Cuttings and layers should not be attempted. It is difficult, if not impossible, to get them to strike.

3. To ensure germination, sow the seed in pots and transplant when the seedlings are a month or two months old. The best time for putting out the seedlings is just before the setting in of the rains. The seed will probably not all come up together: sometimes germination is much delayed.

4. Cattle, sheep, and goats must be kept away from the plants, the leaves of which they eat greedily.

5. Manuring and trenching help the plant the first year; afterwards no particular care is required. The bushy branches thrown out near the roots should be removed: the tree will then develop at top.

6. Saline soil and saline well water must be avoided: they kill the young plant. Use canal or river water, and soil not impregnated with reh, and avoid marshy or water-logged soil. The tree will thrive in almost any soil but these, but it particularly likes a dry soil, with a limestone formation. Tracts where kunkur occurs would suit it well.

7. Heat and sun it will bear to any extent, and in hardly any part of the plains is the cold at any time sufficient to affect it materially.

8. The flowers being dioecious, i.e., the male and female flowers growing on distinct plants, it is useless to grow solitary trees, or to grow them in lines, for then fertilisation (which is effected by the pollen disseminated by the wind and by insects) becomes difficult or impossible, and the tree will either fruit badly, or not at all.

9. Plant in close clumps, fenced to keep out cattle. Circular clumps are cheapest, as requiring least fencing. A circular plot with a radius of 15 yards will hold 44 trees, allowing a square of four yards (16 square yards) to each tree. A circular plot with a radius of 30 yards will hold 176 trees, and this number will form a clump quite as large as it is necessary or useful to sow in the first instance. Care should be taken to space out the trees properly so that each may have room for development.

*Proceedings of the Madras Government, Revenue Department,
10th July 1876.*

No. 98.

ORDER THEREON, 10th July 1876, No. 928.

Miscellaneous.

COMMUNICATED, with copies of the enclosures, to the Board of Revenue and Conservator of Forests.

2. The Board will arrange for the distribution of these papers to the officers indicated in paragraph 1 of the letter above recorded, and they will at the same time direct the special attention of those officers to paragraph 2 of the same letter.

(True Extract.)

(Signed)

D. F. CARMICHAEL,
Secretary to Government.

To the Board of Revenue.

„ the Conservator of Forests.

„ the Agri-Horticultural Society, Madras.

„ the Commissioner of the Nilgiris.

„ the Judicial Department.

Exd. F. R. Bantleman.

928/7

THE CARO TREE

(*CERATONIA SILIQUA*).

WITH REFERENCE TO ITS CULTIVATION IN INDIA.

1. The *Ceratonia siliqua*, a member of the natural order Leguminosæ, sub-order Cæsalpinix, and a rather close ally of the Indian tamarind, is extensively grown on the shores of the Levant, in Turkey in Asia and the island of Cyprus, on the Mediterranean Coasts, both African and European, in Italy, the islands of Sardinia and Malta, and Spain, its culture being particularly extended in Southern Italy and Sicily. In Cyprus it grows wild, and is very abundant. Some of the cultivated Cyprus varieties are held in great esteem as the best existing varieties of the tree. Growing in most soils, and not requiring much moisture or care, it gives but little trouble, and its cultivation is extending in the island every year. The yield of fruit, however, is affected in hot and dry seasons, the quantity being comparatively small and the quality inferior. The bean is exported from Cyprus chiefly to the Russian ports of the Black Sea. The tree also grows in great abundance in Palestine, whence the bean is exported to Alexandria and Constantinople.

2. The synonymes of the tree are: Spanish, Algarroba; Portuguese, Algorroba; Italian, Carrubio and Caruba; German, Karob-baum and Johannisbrodbaum; English, Carob, Locust bean, and St. John's bread. The German and English reference to the apostle is derived from the idea that these beans were the "locusts" on which, as the Scriptures say, he fed in the wilderness. In Greek, Balfour tells us (*Class Book of Botany*), the tree is called Keratia or Keratonia, and he adds that in Luke xv., 16, the word Keratim, which has been translated 'husks,' is taken to mean the fruit of the Carob tree. This conjecture of Professor Balfour is supported by the opinion of Archbishop Trench (from whom perhaps Balfour adopted the view he has expressed), in his *Notes on the Parables*, where it is said that these husks are "the fruit of the Carob tree."

3. The other name of the tree clearly comes through the Spanish from the Arabic name of the tree *Kharoub* or *al Kharoub*. In India it is known by the Arabic name, and is also sold in the bazaars under the name Kharnub Nubti and Kharnub Shami, or Syrian Kharnub, seemingly a corruption of the Arabic word.

