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UNIVERSALISING SECONDARY EDUCATION.

BY THE EDITOR.

THE movement for free Secondary Education in Great Britain is fast growing. In Canada and Australia all education is practically free from the Primary to the University stage. The system of free public schools all over the United States is well known. Such schools are a feature of the education system of the United States. So important is this system of free education considered in the United States that these free schools in the States forming the Union have a statutory basis. According to law no State can be without such schools for the benefit of the people of the State. To make Free Education possible even in new States, the Federal Government has taken care to set apart for elementary schools, in each of them, from two to four 'sections' (or square miles) in each township six miles square, the proceeds from the sale of which form the chief part of the permanent school funds of those States, the income alone being used for the support of the schools. This income is supplemented by local taxation so that it constitutes about 3'3 per cent of the total school revenue of all the States. The gradual wiping out of illiteracy in the States by this and other means (such as

private and parochial schools) may be seen in the following figures:—

Year.	Percentage of illiteracy in the pop. above 10 years of age.	
1880	...	17 per cent
1890	...	13'3 "
1900	...	10'7 "
1910	...	7'7 "

This 7'7 per cent is made up as follows:—

Native whites	...	3'0
Foreign whites	...	12'8
Coloured	...	30'5

The coloured people in the Union are about a little over ten millions, of whom two-thirds are literate; the foreign whites total something like 13½ millions, of whom about only 1½ millions are unable to read and write; and the native whites who number 68½ millions and thus form the bulk of the population are practically all literate. It is no exaggeration to say that before very many years elapse illiteracy will be a thing of the past in the United States, whether among the whites or the coloured people. The system of free public schools and the many facilities given to boys to learn to read and write will make soon literacy practically universal in America.

The effect of free education in the colonies in wiping out illiteracy has made itself felt in England. At the last conference of National Union of Teachers held at Chel-

tenham, the executive's resolution on Mr. Fischer's Education Act asked *inter alia* for the extension of the compulsory clauses for the continued education of adolescents and for making secondary education entirely free. As the *Times* correspondent puts it in his report, the conference desired stronger meat than that offered by the resolution of the executive. One member—a new acquisition to the executive—demanded free education right up to the University, together with adequate maintenance grants for all pupils. Mr. W. P. Folland, the new President of the Union, in his vigorous address struck the same note—the vital importance of education and the necessity of helping and safeguarding the teachers in every grade. He pleaded for free and open secondary education, for giving to every child the opportunity to have his abilities fully trained, for substantial salaries to teachers, and for conditions of service that make for efficiency and happiness. So the wave for free secondary education is beating high. The demand for it in England shows that the movement is gaining in volume and strength. Before long it will be recognised that every State should, as part of its bounden duty, provide for the free educational advance of its citizens, rich and poor alike. Education, in other words, will be regarded in the future as more a State than a parental duty.

The argument that primary education should first be made free and compulsory before universalising secondary education is fallacious inasmuch as modern educational theory and even practice does not accept primary education, corresponding to though not higher than the education imparted in what are called elementary schools in England, as any education at all. This view is no doubt comparatively new to England but is now becoming more and more familiar there. The old view which asked the generality of children to rest content with the education given in elementary schools and made secondary education

possible only to a few was condemned at the conference referred to above. It was attacked as a thing educationally unsound. Commenting on this, the *Times* (Educational Supplement dated 1st May) wrote as follows:—

"We have a good deal of sympathy with his view. Why should certain children from Elementary Schools be sent to Secondary Schools, and others not less intellectually competent, and sometimes more competent, be sent to the schools of the higher elementary type? Is it a fact that the children sent to the central schools are intended to supply the labour market, while the secondary are to supply the professions? If there is any such intention underlying the scheme, it is certainly undemocratic and as certainly unsound from the point of view of national education. But the truth of the matter is that these schools are a product of the 1870 conception of Education for the people, a conception which we believe to be largely unsound. There ought not to be elementary schools at all. There ought to be preparatory schools from which every child should be transferred to the appropriate type of secondary school at the age of eleven. No doubt it can be argued that the central school is a transitional device leading in this direction. But meantime we are going to waste half a dozen generations of school children in the process. The National Union of Teachers sprang out of the old elementary system, and a percentage of its members cling to the old elementary ideal. The conception of universal secondary education, which in fact is accepted as a sound position in America, is still not fully accepted by the Union, which rejected Mr. Gauntlett's views by a large majority. Ten years ago the conference would not have listened patiently to these views. Last week the stalwarts of the elementary conception of education had to fight hard for their position. In less than five years we venture to prophesy, Mr. Gauntlett's view will be a common-place of the profession. It is interesting to note that Germany made exactly the same mistake as England. Her folk-schools were and indeed still are, even more thoroughly cut off from Secondary Education than our Elementary Schools. But the type is the same; a special education for a special class, that class forming the vast majority of the children of the country. The doctrine of the Universal Secondary Education does away with this distinction and should give every child the education best suited for the unfolding of his or her personality. Central schools and compulsory day continuation schools are steps in the right direction, but they are more transitional phenomena."

