Select writings of Principal G. C. Bose

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AGRICULTURE

Broad features of Indian Rural Economy

Indian rural economy is marked by two broad features which it is desirable at the outset to place clearly before our readers. First, it is no exaggeration to say that nearly the whole of the rural population lives by the cultivation of the soil, a statement which can hardly be made of any other country in the world. The Famine Commissioners estimate that 90 per cent of the rural population lives more or less by agriculture. Secondly, Indian agriculture is pre-eminently a petite culture and forms the backbone of the Indian village community of which the cultivator or ryot is the unit. The village contains no doubt the blacksmith, the carpenter, the weaver, the potter and other handicraftsmen besides the ryot, but all alive for his benefit and are supported by the produce of his land. Take away the unit—the ryot—the whole village organisation breaks down. Various causes are now at work tending to draw the ryot from his land, to increase in fact the non-agricultural or landless class; but the love of the ryot for his small plot of land and homestead is so great that generations must yet elapse before this tendency will have any appreciable effect in disturbing the ancient rural organisation of India. The ryot clings to his district with a tenacity which it is extremely difficult for an outsider to realize. Hence it is that the system of emigration devised by the Government with the best of intentions draw half-starved peasants from congested areas to sparsely populated ones, has not met with that amount of success which the system deserves.

Simplicity of Indian agriculture

The systems of agriculture pursued in different parts of India vary infinitely in detail, but they all agree in one broad aspect,—simplicity. The implements of cultivation from the plough to the sickle are extremely simple in their construction and in the mode of their working; they are all manufactured, changed, and repaired in the village without any assistance from skilled town-mechanics. The motive power of the ryot, the inevitable bullock, supplemented

here and there by the buffaloe, excepting in Sindh and the western districts of the Punjab where camels replace the bullock, is easy to manage, to breed, to feed, to doctor, and to buy and sell. The various operations of husbandry are equally simple. Ploughing in the English sense of turning up a furrow is unknown and perhaps unnecessary in this country, where it is a much simpler operation which turns up no furrow but merely scratches the surface soil, and requires no complicated implement like the English plough or skilled workman like the English plough-man. So on with the rest.

General aspects of the Indian agriculture

The great problem of agriculture in India is the storing of water in the soil. In this respect it differs totally from agriculture in Europe where the drainage of surplus water is the main difficulty. This essential requisite of Indian cultivation, except in localities where natural means are sufficient, is supplied by wells, as in the Punjab and the Deccan, by tanks and *bandhs*, as in the Karnatic and the uplands of Bengal, by inundation channels, as in Sindh and parts of Bihar, and by terraces cut on every hill side, which together water a far larger area than is commanded by the Government canals and are more adapted to the soil, climate and social conditions of the people than the latter. But all these means of irrigation taken together do not command more than 13 per cent of the total cultivated area. In a country like India where rainfall is capricious, both in its amount and distribution, and where the conservation of water is the first and most essential requisite of cultivation, the proper control of the water-supply becomes a question of paramount importance, more so than the introduction of labour-saving implements, chemical manures and scientific methods of cultivation. Manures are copiously applied to his valuable crops by the ryot, who knows fully well the forcing power of his applications; but his scope in this direction is limited both by the number of manures at his disposal and their quantity. Scientific agriculture can help him more in this than in any other department of his profession. Rotation of crops in its European sense is unknown and not at all a necessity in the vast rice-growing deltas of the great Indian rivers. But at the same time the exhausting effects of cropping a land with the same crop from year to year and the recuperative power of fallows are widely recognized. From the famous 'black' or 'cotton' soil of the Deccan, which is wonderfully fertile and retentive, and the alluvial soil of the river

deltas, annually rejuvenated, to the deserts of Sindh and Rajputana, the soils present an infinite variety; and the ryot has adapted his cultivation to these varying conditions with a skill which only the accumulated experience of ages can generate in persons who follow a hereditary calling. The plough-cattle of India speaking generally are not such undersized, ungainly and inefficient creatures as foreigners have often described them. Considering the soil, the climate, and the other conditions under which they have to work, the cattle are well adapted to the purposes of the ryot. No doubt there are local breeds such as the Nellore cattle of Madras, the Amrit Mahal of Mysore and the trotting bullocks of Jubbulpore, which in point of breeding, beauty, and the special purposes for which they are bred can stand comparison with any cattle in the world. But even the much condemned ordinary plough-cattle of the country, if not carefully bred, are well looked after and well fed so far as the poor ryot's means allow. His means however, which are never very affluent, fall to their lowest ebb in seasons of scarcity; and his cattle have to share with him the pinch of penury and starvation which claim as victims thousands and thousands of their number annually. Add to this the heavy mortality due to various forms of cattle diseases which follow in the wake of scarcity, and the causes of the insufficiency and degeneracy of Indian cattle become apparent. Mr. Hume, a late Secretary to the Government of India in the Department of Revenue and Agriculture, estimates 'the average annual loss of cattle in India by preventible disease at 10 million beasts worth 7½ millions sterling.'

Principal Crops

Having thus summarised the general aspects of Indian agriculture, and adverted to the three main impediments from which it suffers, it may be useful now to give a brief account of the principal crops of the country. For convenience of treatment, the crops are divided into, (1) *Food crops*, and (2) *Industrial crops*. Of these some are grown principally for home consumption, while others are grown for export. Of the food crops grown for home consumption, the chief are Rice, Millets, Pulses, Oilseeds and Sugar-cane; of those grown for export, the most important is Wheat. Of the Industrial crops, Cotton, Jute, Indigo, Opium, Coffee and Tea are grown for export, and Tobacco and Cinchona for home consumption.

Rice

Rice has been cultivated in India from time immemorial. Competent observers on Indian Botany assert

—and their assertion accords with the prevailing opinion of the people of the country,—that *uri dhan*, which grows wild all over Bengal and other parts of India, is the parent stock from which all the cultivated varieties of Indian paddy have sprung. Philological evidence has been brought forward to corroborate or controvert the Botanical evidence, but this is not the place to discuss the matter.

The Famine Commissioners estimate the rice-eating population of India (excluding Burma) at 67 millions, or over one-third of the whole population. The proportion is highest in Bengal, being 43 out of 69½ millions and Madras stands next with 10 out of about 31 millions.* In Lower Burma, out of a total cultivated area of 5,664,987 acres, in 1891-92, as many as 4,662,897 acres, or 82 per cent were under rice. In Bengal, out of a total cultivated area of 55,407,360 acres, in 1889-90, as many as 41,618,560 acres or 75 per cent were under rice. For Madras, in 1891-92, the total cultivated area was 28,823,826 acres, out of which 5,771,182 acres or over 23 per cent were under rice. Throughout the interior of the country, rice cultivation occupies but a subordinate place. In the North Western Provinces and Oudh, the total cultivated area in 1891-92 was 36,797,272 acres, of which 7,139,042 acres or slightly over 19 per cent were under rice. In Punjab, the acreage of rice is 722,511, or slightly under 3 per cent, out of a total acreage of 25,779,366 acres. In Bombay, the acreage of rice rises to 6 per cent, or 2,299,593 acres out of the total cultivated area of 36,438,830 acres. In the Central Provinces, the percentage rises still higher, namely 24, or 4,292,480 acres out of 17,786,399 acres of total cultivated area. Taking India as a whole, out of a total cultivated area of 221,583,646 acres, in 1891-92, 68,843,662 acres or 31 per cent were under rice.

The conditions under which rice is cultivated are so exceptional, that the areas in which it forms the staple food-crop may easily be defined. The Deltas of the great rivers of Lower Burma and Bengal; the Deltas of the Godavery, the Krishna and the Caveri; the long narrow strip of land fringing the coast; and the lowlands of Travancore, Malabar, Kanara and Konkan present all the conditions of successful rice cultivation, and constitute the great rice growing area in India. If we except this area, rice may be said to be a subordinate, if not a rare crop throughout the remainder of the country; in fact, Millets take the place of rice in the interior (excepting Assam). Sir William Hunter

* These population figures are from the census of 1881.

writes—"Taking India as a whole, it may be broadly affirmed that the staple food-grain is neither rice, nor wheat but millet."

The conditions of rice-cultivation as have already been stated are quite exceptional. It stands in stagnant water from transplantation time to almost harvest time. In some Bengal districts, pre-eminently Dacca, a variety of paddy is grown which will keep its head above 20ft. of water "and has a remarkable power of growth, often shooting up to the extent of 12 inches in the course of 24 hours as the inundation rises." The two principal varieties are, (1) *aus* which occupies the field from April-May to August-September, and (2) *aman*, which occupies the field from June-July to November-December. There is a third (3) variety *Boro* which holds a very subordinate place except in the Eastern Districts of Bengal, especially Dacca. This variety occupies the field from January to April. Considered by area and consumption, the most important variety by far is the *aman*, as it covers more than three-fourths of the rice-growing area. Rice-straw after the separation of the grains forms a very important and valuable fodder. For feeding cattle it is chopped into bits of 2 to 4 inches long and mixed with rapecake, dry or in a state of emulsion with water, and also with the husk of pulses. It is also given to them uncut. Another economical use for which it is highly valued is the thatching of ryots' cottages.

Wheat

The origin and early history of wheat cultivation in India is as much enveloped in mystery as that of rice. There are reasons to believe that it is as old in India as in any other part of the world. Spelts, a coarse variety of wheat cultivated in this country as well as in Europe, is supposed to be the direct descendant of the parent stock from which all the cultivated varieties have originated. De Candolle, the greatest authority on the origin and history of cultivated plants, considers Mesopotamia to have been the original home of wheat whence it has spread both East and West. But the evidence on the subject is not conclusive.

The importance of wheat cultivation dates from 1869, in which year the Suez Canal was opened reducing the time of transit from India to Europe from three or four months to as many weeks. The importance was further emphasized in 1873 on the 4th January of which year the export duty on wheat was taken off within the last twenty-two years, the export trade in wheat has gone on steadily increasing without any serious fluctuation. The total quantity of wheat exported rose from 637,099 cwt.

in 1871-72 to 1,755,954 cwt. in 1873-74 and to 30,306,989 cwt. in 1891-92. To feed this steady increase of export there has been a steady increase in the area devoted to wheat cultivation which is returned at 19,573,982 acres in 1891-92. This includes 1 million acres as the estimated wheat acreage of Bengal. Taking by the provinces, in 1891-92, the Punjab grew 6,767,893 acres of wheat, or 26 per cent of its total cultivated area, the Central Provinces 3,957,260 acres, or over 22 per cent of its total cultivated area; the North Western Provinces and Oudh 4,757,397 acres or 13 per cent of the total cultivated area; and Bombay 2,299,593 acres or 6 per cent of the total cultivated area. Other provinces grow wheat, but to a very small extent; and hence separate acreages for them are not given here. From the above figures it will be clear, that wheat flourishes most where rice does not, and that the great wheat producing area embraces the whole of Northern India up to the head of the Gangetic delta and, in Southern India, the whole of the table land above the Ghats.

Wheat does not form the staple food of the people of the country and is grown principally for export. It has been estimated that the Indian consumption of wheat does not exceed 6 million tons. Contrast this with the figures for rice, namely 25½ million tons, and the comparatively less importance of wheat consumption becomes at once apparent.

The Punjab, which has the largest area under wheat, exports comparatively the smallest amount; so that in the Punjab wheat forms an important article of food. On the other hand, the Central Provinces, which stands next to Punjab in the percentage of wheat producing area, grows wheat almost exclusively for export. The great wheat producing countries in the world are the United States with 45,000,000 quarters as its gross annual outturn; India, France, and Russia with 30,000,000 to 35,000,000 quarters each. The largest consumer of Indian wheat is the United Kingdom, which in 1891-92, imported from India 12,345,453 cwts. out of the total Indian export of 30 million cwts. Indian wheats are more glutinous than English ones and not suited for bread-making excepting with a fair admixture of soft English wheats. They are however said to be very well suited for macaroni for which purpose a demand for them has sprung up in Italy. The questions of adulteration and trade refraction need not be mentioned here.