4. The tree bears a thick, flat, brown curved pod, containing hard red seeds resembling those of the tamarind, embedded in a red fibrous pulp of sweet and somewhat astringent taste. These seeds are said to have been the original carat weight of jewellers. The pulp, which is very nutritious and gently aperient, is the useful part of the tree. The crop is very abundant, trees sometimes yielding from 800 to 900lbs of pods. In countries where the tree is grown it is used for human consumption, especially in times of scarcity,* and at all times forms a nourishing, palatable and fattening food for horses, mules, asses, and horned cattle. "The plant, seeking its nourishment under ground,

* In his Commercial Report on Cyprus for 1873, a year of great distress in the island, the British Consul writes:—"Great numbers of the quasi-starving peasants were obliged to subsist on the edible roots of such indigenous plants as they could dig up in the fields, using also locust beans to a large extent in lieu of cereals."

Govt. of 1876

REVENUE.

THE BOARD OF REVENUE.

As. Ac. Ps.

Date July 10th

G.O. 10th July 1876, No. 928

JULY.

No. 97-98.

Carob Tree.—Communications with reference to the Board of Revenue and Conservancy of Forests from the Government of India regarding the cultivation of the

is so independent of surface irrigation and so retentive of life, that, according to M. Bové, a tree supposed to be three hundred years old, which was cut down during the French invasion of Egypt, sprang up again thirty years after on wells being sunk in its neighbourhood." (*Voigt. Hort. Sub. Cal.*)

5. The bean is now largely imported into England, where it is made up with oil-cake into food for cattle. Morton, in his *Cyclopædia of Agriculture*, speaks favourably of it as cattle food, and it is said that it forms one of the principal ingredients of the well-known "Thorley's food." The pulp is also said to be chewed by singers to improve the voice. The Turks make use of the pulp for sherbet, as the people of India do with tamarind pulp, mixing it with liquorice root and fruits. The bark is sometimes employed as a substitute for oak bark in tanning hides, and an invention has been patented at Paris for the application of the beans to the production of a species of glucose or fermentable sugar adapted to a variety of manufacturing purposes.*

6. In India it is held in reputation as an astringent, and is employed in cases of cough accompanied with much expectoration. It is imported for medicinal purposes from Kabul, and is sold as high as Rs. 10 the seer in the markets. It is not as yet used for food, but indeed is sufficiently manifest from this extremely high price. In Cyprus £1-10 per ton is considered a high price and much above the average; the Indian price is equivalent to a rate of £1,220 per ton.

7. The history of the introduction of this tree into India greatly resembles the history of the experiments made with many other useful vegetable productions. The process has generally been somewhat as follows: The article is first lauded as a most useful thing, and its acclimatisation declared to be most desirable. Then there is a lull. A little later, some official, or perhaps some non-official gentleman, with a taste for these matters, sees the plant growing in some favourable locality, is struck with its appearance, introduces it with more or less success, and then leaves the district or the country, and the subject drops out of sight with him. A little later, the whole process is gone through again, and so on *ad caput*, the very slightest reference, if any, being made by each successive experimenter to the results of the trials made before his time. Thus the experiment, which might, if carefully watched, finally shew in two or three years whether it was worth pursuing or not, drags on its weary course through thirty and forty years with indecisive results at last. The moral of the story is, that such experiments should be carried out in suitable conditions under the close supervision of a central Government department, charged especially with such business and competent to undertake it.

8. The main fields of experiment with the *Ceratonia siliqua* have been in the North-Western Provinces, the Punjab, and Madras. In the North-Western Provinces its introduction dates as far back as 1840, having been recommended by Professor Lindley, through Dr. Royle. In that year the Superintendent of the Saharanpore Garden reported to Government that several hundred plants had been raised for eventual distribution along the dry and sandy tracts of those provinces. He stated that at that time the pods were selling in the markets at Rs. 10 the seer.†

Apparently the experiment came to nothing after all, for twenty-two years later the Superintendent of the Gardens, Dr. Jameson, reported to Government that he had *en route* to England visited Malta, and had been much struck with the growth of this tree in the most barren, dry, and stony places, and with its useful qualities, which he thus detailed: "It seeds immensely. By the poorer classes it is ground and mixed with grain, and when baked in the oven it is anything but disagreeable. In seasons of scarcity it is therefore much used by the poorer inhabitants. It is constantly given to horses and mules in the proportion of one measure carob beans to two measures of barley, and on this food they both work and thrive well." Dr. Jameson accordingly brought with him a large quantity of seed, from which he raised a number of plants to test the value of the tree "in the dry places of the North-Western Provinces."‡

* *Ure's Dictionary of Arts, Manufactures and Mines*, ed. 1872.

† This statement I find repeated in various successive papers, including that most useful book, Mr. Baden-Powell's *Punjab Products*. Apparently the import of the article as a drug is small, and the price is not subject to great variation.

‡ Letter to the Government of the North-Western Provinces, No. 313, dated 26th May 1862.