The primary stage is thus held to be no stage at all in education; to regard it as a distinct stage in itself is to create a stumbling block to ourselves. Educational views filter down slowly to the people of any nation; but that is no reason why they should not be assimilated by experts and incorporated into their every day thought. That would help to create a new atmosphere and progress would be more marked. The change of views in England, though slow, is still a notable one. The sounder view, prevalent in America and on the continent of Europe that primary schools should only be treated as preparatory schools from which every child should be transferred to the appropriate type of secondary school at the age of eleven is coming to prevail. And it is to be hoped that that view, which is now in possession of the educational field everywhere in the civilized world, will also be eventually adopted in this country. If this were done, much of the prejudice now existing against universalising Secondary Education and making it free would soon disappear.

In this country, public opinion has still to be educated in this matter. The need for pressing home this vital matter is great. Persistent attention should be given to it by those interested in the development of the country. Without education, industrial advance is impossible; without education, agricultural improvement is impossible; and without education sanitary improvement is impossible. If the parent is either ignorant or careless, no doubt he suffers for it, but the State of which he is a citizen or subject suffers ten times worse. That is the reason why education has slowly but steadily come to be recognized as a duty of the State *qua* State. Every child—of whatever caste, creed or colour—should be afforded the fullest opportunity to develop the faculties given to it by God. That is coming to be realized as the prime duty of every civilized Government in the world. Can any country hope to sail against that current? The

answer is obvious. President Wilson not long ago said: "The nations are renewed from the bottom not from the top; that the genius which springs up from the ranks of unknown men, is the genius which renews the youth and energy of the people. The utility, the vitality, the fruitage of life does not come from the top to the bottom: it comes like the natural growth of a great tree, from the soil, up through the trunk into the branches, to the foliage and the fruit. The great struggling unknown masses of the men who are at the base of everything are the dynamic force that is lifting the levels of society." Without education, where could these masses be? And what is the loss to a people who cannot afford to provide facilities for mental improvement for them? That is really at the bottom of the *free* education movement, all the world over.

It is thought that with the coming of Peace the paper industry will be extensively promoted. From paper tissues all possible articles one can think of are made, as overalls, table-cloths, curtains, handkerchiefs, collars, shirts, embroidered blouses, hangings for the wall, and imitations of Persian carpets. One German firm made a complete set of horse's harness out of very strong tissue made of a web of from 3.5 woven thickness. This web was strengthened with a mixture containing tar to give it greater resistance. In order to convince the public as to the washing qualities of paper yarn, a section was fitted up where paper articles were washed and boiled before the eyes of the onlookers. It was shown that a stocking, after being washed several times, was softer and thicker than when it was first new.

REPORT OF THE INDIAN COTTON COMMITTEE.

BY A. K. YEGNANARAYANA IYER, M.A.,

Deputy Director of Agriculture, Mysore.

THE Indian Cotton Committee, whose report has just been issued, was appointed by the Government of India in September, 1917, to enquire into the possibility of extending the cultivation of long staple cottons in India. The terms of reference were the following :—

"The Committee will examine the work which has been done in the various Provinces of India in the establishment of long stapled cottons. It will report regarding the possibility of the extension of any methods which have led to success. It will investigate the causes of failure where this has occurred, and if it finds that the failure has been due to Agricultural, Irrigational or Economic causes or to administrative difficulties, will propose appropriate remedies. It will carry out a detailed study of local conditions in each cotton growing tract and will enquire into the possibility of improving existing methods of ginning and marketing and also of preventing adulteration and damping. It will further report on the possibility of improving the accuracy of the cotton forecasts and generally of making the statistical information published by Government of greater utility to the cotton trade. Finally, it will submit recommendations in regard to the staff required and organization necessary for the development of the cultivation of long stapled cottons in tracts which it considers suitable for that purpose."