Wheat is classed as a winter or *rabi* crop; the sowing commences from the end of October and the harvesting finished

by the end of May. Where facilities exist it is always irrigated. The varieties cultivated are too numerous to be detailed here, but they are grouped under the general headings of hard and soft, red and white, and bearded and beardless. Heavy clay loam is best suited for its growth. There is a variety of wheat grown in local areas in which the husk does not fall off from the grain but which has to be husked like paddy for separating the grain from its outer-coat. The average yield of wheat per acre has been variously estimated. Sir William Hunter puts it at 13 bushels per acre in the Punjab, as compared with an average of 15½ bushels per acre for the whole of France. If we include the whole of India, the present average yield will not exceed 9 bushels per acre. Contrast this with the average yield of an English acre, namely 30 bushels, and the possibility of improvement in wheat cultivation becomes at once apparent. Wheat straw in the form of *bhusa* or *poal* is largely used as cattle food, but not for thatching.

Millets

As rice forms the staple food crop grown for home consumption in local areas as Bengal, so millets form the staple food crop in those localities where rice is not cultivated. In fact the millets are the poor's grains, that is, the food of the majority of the Indian people. The total area of land under millets, in 1888-89, has been estimated at 35,154,468 acres, of which Bombay has 15, Madras 11½, the N. W. Province 1 4/5, the Punjab 5, and Berar over 2 million acres. In Bengal Proper and Orissa, millets are seldom cultivated, but in Behar they are more common. The two most common kinds are the great millet or guinea corn (*Sorghum vulgare*) known as *joar* or *jawari* in Northern India, and *cholum* in Madras; and the spiked millet (*Pennisetum typhoidem*), known as *Bajra* in the North and *Kamba* in the South. Besides these there are five other cultivated species which hold a very subordinate place in acreage. Of these *ragi* (*Eleusine corocana*), takes the first place in Mysore where it is the staple food grain. Millets are classed as *kharif* or autumn crop as opposed to wheat classed as *rabi* or winter crop.

Minor cereals: Maize

Indian corn or Maize (*Zea mays*) is the most cosmopolitan of all cereals, being cultivated throughout the world. In India, for instance, it grows in the swamps of Eastern Bengal, in the sands of Rajputana, and in the colder regions of the Himalayas. Some varieties are grown only as green crops, which, when ripe, are unfit to be eaten,

while others are grown for the ripe grains only. It is a *kharif* crop, though it is not unusual to come across *rabi* maize, which is sown in autumn, and reaped in spring. In Upper India, only the ripe grains are made into flour and then into bread. In other parts, the green cobs are eaten after being roasted or fried. The straw reaped green is a good fodder, but useless in the ripe state. The area of maize cultivation has not been separately given and can hardly be determined. Many ryots grow it as a vegetable in small plots around their homesteads. Dr. Watt, in his Economic Dictionary, says that the maize area of India closely corresponds with that of wheat. Of the different provinces, Punjab has the largest, and Bengal and Madras the smallest area under maize.

Barley

Barley is grown in Northern India, especially the North-Western Province which has the largest area under the crop. The toal area under barley has been estimated at over 7 million acres, excluding Bengal and the Native States from which reliable statistics can not be had. It is grown either alone, or mixed with pulses as gram, peas, or lentils. The seed is sown in October-November and the harvesting is complete in April-May. It is a *rabi* crop like wheat, but is grown chiefly for home consumption, very little being exported. In North India a curious practice prevails in some places of cutting the whole crop down to the ground when about to flower and feeding the cattle with the green stuff. The barley is allowed to grow again from the green stubble left on the land and, strange to say, the new crop is not any the worse for this treatment. Until very lately Indian maltsters used to import barley from Persia, but now the barley used by the Indian brewers is entirely grown in this country. English maltsters have complained of Indian barleys not germinating freely for malting purposes, but the grounds of complaint have not yet been closely examined or established. But the use of the grain in many parts of India for the preparation of a kind of spirituous liquor or beer has long been known. Barley meal, known as *chhatu*, is a common food amongst the lower classes in Northern India.

Oats

Oat (*Avena sativa*) is a recent introduction into Indian agriculture under English auspices. Its cultivation is restricted to Northern India where it is principally grown, in districts where horse-breeding is carried on, as food for horses. In the dietary of horses in India, gram usually takes the place of oats in England.

Pulses

The pulses of various sorts form very important articles of food. Next to rice and millets, the pulses have the greatest consumption. They are mostly consumed in the form of a thick soup known as *dal* formed by boiling split pulses. This soup is seldom taken alone, but used as an accompaniment of the staple article of food. The area under the heading "Other food grains including pulses" given in the Statistical Returns of 1891-92 is 76,452,323 acres, of which fully one-half, if not more, may fairly be assumed as under pulses alone. Dr. Watt in the Colonial and Indian Exhibition Catalogue puts the total area under pulses at 48,000,0000 acres; but it must be remembered, that lands which grow pulses are generally twice cropped, in other words pulses are taken as catch crops. The principal varieties of pulses grown are the common gram (*Cicer arietinum*) *arhar* (*Cajanus indicus*), lentils (*Lens esculenta*), *mug* or *mung* (*Phaseolus Mungo*, *mashkalai* (*Phaseolus radiatus*), the common pea (*Pisum sativum*) and *khesari* (*Lathyrus sativus*). The pulses are all *rabi* crops excepting *arhar* which stands in the field a full year.

Oil Seeds

The principal varieties of oil seeds cultivated in India are rape or mustard, linseed, *til* or gingelly and castor-oil. The total area under oil seeds, in 1888-89, was 7,381,811 acres; but as this did not include Bengal, for which reliable statistics are wanting, and as the area in Bengal under linseed alone in the same year was estimated at 1,500,000 acres, the total area under oilseeds for the whole of India may be estimated at 9 million acres. The total area in 1891-92, excluding Bengal, has been returned at 8,498,058 acres, to which if we add 2 million acres for Bengal the total comes to over 10 million acres. The increase in acreage has been due to an impetus given to export trade in oil seeds, especially to France. In 1879-80, the total quantity of oil seeds exported was 7,091,469 cwt. valued at Rs. 4,68,58,927, and the export steadily went on increasing till in 1889-90, it rose to 15,794,742 cwt. valued at Rs. 10,62,75,533. Mr. O'Conor says in his review of the sea-borne trade for 1884-85. "This trade has developed in recent years into one of the first importance, exceeding greatly the trade in wheat, rice, jute, indigo, or tea, and being exceeded only by cotton and opium". Mustard or rape is a *rabi* crop harvested in January, linseed a *rabi* crop harvested by the end of April or beginning of May; *til* or gingelly is a *kharif* or autumn crop harvested in September-October. There is a variety of *til* which is grown as a spring crop and harvested just before the commencement of the rains.

Coarse sugar or *gurh* is produced from sugarcane (*Saccharum officinarum*) and date palm (*Phœnix sylvestris*). The cultivation of sugarcane and date-palm in India and the use of *gurh* (coarse sugar) are mentioned in old Sanskrit works such as the *Manusamhita*, *Charaksamhita* and *Susruta*. There is evidence to show, that *gurh* was known and produced in this country long before the Christian era. Botanical evidence favours the idea of India being the home of the parent stock from which the cultivated varieties of sugarcane have been gradually evolved.

Sugar

Gurh is one of the cheapest luxuries which the poor of India have. So far as the consumption among the native population of the country is concerned, refined sugar is at a great discount. It is wholly wanting in that flavour and sweetness which make *gurh* palatable to them. Their prejudices against refined, or as it is often called loaf sugar, are due not merely to the impression, right or wrong, that bone is used in its manufacture, but also to the fact that it does not come up to their standard of palatableness. Of late years the export trade in sugar has declined. But the acres of sugarcane cultivation quoted below will show that there has been no decline in it, but rather expansion. Of the two chief sugar-producing regions in India, in 1847-48, Bengal had 223,794 acres and N. W. Provinces 595,441 acres under sugarcane, and in 1887-88, 282,000 acres and 788,000 acres respectively. Messrs. Thomson and Mylne, the enlightened and enterprising Zemindars of Behea, in Bengal, have estimated the area under sugar plants at 2½ million acres, the outturn of coarse-sugar per acre at 1 ton, and the total outturn at 2½ million tons. The total area of sugarcane for the whole of India including Bengal and the Native States, in 1887-88, has been put in Dr. Watt's Economical Dictionary at 2,107,200 acres; and the statistical returns for 1891-92, which do not include Bengal and the Native States, have put it at 1,940,332 acres, to which if we add the areas for Bengal and Native States and the areas under sugar-date, the total would come very near to the estimate of Messrs. Thomson and Mylne quoted above.

Sugarcane requires well-drained, light, alluvial soil capable of being irrigated whenever necessary. Stagnant water is its greatest enemy. It occupies the land for full one year from March-April. As a rule sugarcane lands are heavily manured with dung or oil-cake, or both; the oilcake used was formerly rape cake, but now it is being rapidly replaced by cheaper castor

cake. The Provinces which grow most sugar-cane are, in order, the N. W. Provinces (788,000 acres in 1891-92), the Punjab (354,000 acres), and Bengal (282,000 acres). The outturn of coarse sugar per acre has been variously estimated, 27 maunds per acre being the average put down in Dr. Watt's Economic Dictionary. It is sometimes so high as 90 to 100 maunds per acre.

The stools left in the ground after harvesting are sometimes allowed to grow and produce another crop, the process being known as ratooning and the crop as ratooned crop. Sometimes as many as three ratooned crops are taken from the same field. But the yield of the ratooned crop gradually diminishes. The varieties of sugarcane grown are numerous. They have been classified as Mauritius canes. Otaheite canes, Bourbon canes, Batavian canes, Singapore canes, and the so-called Indian or Indigenous canes. The canes that were formerly grown most in Bengal were an indigenous variety, and red Bombay canes. But the latter which was an introduced variety became attacked by a worm and suddenly died out after it had been cultivated for a certain number of years. This has been the history of all cultivated varieties, indigenous or introduced, when cultivated for a number of years in the same district. That this is a fact well known to the ryots, is proved by their constantly changing indigenous varieties of cane for those introduced from other districts. Bengal now grows principally a variety of introduced cane. Sugarcane and potatoe cultivation illustrate powerfully the well-established agricultural principle of the absolute necessity of change of seeds at intervals.

Date-palm is grown all over India as a source of *gurh* and sugar. Madras, in Southern India, and Bengal, in North India, are the chief date-sugar areas. In Bengal again, Jessore is the district well known for its date-palm cultivation and sugar industry. Those who are interested in date-sugar are referred to Mr. Westland's valuable report on the subject.

Cotton

Cotton is one of the most important agricultural products of India. Its cultivation and use have been known in India long before it was known in any other civilized country in the world, and authorities seem to be unanimous in thinking that Europe owes its knowledge of cotton and its manufacture to India. Even China with which India has had communication from very early times, seems not to have been aware of it till within comparatively recent times. Another very striking feature in the history of cotton is the fact, that although cotton

spinning and weaving were known from very remote times, no direct mention of cotton has been found in the most ancient Sanskrit works, which, nevertheless, refer to other articles used for the manufacture of cloth, such as silk, and wool.

The present importance of cotton dates from the enormous demand of Lancashire caused by the American War of 1862. Prior to 1860, the cotton export averaged in value from 200 to 400 lakhs of rupees, but after that year it rose by leaps and bounds until, in 1864-65, it reached 4,687,972 cwts. valued at 3,387·3 lakhs of rupees, the highest value ever attained. The restoration of peace in America recoiled heavily on the Indian trade, and the export fell steadily to just under 800 lakhs of rupees in 1879. Since then the trade has recovered, and in 1888-89, it stood at 5,331,536 cwts. valued at 1,505·6 lakhs of rupees. The English manufacturers look upon Indian cotton with disfavour and prefer the longer stapled American, Egyptian or Brazilian cotton; consequently, exports to the United Kingdom have been decreasing. But exports to other European countries have been increasing. This fact has been explained by the difference of machinery used in the mills in England and in those on the Continent. The English machinery has been constructed for longer stapled cotton, while the machinery used in the continental countries has been specially adapted for the treatment of short stapled cotton like that of India. The Statistical Abstract relating to British India returns 8,859,429 acres under cotton in 1891-92*. The average yield of cleaned cotton per acre varies from 50 lbs. to 175 lbs., the proportion of cleaned to uncleaned cotton being usually taken as 30 : 100. The Province in which cotton is most largely grown in Bombay, Berar comes next, then comes Madras and the North Western Provinces; the other Provinces grow less than a million acre each. The variety that is cultivated most is the *'Bengals'*; the *Hinganhati*, the *Amraoti* and the *Dhollera* are also among the most favourite varieties. The time of sowing is different in different provinces, as is also that of picking. Generally, it may be stated, that the sowing begins with the beginning of the rains and the picking begins with the end of the rains and lasts up to the end of April. The number of pickings varies from three to five according to the nature of the crop. Cotton is essentially a sunny crop, too much rain being injurious to it. As it is a very exhaustive crop, it is seldom grown two or three years consecutively in the same field, being

*If Bengal and the Native States be included, the area would be much larger.

alternated with wheat or millets. As a mixed crop, it is often sown with millets, gram, *til*, tisi or linseed.