In the following year (1863) he reported that the tree had been extensively propagated and distributed, but had not, though it flourished well, yielded pods in such quantity as in Malta and Italy. This, however, he said, might be due to the trees being too young. This remark I am unable to understand if Dr. Jameson referred to the produce of the seed of the previous year, for the tree never fruits until it is seven years old at least.

In the next year (1864) no reference was made in Dr. Jameson's report to these trees, but two cases of seeds are mentioned as having been received from the India Office, placing the Superintendent in a position to distribute the tree largely throughout the North-Western Provinces.

From this time down to 1872 official records, as far as I can ascertain, are silent on the subject of this experiment. In that year, however, we find it stated that many trees (among them the carob) had been raised from seeds received from the India Office and naturalised in the plains of the North-Western Provinces.

9. In 1862 Mr. G. Ricketts, C.S., of Allahabad, brought seed with him to India and sowed some at Benares and Cawnpore. One of the trees grown at Benares was afterwards removed to Cawnpore, where it grew extremely well, standing the climate perfectly. In 1873, when Mr. Ricketts saw it, the tree was nearly 25 feet high and 9 inches in diameter.

10. The latest experiment in the North-Western Provinces was tried with some seed presented to the local Government in August 1874 by Mr. W. S. Halsey, C.S.; most of the seed was sent to the Superintendent of the Botanical Gardens at Saharanpore, with instructions to give the plant all possible chances of successful growth. Of the progress of this experiment we have no account.

Some of the seed was also sent to the Commissioner of Kumaun for trial, and by him was distributed to gentlemen whom he thought likely to take an interest in the experiment. Some of the seed, the Commissioner reported, germinated freely at Haldwani, and he proposes to try whether the tree will mature in the severer climate of the Bhabur. This is unlikely, for, as the Secretary remarks, the climate of Kumaun is too cold for it. This is clear from the fact reported by the Commissioner that some plants which germinated in 1873 were in March last only a foot high. Kumaun is not a good locality for this tree.

11. In the Punjab the tree seems to have been introduced by Mr. Charles Gubbins, C.S., between 1842 and 1844. He imported considerable quantities of seed from Italy, and sowed it in the districts of Panipat, Gurgaon, Rohtak, and Delhi, also distributing seed to natives. In 1849 many of the trees thus planted were alive about Delhi, but all trace of them seems to have disappeared, and no record of the experiments exists, all Government documents at Delhi having been destroyed by the rebels in 1857. An unsuccessful attempt seems to have been recently made to grow the tree in the Queen's Gardens, Delhi.

The tree was re-introduced into the Punjab by Mr. George Ricketts, some of the seed imported by that gentleman in 1862 having been sown at Lahore and Ferozepore. In 1866 Dr. George Henderson stated to the Agricultural and Horticultural Society of the Punjab that there were then four large trees in Lahore in the gardens of gentlemen,—one which was measured was three feet in girth at the ground, and they were all about the same size. One of them was in fruit when Dr. Henderson mentioned the subject. These were the produce of the seed brought out in 1862 by Mr. Ricketts. Trees produced from this seed were still growing at Lahore and Ferozepore in 1873, and in that year Mr. Ricketts sent the Agricultural and Horticultural Society of India some seed obtained from the trees at Ferozepore. Mr. Ricketts says it has been proved that the tree will thrive in the Punjab and the North-Western Provinces.

The seeds, he says, should be well soaked before planting, and the trees, when planted out, should not be too far from each other to ensure their fruiting.

The explanation of this suggestion will be found in para. 13 in Dr. Henderson's memorandum, which is the completest account on this subject which the Government possesses.

Dr. J. L. Stewart in his *Punjab Plants* (ed. 1869) stated that the tree had been introduced into the Punjab some years, and in some parts had thriven

and was spreading though it did not grow rapidly, and had not yet ripened its seed, or indeed produced pods, except in rare instances. "One or two female trees existed, Dr. Stewart says, in one of the Lahore gardens, and were cut down by the owner, Vandal-like, probably because he did not care to be bothered by questions from the Agri-Horticultural Society as to their progress. It is curious that in the bazaars the pods are sold as an astringent medicine under the name *Kharnab Nubli*, probably finding their way from Syria by devious routes."

In a letter dated the 3rd January 1876, the Financial Commissioner of the Punjab reports, that of the carob trees in Lahore, those in the garden of Mr. Ladlam have grown well and produced seed freely; these trees are supposed to have been planted about 1858. The largest is now four feet in girth a yard from the ground, and 25 feet in height.

At Madhopur some trees were planted about eight years ago (1868) in the church grounds. These seeded freely for the first time in 1874, and again in 1875, and five hundred seedlings have been raised. Captain Garstin, Executive Engineer in charge of the Bari Doab Canal at Madhopur, proposes to form a plantation of young trees on the bank of the canal where they can be irrigated. A few trees were planted out on the canal, and were alive at the end of the year. Captain Garstin says that they ought to be planted tolerably close together, to admit of fertilisation, and that they should be protected from cattle, which are very partial to the leaves, browsing on them freely. Seedlings and seeds are now available at Madhopur for distribution.