Cotton for Lancashire.—The circumstances which called the committee into existence are pretty much the same as have led the Government of India on more than one occasion in the past to take active

measures for the improvement of Indian Cotton and the extension of its cultivation, viz., the desire to make Lancashire independent of supplies from outside of the Empire. Among the many problems of reconstruction that have been exercising the forethought of the Government during the stress of War, this important subject has not been omitted. The cotton crop of America on which Lancashire has been depending very largely is being absorbed more and more by the rapidly expanding cotton industry of America itself. In the quinquennium 1890-95, the American consumption of cotton was 33 per cent of its total production. In 1910-15, it rose to 39 per cent and in the three years 1915 to 1918, it rose to 59 per cent implying no doubt a corresponding shrinkage in the amount of cotton available for export to the United Kingdom. "It is obvious," the Committee says, "that the Lancashire Cotton Industry, the importance of which to the Empire needs no comment from us, is faced with a serious situation and that it is most desirable that it should cease to be almost entirely dependant on a source of supply, the future of which is so problematical. India as the largest cotton producing country in the Empire and the second largest in the world clearly offers the greatest possibilities of any considerable increase in the supply of cotton in the near future."

Indian Interests Predominant.—Such a clear statement as to the main object of the Committee's enquiries may easily lead one to believe that the interests of Lancashire have been the main concern of the Committee and that its recommendations centre mainly round this question. It happens, however, that the question of long staple cotton occupies quite a secondary place in the recommendations and that the main enquiry deals with the whole question of the improvement of the cotton industry in all its aspects, principally in the interests of the Indian cultivator. "To avoid all

possibility of misconception, we would wish here," states the Report, "to emphasise that our primary consideration throughout has been the interests of the Indian cultivator." We are glad to note that the report bears ample testimony to this statement. We may specially refer to the Committee's recommendation regarding the cultivation of "roseum" cotton in the Central Provinces, a cotton of poor and coarse staple, but strikingly high in ginning percentage, and found more profitable to the cultivator than superior varieties. As far as the cultivation of long staple cotton is concerned, the Committee concludes that "India cannot, for at least ten years, grow cotton in any large commercial quantity of a staple longer than $1\frac{1}{8}$ th of an inch." The only important addition to the production of this cotton which they anticipate is an area of 400,000 acres which would come under irrigation, if the Sukkur Barrage Project in Sind is taken up for execution—a conclusion which would no doubt be considered disappointing by those who look to India for a large supply of long staple cotton. It may be also noted that the flourishing cotton industry of India itself absorbs the bulk of the cotton grown in India, the export of Indian cotton to the United Kingdom being only about 4 per cent of the total cotton produced in India. It is stated too that the average yield per acre of the Indian crop is only 85 lbs. of lint, while that of United States crop is nearly 200 lbs. per acre and of the Egyptian crop, 450 lbs. It has been estimated that Indian cotton is so badly marketed that it loses about 10 per cent more in the blow room than American or Egyptian, thus reducing the yield per acre to less than 75 lbs. The existing practice regarding the sale of the cultivator's cotton and the frauds perpetrated in the gineries and cotton presses—result in losses to the producer on the one hand, and to the mills which finally make use of the cotton, on the other. All these facts to which the

enquiries of the Committee have been directed mainly concern themselves with the interests of India itself.

The Committee deals with the whole subject under two sections: (1) Agricultural and Irrigational, and (2) Commercial. We shall follow this scheme in this brief review.

I. AGRICULTURAL AND IRRIGATIONAL.

Indian Long Staple Cotton and Irrigation.—The long staple cottons of India are, the *Karinganni* cotton grown as a dry crop on the black cotton soils in the Tinnevely District; Cambodia cotton, when grown as an irrigated crop; the American cotton varieties also grown under irrigation in the Punjab; the Egyptian cotton—the *Mitaffafi*—the successful cultivation of which under irrigation in Sind has been demonstrated fully in recent years. The long staple cottons, therefore, principally depend upon irrigation and any extension of the area under them can be looked forward to only with improvements in existing irrigation sources or with the opening of new ones. The problems of irrigation as they effect this question are, therefore, gone into somewhat in detail under the head of the various Provinces. The important Irrigation Project in Sind called the Sukkur Barrage Project comes in for considerable attention. We note that the Committee recommend the prohibition of rice growing in the area which may come under irrigated cultivation under this project and the raising of the water rate for rice growing in the old areas in this tract, with the object of encouraging cotton cultivation. Readers acquainted with the proposals for the encouragement of sugar-cane cultivation under the Canavery Channels in our own State may detect a similarity of ideas in the above recommendations. The Committee have gone into questions of colonization, prevention of Malaria, lining of irrigation channels, water logging, alkali reclamation, and so on. Limited thus by facilities for irrigation, any increase in the

cultivation of long staple cottons can only be slow and even at the most sanguine expectation, only moderate.