For a sketch of the cotton industry, the reader is referred to the next two chapters.

Jute

Jute was known to the people of India from very remote times; but, as the name of the plant or its fibre is not found in early Sanskrit works, which contain the name of a similar fibre, *san*, it may be doubted whether the plant is indigenous to India, though India is, at present, the centre of its cultivation. Besides India, it is known to be cultivated, to a small extent, in Ceylon, Sunda Islands, South China, Phillipine Islands, in fact in many parts of Southern Asia. Though known all over India, it is almost exclusively cultivated in Bengal, especially Northern and Eastern Bengal. It grows best in the deltas of the Hughly, the Brahmaputra and the Megna. It delights in the alluvial deposits thrown down by rivers subject to annual inundation. The development of jute cultivation and of jute industry is entirely the product of British rule. With the increase of the British trade in grains, especially wheat, grew up the demand for gunny bags, and this gave an impetus to jute cultivation. The ryots sure of the market and attracted by cash-return for their labour, began to throw more of their land under jute and devote more of their spare time to the manufacture of the fibre into gunny bags. The area of cultivation began to advance by rapid strides. But the hand-loom failed to supply the ever increasing demand for gunny bags. The steam mills of Dundee grew up, and a large export trade in raw jute was established to feed them. The application of steam in the manufacture of jute in this country was not thought of till about 1857, when the first jute mill was started near Calcutta. Now there are 22 jute mills in the vicinity of Calcutta. Practically jute cultivation is confined to Northern and Eastern Bengal, where, in 1891-92, the area under jute was nearly two million acres. In 1889, the amount of raw jute exported was 10,553,143 cwt., and the number of bags exported was 99,79,587. When these figures are compared with the figures of the previous twenty years, the steady expansion in the cultivation and trade of jute becomes at once apparent.*

The jute which is grown in the Western districts of Hughly,

*The first record of Jute Export to Europe in 1828 opens with 364 cwts. Contrast this with the figures of 1889, and the importance of the Jute trade requires no other comment.

Burdwan and 24 Perganahs, belongs to *Corchorus Olitorius* with long pods, and that of Eastern Bengal to *C. capsularis* with roundish pods. The former is of a finer quality than the latter but the weight of fibre yielded is less. The finer qualities are grown in lands round the homesteads of peasants. The coarser qualities which supply the major part of the trade grow in low-lying lands, even in the salt-impregnated soil of the Sunderbans, which are generally submerged in the rains. The seed is sown from March to June; and the harvest, beginning with the end of June with the earliest variety, continues till the end of September. When the flowers begin to appear, it is time to cut down the plants. If cut earlier, the fibre is weak, and if later, the fibre, though strong, is coarse and wanting in gloss. The plants after being out are allowed to wither and drop their leaves for a day or two and then steeped in stagnant water in some road-side pool. Sometimes plants are steeped fresh. The period of steeping varies from two to twenty-five days. If steeped too long the fibre gets rotten and discoloured. When the proper stage is reached, the cultivator standing waist-deep in the foul water, pulls off the skin of the stalk nearest to the root end and then cleverly manages to separate in one pull the whole of the fibre from the stalk without breaking it. When a sufficient quantity of fibre has been secured, he spreads the fibres on the water and washes them clean very much like a washerman. The washed fibres are then suspended from a rope or spread on the ground for drying. The average yield of clean fibre per acre is put at 15 maunds. Although the area of jute cultivation is extending every year, and the little cash that the crop brings in to the cultivators, at the time of the year when he stands most in need of it, serves as a great attraction for him, still it must not be looked upon as a crop that has established itself as an essential part of our rural economy; but only as a subsidiary one to be taken up and put by as the demand for the fibre fluctuates.

Indigo

The seat of indigo cultivation and manufacture is Bengal, the North-Western Provinces and the Madras, the Bengal dye being the best all round. But the earliest European records of indigo manufacture are associated with Western and Southern India. It is very probable that indigo was first introduced in Western and Southern India, whence it migrated to Northern India and Bengal which afforded greater facilities. The development of its cultivation and manufacture

in Bengal is solely due to the enlightend policy adopted by the East India Company, who began by importing good planters from the West Indies and subsidising their enterprise with advances. Until the introduction of tea, indigo was the only industry in which European capital and enterprise, helped by encouragement from the Government met with marked success. Similar attempts were made to import sugarcane planters from the West Indies and establish sugarcane plantations in India on the lines of indigo plantation, but these attempts utterly failed. Owing to various reasons which it would be out of place to discuss here, the indigo enterprise is now gradually passing out of the hands of the European planters who have hitherto had practical monopoly of the business, into the hands of the cultivators and Indian capitalists. This has been specially the case in Madras where the industry has latterly been thriving, while it has been declining in Bengal.

The Statistical Returns for 1891-92, put the area under Indigo for the whole of British India at 541,308 acres. Of this total area, the N. W. Provinces and Oudh had 259,099 acres; Madras 212,255 acres; and the Punjab 58,896 acres. To this may be added 5,000,000 acres for Bengal, as for want of reliable statistics, the Bengal areas have not been included in the statistical returns, the average annual yield of the dye is estimated at 15 million pounds.

In Lower Bengal there are two October sowings and one spring sowing in April, the crops of both the sowings being ready almost at the same time. The manufacture begins in July and goes on till September. In Southern Behar, the principal sowing begins with the beginning of the rainy season and crop continues to grow throughout the year, and is reaped in July and August of the next year. The early rain sowings are ready for the sickle in September-October. In North Behar, which forms the headquarters of the indigo industry, the cultivation is carried on in a more elaborate scale. The sowing commences in February and the crop harvested in June. In Madras, it is generally cultivated as a dry crop. In some parts, it is sown mixed with millets. In dry land, one cutting is obtained on October, and another in January. When grown on wet lands, two cuttings are certain, and sometimes even a third. The system of cultivation is least expensive and troublesome in the char lands of Lower Bengal, where the crop requires no ploughing, no manuring and no watering. Whereas in North Behar, it is cultivated in

comparatively high lands, and manures are frequently applied. Another important point of difference between the Bengal and Madras systems is, that in the former the industry is almost entirely in the hands of the planters, whereas in the latter it is in the hands of cultivators. The present depressed state of the European market has checked the spread of the industry and, if the depression continues, threatens at no distant date, if not the ruin of the industry, at least the closing of many factories. Although indigo is grown and known in other parts of the world, still India has the practical monopoly of the European trade in the dye.

Opium

Poppy (*Papaver somniferum*) is supposed to be a plant not indigenous in India, but introduced by the Arabs. At any rate, though the use of the seed and its oil was known from very early times, the knowledge of the inspissated juice was certainly introduced by the Arabs. De Candolle, the highest authority on the domestication of agricultural plants, seems to differ from this view; but modern Indian authorities are arrayed against him.

The trade in opium is a Government monopoly. It is grown and manufactured in two special areas: (1) in the valley of the Ganges round Patna and Benares, and (2) in parts of Central India corresponding to the old kingdom of Malwa. In the former area, the cultivation is a Government monopoly, whereas in the latter, the cultivation is free, but a duty is levied on opium as it passes through the British presidency of Bombay. Opium is also grown in the Punjab for local consumption, and, to a small extent, in the Central Provinces. Throughout the rest of India, it is absolutely prohibited though it is said that in parts of the wild Himalayan country, it is grown to a small extent, with little or no control whatsoever. The opium grown in the Gangetic valley, is supervised by two Agencies, the Behar Agency with its headquarters at Patna and the Benares Agency with its head quarters at Ghazipur. In 1889, the land actually cultivated with opium in these two Agencies was 459,860 acres. Besides the opium grown in the Gangetic valley, the Punjab has on an average 13,000 acres; the Rajputana States 178,757 acres; Ajmir-Merwara 2,854 acres; Central Indian States 243,494 acres; and a small area in the Native States of Bombay and the Central Provinces. On the whole it may be stated that the total opium-producing area of India does not exceed one million acres.

Under the Bengal system, cultivators enter into an engagement

with the Government Agents to sow a certain quantity of land for which they receive a proportionate amount of advance. They are bound to make over the whole produce, being paid at a fixed rate according to quality. The cultivation requires great care and attention. High lands are best suited to it. There must also exist facilities for irrigation. Manure where available, is plentifully applied to the crop. The land is repeatedly ploughed and harrowed till November, when the seed is sown. When the plants flower, the petals are first removed to serve as coverings for the opium-cakes. The capsules generally ripen in March, and the operation of scarifying and scraping then begins. The capsules are scarified by pointed irons in the evening, and the inspissated juice collected next morning. In April, the produce is brought by the cultivators to the Agency, where it is weighed and valued, and the accounts settled. It goes through a process of preparation in the Agencies and when dry, is packed in chests and sent to Calcutta, whence it is exported to China. The average yield of opium per acre has been put at 10 seers for the whole of India.

Tobacco

Popular opinion seems to suggest that tobacco has been in use in India from very remote times, but historical evidence is against such a suggestion. It was introduced into India by the Portuguese about the year 1605, during the latter part of the reign of Akbar. The aborigines of America are believed to have known and used the drug long before it was known in Europe, where the first tobacco plants were brought about the year 1560. Captain Ralph Lane introduced it first into England in 1586 and Sir Walter Raleigh made the smoking of the drug fashionable. It has since greatly spread to the East, and is now wide-spread economic plants in the world.

The Statistical Abstract returned 327,121 acres under tobacco in British India in 1891-92.. No reliable statistics are available for Bengal; but, it has been estimated, that over 5 hundred thousand acres are under this crop in Bengal. This would make the total for British India a little over 800,000 acres. Tobacco is grown in every district of India for local consumption. The principal tracts in which tobacco is grown for export are Rangpur, Cooch Behar, and Tirhut in Bengal; Karia in Bombay; the delta of the Godaveri, and Coimbatore and Madura Districts in Madras. The well-known "Trichinopoli cheroots" are made out of tobacco supplied by the last two districts, while the "coconadas" are manufactured from the tobacco grown in the *lankas*, or alluvial islands in the Godavery, and are hence called *Lankas*.

The tobacco of Rangpur, Cooch Behar and North Bengal is generally exported first to Calcutta, and thence to Burma to be manufactured into Burma-cigars. Cigars which pass under that name are also partly manufactured in Calcutta.. Next to Bengal, Bombay had, in 1891-92, the largest area with 86,249 acres, and Madras stood next with 72,747 acres.

The system of cultivation of tobacco varies in its detail in different provinces. It consists essentially, first in growing seedings in a nursery, and then in transplanting them in fields well-prepared and manured beforehand. Facilities for irrigation should exist. In Bengal, tobacco is grown in a nursery in August, September and October, and transplanted in November ; and the leaves are ready for gathering from January to March. As a proof of the excellence of Rangpur tobacco, it may be noted that a medal was obtained by a native of the district for a specimen which he exhibited at the Paris Exhibition of 1867.

Indian tobaccos are not in demand in the European market, and this is said to be due to defective curing. The native system of sun-drying the leaves has been universally condemned, and the American system of shade-drying proposed as a means for improving their quality. Two factories under the supervision of experienced American curers, have been started, one at Gazipur in the North Western Provinces, and the other at Poosa in North Bengal, by a private European Firm (Messrs. Begg, Dunlop & Co.). The results of their operation are said to be hopeful. The idea enamated from Sir E. Buck, the Secretary to the Government of India in the Revenue and Agricultural Department, who hoped that the success of the firm would induce indigo planters in the neighbourhood to take up the industry. This hope, however, has not yet been realized.