The Financial Commissioner further reports that "there are many carob trees in the Shahpur district in the church compound, and the Government garden at Sodi, in the Salt Range. The former are apparently, or were in 1872, all of one size, and did not fruit. Those at Sodi fruited freely, and Mr. Egerton has received seed from the Shahpur district, which has germinated in England."

12. The latest experiment in the Punjab, as in the North-Western Provinces, is due to Mr. W. S. Halsey, who last year presented to the Government of the Punjab a quantity of seed obtained by him while in Italy during that year accompanying the gift with the following memorandum on the cultivation of the plant prepared by the Italian Department of Agriculture and Commerce:—

"The carob is an evergreen; it belongs to the order of Leguminosae, and resembles the tamarind in some of its characteristics.

"The size of the tree varies with the climate and the soil where it is cultivated. In Central Italy, where it is difficult to make it fruit, it seldom grows above 20 to 25 feet. In Southern Italy it reaches 36 to 40 feet and possibly higher. It is easily cultivated by sowing in the open ground or in suitable pots, and the young trees need not be finally planted out for four or five years.*

"The habit of the plant is to grow very bushy near the roots, but provided the shoots at the base are taken off, it will grow large and thick above, and will require a space of 15 to 16 feet between each tree.

"The climate best suited to the carob must be hot, and to a certain extent dry, and with these qualities it is immaterial whether the land be level or hilly.

"It bears its first fruit when it is about ten years old, and gives its largest crop between the ages of fifteen and twenty years, but it goes on yielding for many years, as it lives to a great age.

"The cultivation is very much restricted to the south of Italy, with the exception of the provinces of Savona and San Remo in Northern, and Portoferraio in Central Italy. It is grown also in the provinces of Cagliari and Sapari in Sardinia,—not, however, to any very great extent.

"The cultivation is very important in Sicily, especially at Modica and Noto.

"The annual produce in these two districts is estimated at 52,500 tons, of which a large portion is exported to England.

"The districts in Southern Italy which cultivate the largest quantity of carob are in the plain of Puglia, in fact the neighbourhood of Bari produces annually 8,750 tons, which are generally exported to foreign parts, and the neighbourhood of Foggia 150 tons, ordinarily exported to Venice and Trieste.

"In Italy the carob is used as food for beasts, especially for mules and horses, particularly for horses, because they feed the mules, which they work very hard, on oats and barley, and in some places with beans.

"Horses which are let on hire are generally fed all the year round on carob seed mixed with bean in the proportion of one-third to one-fourth.

"In some places the poorer classes use it as food, but this is to an insignificant extent.

"The income derived from a hectare of land cultivated with the carob is, according to Professor Ottari, larger and more certain than that of the better kinds of forage, because the tree can bear the heat better than green crops.

* In this case it would be advisable to shift the plant each year.

"The produce of the carob tree, well manured and deeply trenched during the first year (because in after years the roots become too superficial), is at least about 9 tons the hectare,—that is equivalent, as regards nourishment, to 44 tons of green food.

"The foliage also of the tree serves as food for the beasts. Alcohol is distilled from the seed, and an excellent oil for burning is also extracted from them. The bark is used for tanning.

"At Naples they use the wood for constructing wheels with teeth and also for furniture.

"The annual production of the carob in Italy proper is calculated at 79,750 tons, and, though large quantities are exported annually, an equivalent amount is imported from Turkey, Greece, Egypt, &c."

13. Dr. Henderson, having been asked for his opinion, wrote the note referred to in para. 11. The substance of this note is as follows:—

"The value of this tree for the Punjab depends on the fact that it will grow and thrive in the most arid tracts; that it requires almost no cultivation; and that it prefers excessive heat and a soil containing lime: kunkar soil seems to suit it well.

"Habit of the tree, Climate, Soil, &c.—The carob grows to a height of 25 to 35 feet. There are now many trees in Lahore quite 25 feet high. As far back as June 1866, I find in the proceedings of the Agri-Horticultural Society of the Punjab (page xxxvi.) a note of my own regarding a tree in a private garden in Lahore, which had then a stem three feet in girth at the ground.

"The carob is evergreen; it is readily propagated by seed; but I have failed to get either cuttings or layers to strike.

"In the Punjab the seed should be sown towards the end of the cold weather—say in January or February—in a seed bed where it can be watered, or in pots. Most of it will germinate in April and May.

"I find that saline soil or saline well-water kills the young plants. Canal water and soil without *vel* should, therefore, be selected. There is a peculiarity about the germination of carob seed which, no doubt, has something to do with the fact that it is a tree of dry and parched countries. It is this; that of a pound of seed sown in February, three-fourths will germinate within a month or two, more will come up when the rains set in, and some will lie dormant in the ground for one or two years. To cause the seed to germinate quickly, I always soak them in a vessel of water hung up in the hot sun and make the gardener examine them every other day and pick out all those for immediate sowing which have swollen by imbibing water. I have now a quantity of seed gathered last June in Lahore which have been soaked in water exposed to the hot sun daily for 45 days, and, although they have been examined every day, I do not think that a dozen have yet shown signs of germinating.

"The carob is dioecious, in other words, the male, or staminate, flowers are found on one plant, and the female, or pistilliferous (fertile), flowers on another. This necessitates grafting to render a solitary tree fertile, but in any case grafting is to be recommended, because, just as in the case of the mango and most other fruit trees, varieties don't come true from seed. Several bushels of fruit ripened in gardens about Lahore in June last, but most of the beans were only about half the size of those I have seen in Italy and Malta. They were also much less sweet and very much more astringent, and though I believe they would have been valuable as food for cattle, I found them too astringent to be very palatable.

"This convinces me that if the tree is to be extensively grown here a few good grafted trees must be obtained, and I shall undertake to get them out from Italy if necessary.

"In grafting the usual mode of proceeding is to preserve on each plant in the nursery three shoots only; on two of these female grafts are put, and on the third a graft off a male tree; afterwards the male branch is allowed to grow only just sufficiently to produce enough pollen to fertilise the flowers on the other two or female branches. Where trees are plentiful they fertilise each other by pollen being blown from a considerable distance by the wind, and I have found isolated female trees in Lahore produce abundance of fruit, although no male tree was within several hundred yards as far as I could ascertain.

"The carob likes a dry soil containing lime, but will grow and thrive on almost any soil that is not marshy. In damp marshy ground it *dies*; it does not thrive either in Saharunpore or Calcutta. The climate cannot be too hot. I never saw even very young seedlings killed by the hot wind (140° to 160° F.),* except where there was saline matter in the water, or soil, or where too much water was given.

"As to the other limit, I believe it is found that wherever the orange will ripen its fruit without artificial protection the climate is not too cold for the carob. At Lahore on the worst soil about the Central Jail it thrives well, in fact, all over Lahore. On the Salt Range it thrives even better and grows very much more rapidly.

"I believe it has most chance of turning out to be valuable where the olive (kow) grows wild. Carobs, olives, and vines are usually found growing together, and often on ground unsuitable for grain crops. They would all thrive equally well here on what district officers now call unculturable land, and what the people call "bungar." This I have proved at the Central Jail. I have now French olives as large as walnuts; the only two trees I have, bore fruit abundantly last year and this year, and of twenty sorts of the best European vines not one has degenerated in the least. These have all been grown on soil which seven years ago was

* The British Consul in the island of Cyprus, however, says that a too hot and dry season injuriously affects the quantity and quality of the produce.—O.C.

unculturable. I planted it with thousands of Farash cuttings, but in spite of every exertion all died except one. Now it is covered with vines, which bear as good fruit as I ever saw or ate out of an English hothouse.

"This is the third or fourth attempt which, within my knowledge, has been made to introduce the carob into the Punjab, and unless the experiment is now carried on in a less desultory way than former ones, I doubt if it will have any better results.

"Thirteen years ago I urged on the Agri-Horticultural Society here the advantage of getting a large experiment made with the carob tree. Some bushels of seed were then obtained from Europe, and were distributed. I did not then know that the same thing had been done five or six years before. Almost every year since I came to the province seeds have been sown in the Agri-Horticultural Society's garden and plants distributed, and we now know for certain, not only that it will live and thrive, but that it will fruit freely six or seven years after planting. I therefore trust that an experiment will be made to form a plantation of 50 or 60 acres on some of the waste land about Lahore, where it would be within half an hour's ride of all the Government officers. If put away in the desert, it will be lost sight of and forgotten within five years, until some energetic officer re-discovers it.

"I merely mention this to show that the plantation should be close to head-quarters, so as to excite and keep up an interest in it. Had Government seen fit to encourage the starting of the jail farm proposed by me four years ago, such an experiment could have been carried out without almost any expenditure beyond the labour of ticket-of-leave men, and in eight years the actual money value of the tree would have been thoroughly tested once for all. If a quantity of the seed is now made over to me at the jail, I can raise plants in large pots. They will not cost, pots and all, above Rs. 250 per 10,000. If afterwards it is decided to form a plantation of these and of European olives, the waste ground can at any time be purchased for a trifle.

"The Punjab now abounds in corn. I doubt if it ever will abound in vine, unless it be grown in Kashmir; but oil is now very scarce and of very inferior quality, and, as pasture land gets encroached on by grain crop, the supply of butter will probably get less and less up to a certain limit when green crops will become more extensively grown; but there can be no doubt that in many submontane districts the olive would yield an enormous amount of oil fit for human food; and if the introduction of the carob is to be carried out systematically, as in the case of tea and chinchona, the olive should be introduced along with it, or rather multiplied, for the plants introduced by me in 1867 have now increased to thousands I believe.