Silk

Sericulture is a very old industry in India. Silk is found mentioned in early Sanskrit works. But, it is almost certain that neither the mulberry nor the silk worm was indigenous in India. When the East India Company established their trade marts in Bengal, they found the silk industry in a declining state, and took great pains to revive it. As Bengal has always been the chief seat of mulberry cultivation, they established several factories with numerous filatures in each, to which the cultivators brought their cocoons. They brought, in 1769, a company of Italian reelers to teach the Italian system of reeling to their factory hands. Bengal silk soon became an important article of trade and superseded all other silk in the

European market. The palmy days of Bengal silk-industry lasted till 1833, from which year the company abandoned the trade on their own account and it fell into private hands. Sericulture has ever since been steadily declining. Bengal silk which was once the glory of India, and which, at one time, almost monopolized the European market, has now hardly any demand outside India. For instance, the annual export of raw silk from Calcutta about the time when the trading operations of the Company ceased, was about one million lbs., and now the average export of raw silk seldom rises above 6 hundred thousands pounds. Estimated by its value, the decline in the export trade of silk becomes still more conspicuous. The imports of raw silk into India now exceed the exports. The silk of Japan, of China, and of the countries bordering on the Mediterranean now controls the European market.

At present the industry still clings to its old head quarters, namely the districts of Murshidabad, Rajshahi, Bogra, Maldah, Beerbhoom, Burdwan and Midnapur. The cultivators grow the mulberry plants and rear the silkworm which feeds on the mulberry-leaf. Cocoons raised by the peasants are not dealt with by them, but find their way either to small native filatures where they are reeled in the rough native fashion and usually used in the hand-looms of the native silk-weavers; or they are brought to the large European factories where they are usually reeled and worked up by machinery and then consigned direct to Europe. Mulberry is a perennial plant, and in this respect differs from most agricultural plants of India. Three *bunds* of silkworms are usually obtained in the year, namely in November, March and August. The silkworm proper of Bengal (*Bombyx mori*) is a thoroughly domesticated species. Besides this, there are several species of wild silkworms that abound in the jungles of Chutia Nagpur, in Bengal, of Assam, and of the Central Provinces. The 'wild silks' are known by the common name of *tussur*, while the cultivated silks go by the name of *garad*. Of these the wild silks, *eri* and *muga* of Assam are well known and are great favourites. The *eri*-worm feeds on castor-oil leaves, and the *muga*-worm on *sum* leaves. The jungle plants which furnish food for the wild silkworms are, *asan* (*Terminalia tomentasa*), *sal* (*Shorea robusta*) *bear* or *kul* (*Ziriphus jujuba*), &c.

The present decline of Bengal sericulture is believed to be due to silkworm plague (pebrine), bad reeling and hard competition

with Japan, China and Mediterranean silks, and attempts are now being made by the Government to arrest this decline.

Tea Tea, Coffee and Cinchona are crops with which the peasantry of India have little or no connection. These agricultural industries are almost exclusively financed by European capital, supervised by European skill, and except in the case of coffee, were introduced into India under the auspices of the British Government.

Tea is generally taken to be a native of Assam whence it was introduced into China at a remote past. But recent authorities do not seem to favour this general opinion. They hold that the so-called indigenous tea-plants found wild in the forests of Assam are escapes from cultivation, and that Manipur is its real home. The discovery of the tea-plant growing wild in Assam is, generally attributed to two brothers, named Bruce, who brought back specimens of the plant in 1826. Lord William Bentinck, in 1834, made arrangements for the introduction of its cultivation into India. Plants and seeds were brought from China the following year, and Government took upon itself the formation of experimental plantations in Upper Assam, and in Kumaun and Gharwal. Skilled manufacturers were also brought from China, and the leaf they manufactured was favourably reported on in the London market. Soon after, private enterprize took up the business and Government gradually retired from the field. The first Company that was found was the Assam Tea Company (1893). The success of the Tea Companies which gradually sprung up led, since 1859, to wild speculations in Tea-shares both in India and in England, and the crash came in 1865. The industry did not recover from the effects of this crash until 1869. Now tea has established itself in Assam, the Darjeeling *Duars*, the Punjab, and the Districts of Kumaon and Gharwal in the N. W. Provinces. It is extending gradually in the Chittagong district, in the Nilgiri hills, on the slopes of the Chutia Nagpur hills, in Bhutan *Duars*, and even in Arakan.

The total tea-area actually under cultivation, in 1891-92, was 266,219 acres, exclusive of 48,091 acres in Bengal. Of this area, 241,586 acres were in Assam. The average out-turn of the mature plant in Assam is put at 290 lbs. per acre, and the total annual out-turn is estimated at nearly 50 million pounds. The export from Assam into Bengal is approximately valued at $2\frac{1}{2}$ million pounds. The area of tea in the N. W. Provinces, in 1891-92, was 9,374 acres; Punjab 9,011 acres; and Madras 5,481 acres.

Until recently almost the whole of the total exports used to go to England, but now attempts are being vigorously made to introduce Indian tea into the markets of Australia and the United States, and already an export trade with these countries has sprung up. The export of tea from the Punjab and the Darjiling Duars to Central Asia has also been steadily increasing of late years.

Three main varieties of tea are recognized in India, namely, the indigenous Assam, the China, and the hybrid; of these the last is most in demand among the planters. The plants are raised from seeds which are sown carefully in prepared nurseries in December and January. The seedings are ready for transplantation in April, and the operation goes on till July. The site of tea-gardens should be raised and well drained, and, if possible, on the slopes of hills. Plantations succeed best in virgin jungle clearings. Unlike most Indian crops, tea is a perennial plant, and for two years after transplantation, requires careful weeding. Afterwards the plant requires pruning every year in winter. From the third year the plants begin to bear, and the yield reaches its maximum in the 10th year. Before being ready for export, the leaf undergoes the processes of withering, rolling, drying and sorting.

Cinchona

Like tea, quinine-yielding cinchona has been introduced into India at Government initiation. It consists of many species all of which are natives of tropical South America. It was first introduced into Europe about the year 1639 by Countess of Chinchon, hence the name Cinchona. The consumption of the bark in Europe gradually increased, wholesale and indiscriminate destruction by the bark-collectors of cinchona plants in their native forests continued, and, as a natural result, prices rose. The effect of this rise in price was severely felt in India, a great quinine consuming country. With the intention of starting cinchona plantations in India, Mr. C. R. Markham, C.B., was, in 1858, deputed to South America with a view to collect cinchona seeds and plants. A patch of forest land in the Nilgiri hills, Madras, was taken up and cleared by Government to start an experimental plantation. The remarkable success of the experiment led some of the European residents in other highlands and hills of the Madras Presidency to take up the cultivation which thus gradually spread over many districts of the South. In the Bengal Presidency, the cultivation was first started by Dr. Anderson, Superintendent of the Royal Botanical gardens, Calcutta. The success of the Government plantation in

Darjiling, Bengal, has been mainly due to the efforts of Dr. George King, the present Superintendent of the Royal Botanical Gardens and Director of the cinchona plantations, Bengal. The bark is manufactured on the spot by a Government quinologist into a form of cheap quinine known as febrifuge. The febrifuge has been steadily replacing imported quinine, and special facilities have been afforded by the Government of Bengal, since 1893, for the dissemination of this cheap and very necessary drug amongst the rural population of the malaria stricken districts of Bengal, through the agency of the post office. No such use is made of the bark of the Nilgiri plantations.

The total area of Cinchona cultivation in Madras, in 1891-92, was 10,799, acres, of which the four Government plantations on the Nilgiri-hills comprise nearly 900 acres. The Government plantations in the Darjiling district comprise an area of nearly 2500 acres. Besides the Government Estate a few private plantations have been started covering about a similar area. There are about 30 to 40 species of Cinchona with several hybrid forms. The species grown on the Nilgiri Hills and in the South generally are *C. officinalis*, *C. succirubra* ; and *C. ledgeriana*, *C. succirubra* and *C. calisaya* are the principal kinds grown in Bengal.

The plants may be raised either from seeds or cuttings ; the former mode is cheaper and usually adopted. The seeds are sown thickly in a seed-bed previously prepared and manured with leaf-mould and protected from sun and rain by a thatch. In about two to three weeks the seeds germinate and the seedlings when possessed of two or three pairs of leaves are transplanted to a nursery. When about 4 to 5 inches high, they are again transplanted to a fresh nursery whence they are planted in their permanent site when about 12 inches high. In the Nilgiri plantations, the seedlings are transplanted only once before being planted in their permanent sites. The plants yield their first harvest of bark in about five to seven years according to the species. The site of the plantation should be sloping, with rich humus soil and porous subsoil, so as to afford facilities for speedy drainage. Nothing is more harmful to Cinchona plants than stagnant water at their roots. The plants should be rather closely put so as to promote clean erect stem and afford shade to the superficial root-lets.

Coffee

Unlike tea and cinchona, Coffee does not owe its introduction into India to British auspices. It is generally

believed that about two centuries ago, a Mahomedan pilgrim named Babu Budan, on his return from Mecca, brought seven seeds with him to Mysore where the hill range in which he planted them still goes by his name. The cultivation continued on a small scale and remained confined among the native peasantry, till Mr. Cannon took up the industry and established a plantation in 1830 at Chikmulgar in Mysore. At the present day, coffee planting is concentrated in the Madras Presidency, especially Mysore. A few acres of coffee-plant, however, exist in Lohardagga and Chittagong, Bengal, in Assam, and in Bombay. The area under coffee in British India, in 1891-92, is returned at 127,648 acres, of which 65,371 acres are in Madras, and 62,167 acres in Coorg, and only 82 acres in Bombay. In this return the Mysore area as belonging to a Native State has not been included. Dr. Hunter in his Imperial Gazetteer puts the area of coffee in Mysore at 159,165 acres, in 1881-82.

Coffee is a perennial shrub growing to the height of 15 to 20 ft. For successful coffee cultivation, the climate must be warm and moist, rainfall ample but not excessive, soil rich in vegetable mould such as new jungle clearings, and the site sufficiently protected and shady. The seeds which are berries are sown in December in a nursery specially and carefully prepared beforehand, and the seedlings transplanted to their permanent sites from June to August. In the second year the plants are topped to keep down their height, and in the third year they begin to bear; but it is not until the seventh or eighth year that the shrubs are in full bearing. The flowers appear in March-April, and the berries ripen in October-November.

The preparation of the berry to make it fit for the market consists in, (1) Pulping or removing the pulp which covers the seed; (2) Fermenting, to remove the saccharine matter; (3) Washing; (4) Drying; (5) Peeling or removing the 'parchment' (outer coating) and 'silver' (inner coating); and (6) Sizing and winnowing. The last two operations are not performed by the planter but by the shipper.

Agricultural Stock

The table given here regarding the number of live-stock, carts, and ploughs in British India (excepting Bengal), in 1891-1892 will form a fitting sequel to the summary attempted above of its agricultural condition :

Administrations	Cows & Bullocks	Buffaloes.	Horses & Ponies.	Mules & Donkeys.	Sheep & Goats.	Camels.	Carts.	Ploughs.
	Number.							
Bengal	Not available.							
N. W. Prov.	12234664	5591503	342500	270037	4133578	8532	457330	3009686
Oudh	5455686	2439186	146807	62886	1802040	2151	95039	1429408
Punjab	9836923	2767236	226205	493570	6402215	198221	180846	2183239
Lower Burma	822273	899480	11033	1	34030	—	183595	392205
Upper Burma	910414	381242	14404	862	33454	—	189422	290898
Central Prov.	Not available							
Assam	1458993	122627	5545	27	199315	—	4933	303987
Ajmere	197339	43163	3181	5249	312870	966	4682	39581
Coorg	48525	38332	657	421	4182	—	717	29380
Madras	7665770	6551448	42038	121377	12209791	7	439808	2482509
Bombay	4929768	3216289	135224	60761	3324585	1212	488936	1124932
Berar	1638369	465510	35892	20672	518837	857	134639	132872
Pargana Manipur	3635	2176	85	24	259	—	341	817
Total	44202359	22518192	963530	1038896	28975156	211946	2180188	11419514

Agricultural improvements under British auspices.

Attempts to improve and expand the indigenous agriculture have been made by Government ever since the time of the East India Company, as is well shown by the history of the silk industry in Bengal; of the introduction of Carolina paddy, American cotton, tea and cinchona; of the extraction of fibre from hemp; and of the formation of sugarcane plantations on the model of those in the West Indies.