"I should mention that ten days ago I received from the Assistant Secretary to Government several pounds of the carob seed lately sent out by Mr. Halsey. I sowed it all the day after I received it, having soaked it a night in tepid water. I did not expect much of it to germinate till spring, but I am happy to say every single seed has come up, and most of them have opened their seed leaves."

The result of Dr. Henderson's paper was, that the Financial Commissioner recommended that the experiment suggested should be tried on suitable ground near Lahore, and in compliance with this suggestion 35 acres of land near Government House were made available for the purpose. The Conservator of Forests was then supplied with five seers of seed, and told to form a plantation. In June last year operations were commenced and a considerable portion of the land sown with seed.

14. In Madras the introduction of the tree, as food for cattle, was suggested by Sir Gaspard le Marchant, Commander-in-Chief of the Madras Army, in 1866. At that time there were some plants in the garden of the local Agri-Horticultural Society, raised from seed brought from Cairo in the previous year by Dr. G. Bidie. A further supply was obtained in 1866 from Malta, and packets were distributed through the Board of Revenue to the Collectors of various districts. Dr. Bidie also said that as the Society was in a position to give the plant, which promised to be so useful, a fair trial, no pains would be spared to render the experiment successful. The result of the Society's experiments is thus reported in a letter from the Honorary Secretary, dated 13th August 1875:—"From that date [viz., October 25, 1866] nothing further appears in the records of the Society, but from report it is ascertained that the seed germinated and several healthy plants were raised which subsequently died." And I will note in this place that of all unsatisfactory experiments conducted in India, those conducted under the direct supervision of Agricultural and Horticultural Societies have been the most unsatisfactory.

The seed distributed by the Board of Revenue was sent to Nellore, Bellary, Kurnool, North Arcot, Cuddapah, Salem, Trichinopoly, Coimbatore, Tinnevely, Madura, South Canara, Oosoor, and Sydapet. The results were reported on in 1867 and 1868, and are as follow:—

In Trichinopoly no record remained of what had been done with the seed, except that about three dozen had been made over to one of the residents and

sown by him. They germinated, but soon Five were still alive in 1867, but in a bad way exists.

In Bellary the seed was distributed to a gentleman. The result was a failure. The seedlings soon died off.

In Coimbatore and Nellore the seed germinated.

In Tinnevely and Cuddapah none of the seedlings germinated.

In Madura the seed either did not germinate or the seedlings died off at once.

In North Arcot sixteen healthy young plants were lost "from the attacks of white-ants and other mischances." The remainder looked healthy and vigorous, and had attained six feet in height in December 1868. These trees were then in the Government garden at Chittoor, and had been seen a month previously by Dr. Cleghorn, who "thought very highly" of them. No further record of these is to be found in the papers.

In Kurnool the seed was sown by an officer, and the seedlings were coming on well, when he was suddenly ordered to A. sinia, and forgot in the hurry of leaving to recommend them to somebody else. The result of course was, that they came to grief. Two were reported to have been completely new, although they had been completely new seedlings would have thriven if ordinary that they would succeed in that district.

In South Canara (Mangalore) the seedlings were recently unable to penetrate the hard laterite soil.

In Salem (Oosoor) only one seed germinated. The result of course was, that they came to grief. Two were reported to have been completely new, although they had been completely new seedlings would have thriven if ordinary that they would succeed in that district.

15. Of the other experiments there are recent papers on the subject inform us that—

- (1)—There are ten young trees on the Nilgiris, but the elevation at which they are growing (6,000 and 7,000 feet) is against their success.
- (2)—In North Arcot an experiment was conducted by the Collector, but failed, the seedlings dying of the owner of a sugar factory.
- (3)—At Aska, in Gahjam, Mr. Minch and distillery, has sown some seed in his garden, with apparent success so far.
- (4)—There are upwards of two dozen plants in the Government Gardens at Burliar, on the Nilgiris, all of which are healthy and making vigorous growth. Some of these are nearly four feet high. There are also seven small plants in the coffee estate of Colonel Scott, at Wynnullay, on the southern slopes of the hills. Some of these are nearly four feet high, but at too great an altitude their ultimate success is doubtful. The others lower down are reported very healthy. The Superintendent of the Botanical Gardens thinks the tree could be grown in the coffee districts of Wynaad and Mysore.

No experiments seem to have been tried in any of the other districts from which reports have been furnished by the forest officers. One of these officers (a Deputy Conservator) says: "I am unable to identify the tree by the botanical name given [*Ceratonia siliqua*]. Neither Drury's nor Balfour's works contain the name, so far as I can observe, and these are the only books of reference in this office" (The tree is noticed in Balfour's Cyclopaedia, 2nd ed., vol. I., p. 111.)

16. In the Central Provinces an experiment appears to have been made by the Deputy Commissioner of Narsinghpur in 1873 with seed supplied to him by the Agricultural and Horticultural Society of India which the Society had received from Mr. Bicketts. From this seed seventeen plants were raised, but not more than three survived, the others having been destroyed by white-ants, "which are very numerous and destructive at Narsinghpur." The survivors are healthy and likely to prosper. One is six and the others more than four feet high.

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The Deputy Commissioner believes that the tree would grow freely in that district, and that the experiment would have been completely successful, but for the white-ants. No experiments appear to have been tried elsewhere in the Central Provinces.

17. In Bengal the experiment appears to have been repeated two or three times. In September 1873 Mr. Ricketts presented the Agricultural and Horticultural Society with some seed, but what came of it, except that some was sent to the Deputy Commissioner of Narsinghpur in the Central Provinces, does not appear.

In March of the present year Mr. Ricketts presented the Society with thirty seedlings of the tree. These, I have ascertained, are in the garden of the Society at Alipore in a more or less unhealthy condition.

The tree will probably not succeed in the water-logged soil of the Lower Provinces of Bengal, and it would be well if these plants could be transferred to the North-Western Provinces. Dr. King, Superintendent of the Botanical Gardens, reports, in reply to a reference made to the Government of Bengal, that "private attempts are said to have been made to introduce the tree in this province. There is at present one small tree in this garden, and within the past year I have sown a good many seeds. The tree is of slow growth, so that it will be years before any result can be got from these. I do not, however, think it likely that the carob will thrive in the Gangetic delta, which the climate and soil are so totally different from those of the countries where the carob flourishes." And he mentions Oudh, the Punjab, and the North-Western Provinces as much more likely to suit the carob than Bengal.

18. In Oudh the tree seems to have done remarkably well at Lucknow. In his report for 1871-72, Dr. Bonavia stated that he had an avenue of 33 of these trees raised from seed imported many years ago. Some of them were 18 and 20 feet high, and in very healthy condition. Eleven fruited during the year, and again more abundantly during the following year. Dr. Bonavia tried to propagate the tree by layers, but found, as has been found by everybody, that the only efficacious mode of propagation is to raise it from seed. In his report for 1873-74, Dr. Bonavia records that the tree stands frost better than was supposed. On the morning of the 8th January, when the minimum thermometer on the grass indicated 5° 3' below the freezing point, and vast damage had been done to other plants, not a leaf of the carob trees was touched by the frost.

19. On the 20th October last, Her Majesty's Secretary of State for India was asked to obtain from Southern Italy and send out to this country one hundred pounds of fresh seed. This seed is intended for the Government of the North-Western Provinces, which proposes to grow the tree in Kumaun. It seems doubtful, however, whether the tree has a fair chance of success there, and it may be advisable to consider now what had best be done with the seed when it comes. I would venture to suggest that some should be sown in various parts of the North-West and Punjab, the Central Provinces, and Madras. In this last province the failure of the experiments already made undoubtedly resulted from carelessness and ignorance. No seed given to tehsildars and cultivators anywhere has the least chance of success. Over and over again it has been demonstrated that seed entrusted to "intelligent ryots" might just as well have been thrown into the sea. It is unnecessary to discuss the reason of this result; it is sufficient for the present to say that the result is almost invariably the same. I would venture to suggest that no seed should be distributed to any body, European or native, but that it should all be sown carefully in pots in some central spot or spots under careful professional supervision, and that the seedlings should be distributed in due time when properly established. This course would, no doubt, be at first more expensive than that which has been hitherto adopted, but ultimately it would, I believe, be found more economical. The seed might be sown at Lahore, Allahabad, Saharanpore, Nagpore, and Burliar (the Government gardens), and the seedlings be distributed thence from time to time. I would also suggest that good use might be made of the agency of station masters on the lines of railway, both State and guaranteed. The country all along the north-eastern extension of the Madras Railway, from Madras to Rairchore, seems well adapted for the growth of the carob, and much in want of a tree of the kind. It is a dry, stony country where water is scarce, and is mostly only

to be had from tanks (which are chiefly natural hollows embanked at the lowest end). In this tract failure more or less complete of the crops is of not unfrequent occurrence, and the cattle are the first and principal sufferers. Groves of trees here which would provide them and their owners with food in times of scarcity would be a great blessing. If the seedlings were planted about the stations, where there is always sufficient water, and where they would be subject to frequent inspection by officers of the district and of the railway passing to and fro, they would be much more favourably situated than if planted in some out-of-the-way taluk where they would languish neglected and out of sight. Some little inducement to station masters, of the nature of that which has resulted in the embellishment of the stations of the Great Indian Peninsula Railway, would probably ensure unintermitting attention from the station authorities. In such places too, forming points of resort for natives from all parts of the district, a general acquaintance with the qualities of the tree would soon be formed and spread through the country.