Agricultural Departments

But there existed no organization for this purpose previous to 1872, when a department of Revenue Agriculture, and commerce was established under the Govern-

ment of India, with Mr. A. O. Hume as its Secretary. The department was subsequently abolished, but revived by Lord Ripon by whom the scope of agricultural improvements was considerably enlarged. There can be no two opinions on the far-sightedness of this measure.

Demonstration Farms

Demonstration or Model Farms have been established in different provinces all under Departmental supervision, some financed by Government, and some by local Zemindars and Rajas. In Bengal, there are the Sibpur Government Farm, the Burdwan Raj Farm and the Dumraon Raj Farm, the two latter being maintained by the two Raj estates respectively; in the North-Western Provinces and Oudh, the Cawnpur Experimental Farm maintained by Government; in Madras, the Saidapet Government Farm; in Bombay, the Government Farms in Khandesh; and in the Central Provinces the Government farm at Nagpur. Besides these, there are some minor farms in the Punjab, Assam and Burma. Of the Government Farms, the one at Saidapet has lately been reduced to a small school-farm attached to the local agricultural school. This farm and the Cawnpur Experimental Farm, have for a number of years carried on a very valuable series of experiments which, though they have failed to develop any very important improvements in the farming practices of the country, have, nevertheless, succeeded to clear out some rational principles of agriculture.

Deep versus Shallow ploughing

The experiments of deep *versus* shallow cultivation carried on at the Saidapet and Cawnpur Farms clearly established the greater efficiency of the former provided it is safeguarded by certain precautions. These precautions are, that the soil should never be deeply stirred just before sowing time. For seed-bed, the soil should be worked to the depth of 2 or 3 inches and not more. It is also extremely unwise to stir the soil deep after the rains, as deep cultivation at this time exposes the soil to undue evaporation, and tends to make it lose that very element which it should retain. With these precautions, deep cultivation has generally been found useful, especially in clay soils. It makes it easier for the roots to penetrate deeper and spread wider in the soil in search for food, and thus facilitates the growth of crops. The usefulness of deep cultivaion experimentally established in the two farms mentioned above have further been corroborated by experiments in other farms, as the Dumraon Raj Farm; the Sibpur Farm, near Calcutta etc. Neither is it unknown to the cultivators,

because they not unfrequently resort to *spade-cultivation* in garden-culture and in reclaiming waste-lands. The spade or *Kodali* may or may not invert the soil, but stirs it to a great depth, and its only drawback is its extreme costliness which makes its general adoption impossible. Where circumstances of climate and soil make it a necessity, deep-cultivation and implements fit for it are not wanting. For instance, the heavy *nagar* plough of Bundelkhund, and similar heavy ploughs of the Deccan and the Ceded Districts are native implements to work the soil to some depth.

Soil Inversion

Ploughing in the English sense of the term means cutting a clean furrow of 4 to 9 inches deep, and 4 to 9 inches wide, and inverting it as a clean compressed slice. Ploughing in this sense is unknown in India. Indian ploughs are really no ploughs at all but mere grubbers which stir up the soil without inverting it. Whether soil inversion is a necessity has not yet been clearly established. In fact, where the subsoil is sandy, as in most parts of the large deltaic areas, or contains some poisonous substance, as the lower oxide and sulphate of iron, and poisonous organic acids and salts, soil-inversion is positively injurious. But in clay lands, where there is a tendency for a 'pan' to form immediately below the few inches (2 to 3) of surface soil stirred by the native plough, soil-inverting plough confers a great benefit; the poisonous and unwholesome salts and acids being brought to the surface suffer oxidation and are thereby rendered inoccuous.

Ploughs

All English ploughs possess a soil-inverting breast plate or mouldboard, but the so-called native plough possesses no such appendage, and herein lies the essential difference between the two ploughs. To the difference in the mode of their working noticed above is to be added the further difference, that the soil-inverting plough works up the whole surface soil in one attempt, whereas the non-inverting native plough must work up and down across the field several times for stirring up the whole of the surface. Several ploughs have been invented in India, under the auspices of the several provincial agricultural departments, in which all the appendages of the English plough have been discarded excepting the mould-board ; and in most of these inventions, the mould-board more closely approaches that of the American chilled ploughs than the long and curved boards of Howard's or Ransome's English ploughs. The preference for the model is due to the fact that the short and more flat American mould-boards turn up a jagged furrow slice and thereby serves

the purposes both of ploughing and cultivating simultaneously. These newly invented ploughs have not become popular with the ryots, and there is much doubt whether they will ever be so; but the fact that they are largely used by European Indigo Planters in Lower Bengal, Behar, and the North-western Provinces is rather a hopeful sign.

The ploughs used by the Bengal planters are :—

1. The *Sibpur* plough invented by Mr. Ambika Charan Sen, late of the Bengal Agricultural Department, and subsequently improved by other officers of the Department. Its price is Rs. 7.

2 The *Hindustan* plough of Calcutta, priced at Rs. 10-8 (No. 1) and Rs. 11-8 (No. 2).

3. Sealy's "Turn-over" plough manufactured and sold by Messrs. Sealy & Co., of Motihari, Tirhut, priced at Rs. 5-8.

4. The *Bhagulpur* plough invented by Mr. Sakhawat Hossein, late of the Bengal Agricultural Department, priced at Rs. 5.

5. The *St. Jessop's* plough made by St. Jessop, Civil Engineer, Bankipur, priced at Rs. 8.

In the North Western Provinces, the 'Kaiser' and the 'Baldeo' ploughs, made in the workshops of the Cawnpore experimental farm, are reported to be popular with the cultivators.

In Madras, the 'Climax' (Rs. 6), the E.P.' (Rs. 10-8), and the 'cotton soil' plough manufactured by Messrs. Massey & Co., are reported to have found favour with the ryots.

Steam-Ploughs

Whatever may be the advantages of steam-ploughing, the circumstances by which the farm practices of this country are governed render the use of steam-ploughs almost impossible. The division of cultivated land into small areas, the absence of roads to transport the heavy machinery from place to place, and the difficulty of effecting repairs, are almost insuperable obstacles in the way of their introduction. Mr. Bhupal Chandra Basu, in his 'Notes on Indian Agriculture' mentions two instances of the use of steamploughs in India, the first in the district of Banda, in 18[illegible]1, and the second in Captain Chapman's estate at Bati, Oudh. The undertaking proved profitable in Banda in working up a large area of land infected with *kans* (*saccharum spontaneum*) a coarse grass very difficult to eradicate; but it had to be ultimately given up as no other suitable site for the employment of the steamplough could be found. In the Bati estate also the steamplough was successful in reclaiming a large area of waste land thickly matted over with reeds and roots. But here also the enterprize had to be given up.

Thousands of acres of land in the North Western Provinces have been rendered perfectly barren by saline incrustations, called *reh*, which consists of a mixture of sodium chloride (common salt), sodium carbonate (*sajimati*) and sodium sulphate in varying proportions. Such *reh*-infected soils go by the general name of *Usar*. *Usar* lands are rare in Bengal, except in Behar where it occurs here and there in small patches. Various experiments have been made by the N. W. Provinces Irrigation and Agricultural Departments to reclaim such lands, but with indifferent success. The only experiment that seems to have met with a great measure of success is that devised by Mr. Mahammad Hussein, late Assistant Director of Agriculture, N. W. Provinces, and an ex-pupil of the Royal Agricultural College, Cirencester. Mr. Basu thus writes of Mr. Hossein's plan. "The *modus operandi* consisted in first enclosing the *Usar* land for two or three years with the object of encouraging the growth of vegetation, and the formation of a fertile over-covering of humus. A cattle station was then formed on it in order to obtain manure, the cattle partly paying their way by the sale proceeds of the milk. Fields were marked out and embanked in order to hold up several inches of water in the rains. On the ground being sufficiently softened,..... it was ploughed up, manured, and sown with rice. If the rice took, a winter crop followed. The field might then be regarded as reclaimed and could be let to a tenant".

Reclamation of Usar Land

It will serve no useful purpose to enter into the discussion as to the origin of these saline incrustations. The prevalence however of *Usar* lands along the banks of canals in canal-irrigated areas and in saucershaped depressions lends itself to the general belief that rapid evaporation of moisture from the surface-soil, under the influence of a hot sun, in the water logged areas, unduly accelerates soil-capillarity which draws up from the subsoil the injurious salts mentioned above and leaves them on the surface as an incrustation.

Cattle-dung is the only manure which is universally known and used in India. Analysis has disproved the notion that in manurial value, the Indian cattle manure is inferior to English farmyard manure. It has also exposed a very common fallacy, namely, that the ashes of the dung are as valuable as the whole dung, although in certain localities for special reasons, and under exceptional circumstanee, ashes yield better results than the whole dung. Valuable as

Manures and Manurial Experiments. Cattle manure.

cattle-manure is, it may be rendered still more valuable by conserving the urine and protecting the manure heaps from rain and hot sun.

Saltpetre

Careful study of the manurial experiments conducted in the farms at Saidapet, Cawnpur, Dumraon, Bhadgaon, Sibpur etc., show clearly that nitrate of potash or saltpetre (*shora*) is a manure very beneficial to cereal crops and also to sugarcane. The benefit, it must be noted here, is not from an experimental point of view only, but from an economical point of view also. Experiments have shown that the outlay in the application of the manure is more than twice covered by the increase in outturn. Mr. Fuller, the Director of Agriculture and Settlement, Central Provinces, writes : "If the experiment of the past seven years have shown anything plainly, it is that saltpetre is one of the most potent manures available". Saltpetre however when used alone soon exhausts the soil ; and this exhausting nature of the manure may be remedied by adding to it other mineral manures, or simply ashes. But however valuable saltpetre may be as a manure for cereals, the ryots have not yet taken to it.

Bones

The use of bones as a manure is unknown in India. They are collected and crushed in and about Bombay and Calcutta into meal for export, principally to England where they are treated with sulphuric acid and sold as dissolved bones. Experiments to test the manurial value of bone-meal for various crops were made in several Government Experimental Farms, but the results were anything but encouraging. Some soils were greatly benefitted by a dressing of bone-meal, while others derived no benefit, or were sometimes even positively injured by the application. Soils rich in organic matter seem to be more fitted for this manure. As yet the use of bone-meal is confined to tea and indigo plantations ; and to create a demand among them the operation of bone-crushing by *dhenki* was started some three years ago at Jalpaiguri, Darjiling and Saran jails, and the product was almost entirely taken up by the neighbouring planters. But for sanitary reasons, the manufacture of bone-meal in the above mentioned jails has from this year been discontinued. The future of bone meal as a probable manure for India is said to be extremely uncertain ; but if *a priori* considerations have any value, there is every reason to believe that bone-meal or some chemical preparation of it has a great future.

Night-Soil

Night-soil is a very valuable manurial matter, but the repulsive smell that issues from it has stood in the way of its general use in most countries of the world. In India its fertilizing powers are well known to the ryot, but it is seldom used as a fertilizer outside the limits of certain municipal towns, which have undertaken to dispose of their nightsoil in a manner which, while it secures their primary object of sanitation, also at the same time serves the agricultural interests of the country. Faruckabad and Cawnpur in the North-Western Provinces, Amritsar in the Punjab, and Poona in the Bombay Presidency offer noteworthy examples of the utilization of nightsoil and of the different modes of its conservation and preparation to make it fit for use. Readers interested in this question are referred to the interesting chapter on 'Night soil' in Mr. Bhupal Chandra Basu's 'Notes on Indian Agriculture'. Before leaving this subject, it would interest our readers to know, that urine is much more valuable than the solid nightsoil; that the soiled matter of the former contains $4\frac{1}{2}$ times as much nitrogen as the soiled matter of the latter, while the proportion of phosphoric acid is the same in both; that these two elements, namely nitrogen and phosphoric acid, are two of the most valuable ingredients in a manure, and that China and Japan are the only two countries in the world where the knowledge of the value of nightsoil and urine has been practically utilized all over the country.

Sewage

In large cities like Calcutta, Bombay and Madras, the nightsoil diluted with water is conveyed through underground sewers and discharged in places outside the cities. The name *Sewage* is given to such a mixture of nightsoil and water. It has largely been utilized in France and Belgium and, to a small extent, in England, to irrigate farms, which are hence called *sewage farms*. The sewage of Calcutta is discharged into the sewage canal on the border of the Salt Lakes, and along both sides of the canal, for about half a mile, a certain area of land has been reclaimed by filling it with town-sweepings. This area is cropped with rain and *winter* crops, the latter being irrigated with sewage-water. Of course, a small quantity only of sewage is thus utilized, the rest being wasted. In Bombay also a small quantity of sewage is utilized, but the rest is wasted. In Madras alone, the sewage question has received most attention, so as to serve the purposes of both sanitation and agricultural economy. For more detailed information on this point, the reader is referred to the pages of 'Notes on Indian Agriculture'.

Closely connected with the question of the disposal of nightsoil and sewage with a view to restore fertility to the soil as well as to secure better sanitation along with it, is that of the disposal of street-sweepings in towns, which is often a heavy item of expense to our Municipalities. A means devised to subserve the ends both of agriculture and of sanitation will therefore be a great boon to the country. The proper destination of street sweepings is the field of the cultivator where they would serve as manure, provided he is safeguarded against their insanitary effects. In Calcutta, they are partly used to reclaim certain swamps lying to the south-east of the town; in Madras, it is reported that a part is sold and used as vegetable manure; and in Poona, they are burnt to ashes and the latter mixed with night soil to make poudrette. The practice of most Municipalities which use them to fill up foul tanks and ditches in towns, is most reprehensible on sanitary grounds, and can not be too soon put a stop to.

Town-sweepings

It is a standing complaint with the English millers, who are the great consumers of Indian wheat, that it contains an injurious and excessive admixture of small and shrivelled grains of seeds other than wheat and of dirt and pebbles. It is for this reason that Indian wheat does not secure a price and a demand proportionate to its undoubted intrinsic merit, and that the merchant is compelled to admit a percentage of impurities. With the object of obtaining clean wheat, Mr. Ozanne, Director of Agriculture, Bombay, induced Messrs. Balmer Lawrie & Co., the Calcutta agents of Messrs. Marshall and Sons of Gainsborough, to take their steam threshing machinery imported for exhibition in Calcutta, in 1883, over to Bombay to put to practical test his contention that it would pay to import steam machinery and to work it for hire. Several trials were made in the wheat season of 1884-85 in various parts of the Bombay Presidency, and although the ryots did not take to this innovation kindly, the results warranted his conviction that the utilization of steam machinery would effect the desired improvement. His Highness the Thakore Saheb of Morvi, Kattywar, is also reported to have brought a steam thresher and made trials in his State.

Steam threshing

Experiments have been instituted by several Provincial Agricultural Departments as well as the Military Department to store green grass and green fodders of all kinds in under ground pits called *silos*. The sides and bottoms of the pits are made water-tight by masonry work or simply well ramming

Silage

them with clay. The silo thus constructed is filled with green grass which is well trodden and ultimately covered up in an air tight manner with earth which presses upon the mass uniformly. After two or three months, the fodder is ready to be taken out and given to the cattle. While in the silo, the grass undergoes slight fermentaion as long as the air enclosed in the holes and interstices of the mass of grass is not exhausted; and as fresh air cannot enter, the fermentation does not go on to an injurious extent so as to make the grass useless. The fodder taken out of the silo is called *silage*. Even a course grass unfit for cattle-food in fresh state may in this manner be converted into wholesome fodder. Ensilaging is one of the best means of providing green fodder for cattle at a season when it is most scarce. The results of the trials are very promising, but as yet the ryots have not taken to ensilaging.

Silk Experiment

One of the principal causes of the deterioration of Bengal silk, once the great favourite of the world, has been supposed by competent authorities to be due to a disease which is akin to, if not identical with, what is called in France, *pebrine*. Mr. Nitya Gopal Mukerjee, a Cirencester Graduate, was deputed by the Bengal Governmant to France to study the genesis of the disease and to learn the mode of its eradication as practised in France and known as the system of Pasteur. On his return from France, he established experimental silk-stations at Berhampur, Kalimpong in the district of Darjiling, Pukhuria in Manbhoom and Babuikhali in Jessore, all in Bengal. As the result of the last nine or ten years' investigation, Mr. Mukerjee is reported to have discovered a process of eradicating the disease, and to have entirely freed the eggs from its germs in the districts in which he works.

Reprinted from "A History of Hindu Civilisation during British Rule" by Pramatha Nath Bose, published in 1894, *Vol ii, Book iv.*

The author states in the preface to the above book : "I have also to gratefully acknowledge my obligations to Mr. G. C. Bose, M.A., M.R.A.C. for the chapter on Agriculture".

Reviewing the book in the Calcutta Review, 1895, Vol 100, page 128, Romesh Chandra Dutt remarked: "We must hasten, however, to the Fourth Book, the last in these volumes, which contains interesting and valuable information about Agriculture and Industries. Mr. G. C. Bose, a specialist in Indian Agriculture, contributed the chapter on Agriculture, and it is in every way worthy of him."

ভারতীয় গমের উপরে বিলাতের ভাবী নির্ভর।

ভারতবর্ষের বহির্ব্বানিজ্য ক্রমশঃ বৃদ্ধি পাইতেছে। দশ বৎসর পূর্ব্বে যে মাল রপ্তানী হইত আজিকালি তাহার চতুর্গুণ হইয়াছে। ইহাতে যে কেবল রাজার আয় বৃদ্ধি হইয়াছে তাহা নহে, প্রজারও বিশেষ উপকার। উর্ব্বরা ভূমি প্রায় সমস্তই নিঃশেষ হইয়াছে,—কিন্তু তাই বলিয়া প্রজাবৃদ্ধি হ্রাস নাই। প্রতিদিন যে প্রজা সংখ্যা বৃদ্ধি হইতেছে, তাহাদের উপায় কি? মাল রপ্তানি ব্যবসার উন্নতি, সেই সকল লোকের জীবনোপায় উপার্জ্জনের নূতন পথ খুলিয়া দিতেছে। ভূমি লইয়া মারামারি না করিয়া তাহারা স্বতন্ত্র বৃত্তি অবলম্বন করিতেছে। ইহা দেশের পক্ষে বড় শুভ লক্ষণ।

গতবৎসরের আয়ব্যয় তালিকায় খরচ বাদে ৩১ লক্ষ ৯৩ হাজার টাকা বাঁচিবার কথা থাকে—কিন্তু কার্য্যে তাহা ঘটে নাই। গম ও চালের রপ্তানি হ্রাস হওয়ায়, রেলওয়ের আয় ও রপ্তানির মাসুল কমিয়া যায়। সেইজন্যই তালিকামত আয় হয় নাই। কিন্তু গম ও চালের রপ্তানির হ্রাস ও তজ্জনিত রাজার আয়ের লাঘব স্থায়ী কারনের ফল নহে। যে যে কারণে এই হ্রাস হইয়াছে, বিশেষতঃ গম রপ্তানি কমিয়াছে তাহা ক্ষণস্থায়ী। ভারতবর্ষের গম রপ্তানি ব্যবসা কমিবার কারণ, গত বর্ষে বিলাতে চার পোয়া ফসল ও আমেরিকায় অনেক গম মজুৎ। কিন্তু আমরা নিম্নে দেখাইতেছি এই উভয় কারণই ক্ষণস্থায়ী; তজ্জন্য ভারতবর্ষের কৃষকদের কোন ভয় নাই।

প্রথমত, বিলাতে চার পোয়া গম প্রায়ই হয় না। ১৮৬৬ সাল হইতে ১৮৭৬ সাল পর্য্যন্ত এই একাদশ বৎসর মধ্যে কেবল একবার ভাল ফসল হয় বিঘা প্রতি গড় পড়তা ফসল ৮ মণ কিন্তু ১৮৬৮ সালে বিঘা প্রতি গড়ে ১ মণ বেশী ফসল হয়। আবার সেই একাদশ বৎসর মধ্যে চারিবার অতি মন্দ ফসল হয়; বিঘা প্রতি যে গড় ফসল, তাহা অপেক্ষা এক মণ দেড় মণ কম। সেই প্রকারে ১৮৭৭ সাল হইতে ১৮৮৪ সাল পর্য্যন্ত এই আট বৎসর মধ্যে গত বৎসর কেবল কৃষকদের সু-বৎসর গিয়াছে।

দ্বিতীয়ত, ইংলণ্ড, স্কটলেণ্ড, ও আয়ারলেণ্ড দেশে ১৮৬৬ সাল হইতে ১৮৭৬ সাল পর্য্যন্ত এই একাদশ বৎসর গড়ে ১ কোটি ১১ লক্ষ ৩৬ হাজার বিঘা জমিতে গমের চাষ থাকে। কিন্তু আজ কাল গমের চাষ কত কমিয়াছে তাহা দেখ; ১৮৮০ সাল হইতে ১৮৮৩ সাল এই চার বৎসরের গড় ৮৯ লক্ষ

৩২ হাজার ৫ শত ৯৯ বিঘা মাত্র। বিলাতে গমের চাষ ও ফসলের হ্রাস হইবার দুই প্রধান কারণ। প্রথমত গ্রীষ্মকালে সূর্য্য কিরণের অভাব এবং দ্বিতীয়ত বীজ বোনা ও গম কাটিবার সময় ক্রমাগত বৃষ্টি। ইহা ব্যতীত মজুরির মূল্য বৃদ্ধি, চাষের অসুবিধা, বিদেশী গমের আমদানি ইত্যাদি নানা কারণে গমের চাষ কমিয়াছে। এই সকল কারণগুলিই স্থায়ী কারণ, কোনটিই এমন নহে যে আজ আছে কাল থাকিবে না। এই সকল কারণে বিলাতি কৃষকদের গম চাষ করিয়া লাভ করিবার আশা বড় দূরবর্ত্তী। আসল কথা, গম চাষ বিলাতে আর লাভ নাই।

কিছুদিন হইল ফ্রান্সের রাজধানী প্যারিস নগরে এক আন্তর্জ্জাতিক প্রদর্শনী হয়। সেই প্রদর্শনী উপলক্ষে যে কৃষি-সমবেতের অধিবেশন হয়, বিলাতের কৃষি বিবরণ তাহাতে প্রেরিত হয়। সেই বিবরণ পাঠে অবগত হওয়া যায় যে বিলাতে গমের চাষ ও ফসল ক্রমে কমিয়া আসিতেছে ও বিদেশীয় গমের আমদানী তদনুসারে বা তদপেক্ষা অধিক পরিমাণে বৃদ্ধি পাইতেছে। ইহার ফল এই দাঁড়াইয়াছে যে বিলাতবাসীর উদরান্ন অর্দ্ধেক গৃহজাত ও অর্দ্ধেক বিদেশীর মাঠ হইতে আনীত। ১৮৭৮ সালের কথা উল্লেখ করিয়া সেই বিবরণ বলিতেছে যে সমস্ত বিলাতে অর্থাৎ ইংলণ্ড, স্কটলণ্ড ও আয়েরলেণ্ডে খাই খরচ বৎসরে ১৫ কোটি ৪০ লক্ষ মণ গম। ইহার অর্দ্ধেক মাত্র গৃহজাত, বাকী অর্দ্ধেকের জন্য বিদেশের উপর নির্ভর।

গত ছয় বৎসরের আমদানী তালিকা আলোচনা করিয়া দেখা যায় যে বিলাতে গমের আমদানি ক্রমেই বৃদ্ধি পাইতেছে। ১৮৭৯ সালে মোট গম আমদানি ৯ কোটি ৮১ লক্ষ ৩৮ হাজার ৮ শত ৪৯ মণ কিন্তু ১৮৮১ সালে ১১ কোটি ২৫ লক্ষ ২৩ হাজার ৪০ শত ৬০ মণ। ইহাতে বেশ স্পষ্ট বুঝা যাইতেছে যে গমের জন্য বিলাতবাসীর বিদেশ-নির্ভর প্রতিদিন বৃদ্ধি পাইতেছে।