These remarks may also be held to apply to the State lines of railway in the Punjab, the North-Western Province, and Rajputana, which afford even greater opportunities for success in this undertaking. Canal and Forest officers also might be entrusted with seedlings, and held personally responsible that due care is given to them.

J. E. O'CONNOR.

SIMLA,
10th April 1876.

*The Carob Tree (Ceratonia siliqua), with
reference to its cultivation in India.*

Instructions for the cultivation of the Carob tree.

- 928/12
1. The tree grows readily from seed, which should be well soaked before sowing. It is fit to sow when it shows by swelling that it has imbibed the water. Soaking may sometimes continue for a month or even more before the seed swells, but fresh seed will not want soaking for more than ten or twelve hours.
 2. Cuttings and layers should not be attempted. It is difficult, if not impossible, to get them to strike.
 3. To ensure germination, sow the seed in pots and transplant when the seedlings are a month or two months old. The best time for putting out the seedlings is just before the setting in of the rains. The seed will probably not all come up together: sometimes germination is much delayed.
 4. Cattle, sheep and goats must be kept away from the plants, the leaves of which they eat greedily.
 5. Manuring and trenching help the plant the first year; afterwards no particular care is required. The bushy branches thrown out near the roots should be removed: the tree will then develop at top.
 6. Saline soil and saline well water must be avoided: they kill the young plant. Use canal or river water, and soil not impregnated with reh, and avoid marshy or water-logged soil. The tree will thrive in almost any soil but these, but it particularly likes a dry soil, with a limestone formation. Tracts where kunkur occurs would suit it well.
 7. Heat and sun it will bear to any extent, and in hardly any part of the plains is the cold at any time sufficient to affect it materially.
 8. The flowers being dioecious, *i. e.*, the male and female flowers growing on distinct plants, it is useless to grow solitary trees, or to grow them in lines, for then fertilisation (which is effected by the pollen disseminated by the wind and by insects) becomes difficult or impossible, and the tree will either fruit badly, or not at all.
 9. Plant in close clumps, fenced to keep out cattle. Circular clumps are cheapest, as requiring least fencing. A circular plot with a radius of 15 yards will hold 44 trees, allowing a square of four yards (16 square yards) to each tree. A circular plot with a radius of 30 yards will hold 176 trees, and this number will form a clump quite as large as it is necessary or useful to sow in the first instance. Care should be taken to space out the trees properly so that each may have room for development.

928/13
No. 224

FROM

A. O. HUME, Esq., C.B.,

Secretary to the Government of India,

TO

*the Secretary to the Government of
Madras*

Department of Revenue,
Agriculture, and Commerce.
Agriculture and Horticulture.

SIMLA, the 9th June 1876.

SIR,

I AM directed to forward, for *the* information of *this*
Grace the Governor in Council
and for distribution to District, Forest and Jail Officers, copies of a note on
the subject of the cultivation of the Carob tree (*Ceratonia siliqua*). Copies of
instructions in regard to the measures likely to secure its successful cultivation
are also forwarded.

2. The Government of India will endeavour to procure seed for any
officer who may wish to undertake the cultivation of this tree, on his shewing
that the locality in which it is proposed to try the experiment is favourably
situated as regards soil, climate and other conditions, and who will engage
to grow the seed carefully, afford the young trees protection from the ravages
of cattle, sheep and goats, and report promptly and regularly the results of his
experiment.

I have the honour to be,

SIR,

Your most obedient Servant,

A. O. Hume

Secretary to the Government of India.

7 SEP

No 540
Revenue 1876

DEPARTMENT OF REVENUE,
AGRICULTURE, AND COMMERCE.

AGRICULTURE AND HORTICULTURE.

To

No. ⁴
234

Dated Simla, the 9th June 1876.

Read - 4 July -
Encl. 2 - 7th July -

No 928. 10th July 1876

SUBJECT.

CULTIVATION of the Carob tree (*Ceratonia siliqua*).

No 928

10th July 1876

Ad.
928/4

Read letter from G. of
India of June 1876 No. 424
of Rev. Ag. & Com.

Communicated, with
copies of the enclosures, to the
B. of Rev and Ins. of Treas.
The Board will arrange
for the distribution of these
papers to the Officers indi-
cated in para 1 of the letter
above recd, and they
will at the same time
direct the special
attention of those Officers
to para 2 of the same
letter.

- 114 To the Board of Revenue on 24 July
21 The Conservator of Forests
1 The Agric. Horticultural Society Madras
3 The Commissioner of the Madras
5 The Judicial Dept

100

6

Go.
Carob-tree

C. 7. July 176 A 10. July

C. 7. July 176 A 10. July