এক্ষণে দেখিতে হইবে কোন্ দেশ হইতে বিলাতে গমের আমদানি অধিক হয়। এতদিন পর্য্যন্ত রুষ ও আমেরিকা সেই ব্যবসা প্রায় একচেটিয়া করিয়া রাখিয়াছিল। ১৮৭৯ সালে বিলাতে যে মোট ৯ কি ১০ শ কোটি মণ গম আমদানি হয় তাহার অধিকাংশই রুষরাজ্য ও আমেরিকা হইতে। সে বৎসর আমেরিকার আমদানি শতকরা ৬১·১ মণ, রুষের শতকরা ১০ মণ ও ভারতবর্ষের শতকরা ১·২ মণ। ১৮৮০ সালের শেষে অর্থাৎ পাঁচ বৎসর মধ্যে সেই আমদানি ব্যপারে কি পরিবর্ত্তন হইয়াছে দেখ। সে বৎসর মোটের উপর আমেরিকার আমদানি শতকরা ৪৬·৪, রুষের আমদানি শতকরা ১৬·৫ কিন্তু ভারতবর্ষের আমদানি শতকরা ১·২ স্থানে ১৩·৯ অর্থাৎ ১৩ গুণেরও অধিক বৃদ্ধি হইয়াছে। এত অল্প সময় মধ্যে ভারতীয় আমদানির এতাধিক বৃদ্ধি

হঠাৎ বলা, নিতান্ত অদূরদর্শিতার কথা। গত বৎসর বিলাতে গমের ফসল অতি উত্তম হইলেও ভারতবর্ষের আমদানি বিশেষ হ্রাস হয় নাই,—১৮৮৩ সালে শতকরা ১৩·৯ স্থানে ১২·৮ হয় মাত্র।

উপরিউক্ত সংখ্যাগুলি আলোচনা করিয়া দেখিলে স্পষ্ট বুঝা যায় বিলাতের বাজারে ভারতবর্ষ, আমেরিকা ও রুষের প্রবল প্রতিযোগী হইয়া দাঁড়াইয়াছে এবং আশা হয় যে সময়ে বিলাতের গম আমদানি ব্যবসা এক চেটিয়া করিয়া তুলিবে। কেবল এক কথায় বিলাতের সমস্ত অভাব পূরণ করিবার শক্তি ভারতবর্ষের আছে কি না? উত্তর পশ্চিমাঞ্চলের ভূতপূর্ব্ব কৃষি ডিরেক্টর বেলেট সাহেব বলেন, যে দিল্লী ফাইজাবাদ ও লাহোর হইতে বিলাতে (লণ্ডনে) গম আমদানি করিতে মণ করা ২৷৷০ (১) হইতে ৩৷৶০ টার (২) ও আমেরিকা হইতে ৩৷৷০ (৩) খরচ পড়ে। এই হিসাবে এক শিলিং এর দর আট আনা বা এক পাউণ্ডের দর দশ টাকা ধরা হইল। আজিকালি ভারতবর্ষীয় গমের ব্যবসা কিছু নরম পড়িয়াছে—সত্য, কিন্তু তাহার যে কোন স্থায়ী কারণ আছে তাহা নহে। ভারতবর্ষে মজুরি এত সস্তা যে পৃথিবীর অন্য কোথাও এরূপ নাই; এ অবস্থায় রুষ কখন ভারতবর্ষের ন্যায় সস্তা দরে বিলাতের বাজারে গম বিক্রয় করিতে পারিবে না। গত বৎসর বিলাতের বাজারে গমের দর যে বড় নরম গিয়াছিল তাহা নিয়ম নহে, নিয়মের ব্যতিক্রম।

গত পৌষ মাসে বিলাতের বাজারে গমের দর এত পড়িয়া যায় যে মণ করা ২৷৶০ আনা দরেও গম বিক্রয় হইয়া যায়। এরূপ নরম বাজার গত শত বৎসর মধ্যে কখন হয় নাই। কিন্তু এত কম দরে কি আমেরিকা কি ভারতবর্ষ কোন দেশই বিলাতের বাজারে গম পাঠাইতে পারে না। যদি আমেরিকা ভারতবর্ষ প্রভৃতি দেশ গম রপ্তানি বন্ধ করিল, তাহা হইলে বিলাতের অন্ন কোথা হইতে আইসে? দেশে যে গম উৎপন্ন হয় বিলাতের তাহাতে ছয় মাসও চলে না। বাকী ছয় মাসের উদরান্নের কি উপায়? বিদেশ হইতে তাহাকে গম আমদানি করিতেই হইবে, কিন্তু বিদেশী লাভ না পাইলে গম বিলাতে কেন পাঠাইবে? সেইজন্য বলিতেছি গমের দর কখন এত কম থাকিতে পারে না। ইহারই মধ্যে বিলাতে দর চড়িতে আরম্ভ হইয়াছে। বেশ বুঝা যাইতেছে যে শীঘ্রই এমনি দর হইবে যে ভারতবর্ষের কৃষক বিলাতের বাজারে গম পাঠাইয়া দুই পয়সা লাভ করিতে পারিবে; যদিও আমেরিকা সেই দরে গম পাঠাইতে পারে কিনা সন্দেহ।

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(১) প্রতি ৬৷৷০ মণ—৩২ শিলং—১১ পেণী
(২) ,, ,,—৪৫ ,, — ২
(৩) ,, ,,—৪৫ ,, — ৫

বহুনি খরচ ও জাহাজ ভাড়ায় আজিকালি আমাদের বড় বেশী ব্যয় হয়। কিন্তু ইহা সত্ত্বেও আমরা বিলাতের বাজারে আমেরিকাকে হারাইতেছি। রেলপথ রাস্তা ও খালের বিস্তার বৃদ্ধি হইলে আমরা আরও কম দরে গম রপ্তানি করিতে পারিব; তখন আমেরিকাকে বিলাতের বাজার ত্যাগ করিতে হইবে। রেলপথের বিস্তারের দিকে রাজা বিশেষ মনোযোগী হইয়াছেন, অল্পদিনের মধ্যেই বহুনি খরচ কমিবে আশা করা যায়।

এক্ষণে এই প্রশ্নের আর এক দিক দেখা যাউক। বিলাতের সমস্ত অভাব দূরণ করিবার শক্তি আমাদের আছে কি না? ভারতবর্ষের ভূমি কি এত উর্ব্বরা বা তাহার পরিমাণ এত অধিক, যে বিলাতের সমগ্র অভাব অর্থাৎ ১১ কোটী কি ১২ কোটী মণ গম, ভারতবর্ষ একা যোগাইতে পারে? গত বর্ষে ইংরেজাধীন ভারতবর্ষে সর্ব্বসহিত ৭ কোটী ৮০ লক্ষ বিঘা জমিতে গম আবাদ হয়, মোট উৎপন্ন ১৮ কোটী ৯০ লক্ষ মণ গম; তন্মধ্যে ৩ কোটী ১ লক্ষ ২৬ হাজার মণ রপ্তানি হয়। এই রপ্তানির অর্দ্ধেক অপেক্ষাও অধিক বিলাতে প্রেরিত হয় ও তাহার জন্য ভারতবর্ষে দরের উঠ্‌তি পড়্‌তি বুঝা যায় নাই;—ভারতবাসী অনায়াসেই নিজের খোরাক রাখিয়া তাহা রপ্তানি করিয়াছে। আমাদের গমের চাষের আপাততঃ যেরূপ অবস্থা, তাহাতে বিলাতের বাজার এক চেটিয়া করা অসম্ভব। বিলাতে ১২ কোটী মণ গমের অভাবে আমরা যদি সমস্ত রপ্তানি-গম বিলাতেই পাঠাই তাহা হইলেও আপাততঃ তিন কোটী মণের অধিক যোগাইতে পারিতেছি না। বিলাতের সমস্ত অভাব দূরাইবার জন্য, বাজার এক প্রকার এক চেটিয়া করিবার জন্য আমাদের দেশের গমের আবাদ বৃদ্ধি করিতে হইবে; অথবা আমাদের শ্রেষ্ঠতর পদ্ধতি শিখিতে হইবে; অথবা উভয় উপায়ই অবলম্বন করিতে হইবে। আবাদ বৃদ্ধি ও আবাদের শ্রেষ্ঠতর পদ্ধতি লিখিবার কথা পরবারে আলোচনার জন্য রাখিলাম। আজি কেবল এক কথা বক্তব্য, যে আমাদের শক্তি আছে, কেবল শক্তি চালনার আবশ্যক; চেষ্টা করিলে আজি না হউক কালি বিলাতের সমগ্র গম আমরা যোগাইতে পারিব আমাদের বিশ্বাস।

এক্ষণে বিলাতবাসীরও উচিত উদরান্নের জন্য আমেরিকা বা রুষের উপর নির্ভর না করিয়া ভারতবর্ষের উপর নির্ভর করা। নানা কারণের জন্য ইহা যুক্তি সিদ্ধ। যদি আমাদের আশা ও শক্তি অনুযায়ী গমের বাজার বিকাশ পায়, তাহা হইলে কেবল যে রাজার আয় বৃদ্ধি হইবে তাহা নহে; শত সহস্র লোক, যাহাদের জীবনোপায় নাই বলিলেই হয়, তাহারা ইহাতে কাজ পাইবে। তাহারা কাজ পাইলেই ভূমির অনেক ভার কমিল, দুর্ভিক্ষের ভয় দুরবর্ত্তী হইল, রাজার চিন্তা হ্রাস হইল। রাজার প্রথম কাজ যাহাতে প্রজার গ্রাসাচ্ছাদনের

কষ্ট না হয়, তৎপ্রতি দৃষ্টি রাখা। ভারতবর্ষে লোকসংখ্যা এত বৃদ্ধি হইয়াছে যে সকলে ভূমির উপর নির্ভর করিলে আর চলে না। অন্যান্য বৃত্তি অবলম্বন করা নিতান্ত আবশ্যক হইয়া উঠিয়াছে। বিলাতের সহিত গমের বাণিজ্য বৃদ্ধি হইলে এই প্রকার নিরুপায় অনেক লোকের একটা উপায় হয়; এবং রেলওয়ের মালামাল বহন বৃদ্ধি হইয়া রাজারও লাভ হয়। শান্তির সময় হইবে এই লাভ, কিন্তু যুদ্ধ বিগ্রহের সময় ইহাতে যে কি লাভ তাহা কালিকলমে লিখা অপেক্ষা চিন্তা করিয়া দেখিলে ভাল হয়। আমেরিকা বা রুষ সামান্য কারণে ইচ্ছা করিলেই বিলাতে গম পাঠান বন্ধ করিতে পারে কিন্তু ভারতবর্ষ সম্বন্ধে সে ভয় নাই বলিলেই হয়। বিপদের সময় অন্যদেশ অপেক্ষা ইংরাজ ভারতবর্ষকে অধিক বিশ্বাস করিতে পারিবে। এবং ভারত ও বিলাত উভয়ের পক্ষেই ইহা শ্রেয়স্কর।

বিলাতের বাজারে ভারতের গমের আদর প্রতিদিন বৃদ্ধি হইতেছে, রাজার উচিত সেই আদরকে সমাদর করিয়া গম বাণিজ্যের উন্নতি সাধন করা।

কৃষি গেজেট,
১ম সংখ্যা, ১২৯২

মাছের চাষ

কথাটি শুনিতে কিছু নূতন। কিন্তু নূতন বলিলে আর চলে কৈ? জিনিষটি এখন বড়ই দরকারী হইয়া পড়িয়াছে। আজকাল সর্ব্বত্রই শুনা যায় যে, আগেকার মত মাছ পাওয়া যায় না—পূর্ব্বে যে পরিমাণে মাছ পাওয়া যাইত, দিন দিন সে পরিমাণের হ্রাস হইয়া আসিতেছে। এ কথা ঠিক করা সহজ নহে, তবে আমি যে জেলার বিষয় জানি, সেখানে এইরূপই বটে। আমার মনে হয় কিছুকাল পূর্ব্বে, বর্ষার পর, আমাদের নদ, নদী, খাল, বিল, ডোবা, পুকর সব মাছে ভরিয়া যাইত। এখনও সেই সব রহিয়াছে, কিন্তু তেমন মাছে ভরা অবস্থা আর দেখিতে পাই না। মাছ এত কমিল কেন, আর তাহাতে ভারতবাসীর ক্ষতিই বা কি, তাহা দেখা যাউক।

ভারতে যত লোক মাছ খায়, ইংলণ্ডে বা ইউরোপের কুত্রাপি তত নহে। মাছ, ভারতবাসীর সখের জিনিষ নহে, উহা তাহাদের দৈনিক আহারীয় সামগ্রী। মুসলমান সম্প্রদায়কে বাদ দিলে, মাংসাহারী লোকের সংখ্যা ভারতে নিতান্তই কম। জন্তুজাত আহারীয় সামগ্রীর মধ্যে, দুগ্ধ ও মাছই ভারতের সর্ব্বত্র প্রচলিত। সুতরাং মাছের হ্রাস-বৃদ্ধিতে ভারতবাসীদিগের বিলক্ষণ ক্ষতি-বৃদ্ধি, ইহা সহজেই বুঝা যায়। যাহাতে মাছের উৎকর্ষ সাধন হয়, সে সব কথা ভারতবাসীর পক্ষে গুরুতর কথা সন্দেহ নাই।

কিসে মাছ কমিয়া যাইতেছে, এখন তাহাই দেখা যাউক। প্রাণধারণ ও পুষ্টিসাধন করিতে হইলে, সকল জীবেরই উপযুক্ত আহারের প্রয়োজন। আমরা যেমন বায়ু সাগরে বিচরণ করি, কিন্তু বায়ু সেবন করিয়া জীবন ধারণ করিতে সক্ষম নহি; তেমনই জলচারী মাছগুলিও জল খাইয়া বাঁচিতে পারে না,—তাহাদেরও উপযুক্ত আহারের প্রয়োজন। তাহাদের উপযুক্ত আহার কি? ইহা নির্দ্ধারণ করিতে হইলে, অগ্রে দেখা আবশ্যক যে, তাহাদের শরীর কি কি উপকরণে গঠিত? আহার নির্দ্ধারণের প্রণালীই এইরূপ।

এদেশের মাছ এ পর্য্যন্ত রীতিমত রাসায়নিক পরীক্ষা করিয়া দেখা হয় নাই। হইলে খুব ভাল হইত সন্দেহ কি? তদভাবে বিলাতের মাছের পরীক্ষার ফল ধরিয়া লওয়া যাউক। অবশ্য উপকরণ সম্বন্ধে বেশী তফাৎ হইবে না। তাহা এই;—সাড়ে বার মণ মাছে ২০ ভাগ নাইটারজান, ৮॥০ ভাগ প্রস্ফুরস মিলিত অম্ল, ও ৪॥০ ভাগ ক্ষার। তৈলজ পদার্থ প্রায় শতকরা ১৯ ভাগ। সুতরাং মাছের আহার ঐরূপ উপকরণেরই হওয়া চাই।

মাছের আহারের পরিমাণ সম্বন্ধে একটী কথা আছে। স্থলচর জীবজন্তু অপেক্ষা মাছের সুবিধা এই যে, অপেক্ষাকৃত অল্পাহারেই ইহাদের চলে। কারণ অন্যান্য জন্তুদিগের অনেক আহার কেবল মাত্র শরীরের তাপ রাখা করিতেই খরচ হয়, তা ছাড়া দেহের পুষ্টিসাধন, ক্ষতিপূরণ এ সকলের জন্যত আহার চাইই। দেহ রক্ষা, ও বৃদ্ধি করিতে গরুর যত আহারের প্রয়োজন, শরীরের তাপ রক্ষা করিতে তাহার ছয় গুণ আহারের দরকার। মাছের এ বাড়তি প্রয়োজনটী নাই। তাহাদের যাহা কিছু আহারের প্রয়োজন তাহা পুষ্টির জন্য। সুতরাং খুব কম আহারেই মাছের বেশ চলে। এটী খুব সুবিধা, সন্দেহ নাই। তথাত্র মাছের আহারের প্রয়োজন। আর সে আহার উপরোক্ত রূপ উপকরণের হওয়া চাই। স্বভাবত জল বা জলের নীচের মাটী হইতেই মাছ তাহাদের আহার সংগ্রহ করে। সুতরাং নদীগর্ভ বালিময় কিম্বা প্রস্তরময় হইলে তাহার জলে. ও তাহার তলার জমিতে মাছের আহারের উপকরণের অভাব পড়ে; সেখানে মাছ ভাল হয় না—বেশীও হয় না, বড়ও হয় না। অন্নকষ্টে মানুষের যে দশা, সেখানে মাছেরও সেই দশা। আবার যেখানকার নদ নদী, গাছ পালা ও চষা জমি প্লাবিত করিয়া আসে, সেখানে মাছের বড় বাড়। স্কটলণ্ডের পর্ব্বতময় প্রদেশের নদ নদী এক প্রকার মাছশূন্য বলিলেও হয়। সেখানে মাছের আহারের সংস্থান নাই। মাছ থাকিবে কেমন করিয়া? উহাদের মধ্যেই আবার যে যে নদ নদী আবাদী জমি বা সার দেওয়া জমি ধুইয়া আসে তাহাতে অপেক্ষাকৃত বেশী মাছ। নদী নালার জলে ও তলায় কি পরিমাণে উপরোক্ত তিনটি সার পদার্থ আছে জানিলে, তাহা মৎস্যের উপযোগী কিনা বলা যায়। বিলাতের একজন বিচক্ষণ কৃষি-পণ্ডিত এই সকল কথা বলিয়াছেন।

ইহা হইতে বেশ বুঝা যায় যে, যেমন অন্যান্য দ্রব্যের চাষ হয়; মাছেরও সেইরূপ চাষ সম্ভব। অর্থাৎ মাছ বাড়াইতে হইলে ও তাহার শ্রীবৃদ্ধি সাধন করিতে হইলে, তদুপযোগী জিনিষ—সার—দেওয়া চাই। এখন, সহজেই বুঝা যাইবে যে, কেন এদেশে মাছ কম পড়িয়াছে। অনেকেই বুঝেন যে, গাছ কাটিয়া ও বন পরিষ্কার করিয়া ফেলায় বৃষ্টির অনেক অভাব হইয়া পড়ে। এই বৃষ্টির অভাবে মাছের যে কেবল নিবাস-কষ্ট হয় তাহা নহে, তাহাদের আহারেরও বিলক্ষণ অভাব হইয়া পড়ে। যে জেলার কথা আমি বলিতেছি সেখানে দামোদর নদী প্রবাহিত। উৎপত্তিস্থল রামগড় পাহাড়। এখান হইতে বাহির হইয়া প্রস্তরময় ভূমি বহিয়া দামোদর চলিয়াছে। এমত স্থলে, এ নদীর মৎস্যের আশা অবশ্যই অল্প। তাহার উপরে আবার তাহার উৎপত্তি-স্থলের গাছপালা বন পাহাড় কাটিয়া ফেলা হইয়াছে। দামোদরে মাছ

থাকিবে কেমন করিয়া? গাছপালাতেই ক্ষার ও প্রস্ফুরস। আর, এই দুইটিই মাছের প্রধান আহার। গাছপালা হইতে—গলিত পত্র, পচা ডালপালা হইতে—নাইটারজানেরও সংস্থান। তাহার উপর যেখানে গাছপালা, সেইখানেই অল্প বিস্তর জন্তু বাস করে, তাহাদের মৃতদেহ হইতেও বেশ নাইটারজান পাওয়া যায়। এই গাছপালা গুলিই যদি কাটিয়া ফেলা যায়, তবে আর নদীতে মাছ থাকিবে কেমন করিয়া? ফলেও ঘটিয়াছে তাই। তবুও যদি এই সকল পরিষ্কার জমি আবাদ করা হয় তাহা হইলেও কতকটা মাছের পক্ষে ভাল। আবাদে জমি হইতে ক্ষার ও প্রস্ফুরস মিলিত অম্ল সহজে বাহির হইয়া আইসে। পুকুরের বিষয় ভাবিয়া দেখিলে এই সকল কথা হৃদয়াঙ্গম হইবে। যে পুকুরে লোকে স্নান করে, কাপড় কাচে, বাসন ধোয়, সেই পুকুরেই মাছ বাড়ে, সেই পুকুরেই মাছ সুমিষ্ট হয়। ঐ সকল প্রকার মাছের আহার যোগান হয়, তাই সেখানে মাছের এত পুষ্টি। আমার মনে হয় একটি মিউনিসিপাল-পুকুর অতি পরিষ্কার রাখিবার জন্য তাহাতে লোকের স্নান করা, কাপড় কাচা, বাসন ধোয়া সব বন্ধ করা হয়। সে পুকুরে মাছ বড় কম। অন্যত্রও এরূপ ঘটিয়াছে শুনিয়াছি।

এখন কথা এই যে কলিকাতা, বোম্বাই, লণ্ডন প্রভৃতি বড় বড় নগরের মলমূত্র যে নদীতে গিয়া পড়িতেছে তাহাতে কি এই সকল সার বস্তুই নষ্ট হইতেছে? নদীতে পড়িলে কি তাহা হইতে কোন উপকার হয় না? উপকার যে হয়, তাহাতে আর সন্দেহ নাই। অবশ্য স্বীকার করি যে, জমিতে এই সকল সার দিতে পারিলে জমির গুণ বাড়ে, ফসলের শ্রীবৃদ্ধি হয়; আর যাহাতে সেরূপ বন্দোবস্ত হয়, তাহাই করা উচিত। কিন্তু এখন যেমন হইতেছে, জলে ফেলিয়া দিয়া যে সারগুলি একেবারে নষ্ট হইতেছে এমত নহে। জলে মিশ্রিত হইয়া উহা মৎস্যদিগের আহার যোগায়। এইজন্য ভাগীরথীর মোহনা যে, মাছে পরিপূর্ণ তাহা অনায়াসে অনুমান করিয়া লওয়া যাইতে পারে। সাগরের তলভূমি ও তাহাতে যে মল মূত্রাদি পতিত হয় এই দুইটার অবস্থা জানিলেই সেই সাগরের মৎস্য-ধারণী-শক্তি বুঝিতে পারা যায়। এই দুইটি বিষয় ভাবিয়া দেখিলে, বঙ্গোপসাগরের উত্তর ভাগ যে, মাছে পরিপূর্ণ তাহাতে আর সন্দেহ নাই।

মাছ কমিয়া যাইবার আর একটি কারণ আছে। লোকসংখ্যা বৃদ্ধির সঙ্গে সঙ্গে মাছেরও উপর বেশী টান পড়িয়াছে। সুতরাং রীতিমত বিবেচনা করিয়া মাছ ধরা হয় না। যখন্ তখন্, অপর্য্যাপ্ত পরিমাণে মাছ ধরা হয়। ডিম পাড়ার সময়েও অনেক মাছ এইরূপে মারা পড়ে। লোকের বিশ্বাস যে যতদিন জল আছে ততদিন আর ভয় কি, মাছ থাকিবেই। সুতরাং মাছ

ধরিবার আর সময় ভাল থাকে না,—ডিম পাড়িবার সময়েও মৎস্যকুল রেহাই পায় না। ডিম শুদ্ধ একটা মাছ ধরিলে, একটি মাছ মরিল না, একটি বংশের শ্রাদ্ধ করা হইল। ক্রমাগত এমন করিয়া কতদিন চলে? অনেক দেশে এরূপ কুপ্রথা নিবারণ জন্য আইন আছে। আমি অবশ্য এমত বলিতেছি না যে এদেশেও সেরূপ আইন হউক; এদেশে সেরূপ আইনের দরকারও দেখি না। ফলে, এই বলা আমার উদ্দেশ্য যে, মৎস্যেরও চাষ চলে এবং আবশ্যক।

কৃষি গেজেট,
২য় সংখ্যা, ১২৯২

আজ যে আমি শিশু গৌরবে গর্ব্বিত, আজ যে আমি বৃদ্ধ হইয়াও বার্দ্ধক্যের জড়তা বোধ করিনা—বার্দ্ধক্যের হতাশ ভাব যে আজও আমায় আক্রমণ করে নাই, ইহার জন্য সমস্ত প্রশংসা পাইবে আমার প্রিয়-প্রিয়তর-প্রিয়তম ছাত্রগণ। আমি আজও যুবক। সুদীর্ঘকাল ছাত্রদের মধ্যে বাস করিয়া ছাত্রদের যৌবন আমাকে যুবক করিয়া রাখিয়াছে। জীবনের শেষ মুহূর্ত্ত পর্য্যন্ত যেন এই ছাত্রসেবা করিয়া যাইতে পারি।

—গিরিশ চন্দ্র বসু