Manuring and Increased Yield.—On the question of the raising of the outturn per acre of Indian cotton, both long staple and others which is at present so deplorably low compared with yields abroad, the Committee's recommendations are somewhat meagre. Nitrogen manuring increases the yield, but there is not enough manure to go round for the different crops of the country and the yield of cotton which can no doubt be doubled by proper manuring suffers an account of the general deficiency of manure in the country. We wish the Committee whose opinion is sure to carry great weight with bodies whose interests may often be conflicting, had made some specific recommendation on this general question. The growing of a leguminous fodder crop in rotation with cotton has been recommended, but the claims of a food crop like *juar* will be too great to admit of such; in fact when some years back the writer tried to introduce the cultivation of dry land lucerne in the black cotton soils, it was met with strong objections. We are sure that if the British Cotton Growing Association or other body interested in Indian Cotton turns its attention to the manurial aspects of the question, some practical solution of the difficulty will soon be forthcoming. We may add that the question of manuring will relate principally to irrigated cotton, i.e., the long staple cottons.

Improved Varieties and Seed Farms.—With regard to the evolution or isolation of superior varieties, the Committee lays stress on the improvement of the indigenous varieties and of the Foreign varieties which have become acclimatised. The Egyptian cotton proposed for Sind is an exception; the introduction of any further exotics is deprecated. Botanical surveys, trial of varieties, selection and crossing are all dealt with, and the problems of each Province

considered separately and recommendations regarding the most promising lines of work to be adopted in each of the provinces indicated.

The question of seed farms and of the organization necessary for the supply of pure seed is discussed in full and the staff for working these organizations as well as for the improvement of the varieties themselves are specified. This is indeed a very important matter and it will be no small achievement if things can be so managed that one particular variety, whatever it may be, is grown pure and unmixed throughout any one particular tract. Even with the ordinary varieties this will be greatly appreciated by the trade, while with the better or improved varieties the effect will be marvellous. The Departments of Agriculture as well as private agencies and Co-operative Societies, Cotton Growers' Associations and allied bodies will have to work together to secure this end and the necessary staff indicated by the Committee will also have to be provided.

Mysore Cotton.—The recommendations in this section are given province by province and Mysore though only of very minor importance as a cotton tract is not left out. The Chitaldrug cotton and Cambodia are referred to, but the cotton of the Mysore District finds no mention. The extension of Cambodia cotton under irrigation is recommended; and as regards dry land cotton the work of the Bombay Department is to be closely followed, as whatever applies to the Kumpta cotton of Southern Bombay will apply to the Chitaldrug *sannahatti*. Cambodia cotton is, as readers are aware, being popularised and the work of trial and improvement of the local cotton is already in progress.

II. COMMERCIAL.

Better Price for a Better Cotton.—On the commercial side, the Committee's recommendations are elaborate, and the principal ones such as will necessitate legislation. The most important and at the same time the least complex of these, we take it, is the means to be adopted to ensure to the

cultivator a better price for a better cotton. It is obvious, that in the absence of such an inducement no measures will avail anything; as the Committee remarks in conclusion, "It will rest with the Cotton trade to convince the cultivator in the only way in which he can be convinced that long staple cotton pays him better than any other varieties."

We have no doubt that when long staple or other superior cotton comes into the market in really large quantities there will be buyers willing to pay a better price for it. It is in the initial stages when the various Agricultural Departments introduce the cultivation of superior varieties that the chief difficulty arises; and it is at this stage that the sympathetic co-operation of the trade is quite essential. In general, the trade cannot guarantee a better price unless large shipments are forthcoming, and the large area required for this purpose cannot be put down unless a good price is assured. This vicious circle cannot be broken unless the trade views matters with far sighted sympathy. The Committee's recommendations are most valuable in this regard. New varieties have to be properly tested, not merely in the Experimental Farm scale but in the ordinary ryots' way; the trade has to approve and set its seal of sanction upon the new variety; auction sales are to be conducted of the new cotton by the Departments of Agriculture, until such time as the variety becomes established both with the grower and the buyer. Even in the sale of ordinary varieties, the Committee makes important recommendations calculated to secure for the cultivator a better price for his cotton.

Prevention of Fraud.—The other important subject dealt with in this section is the prevention of adulteration, damping, lack of cleanliness in the cotton and other defects of Indian cotton. The Committee exonerates the cultivator from blame as they are venal and often unavoidable. It is the ginneries and presses that are the greatest offenders and the Committee is justly severe on them both in its condemnation and in the preventive measures proposed. "Cotton waste is imported by wagon loads from Bombay for being mixed up with cotton. Cotton damaged by rain is mixed with good cotton. Cotton is deliberately watered. Cottons of different varieties are mixed, short staple or inferior cotton being often imported

from places hundreds of miles away to be mixed with higher priced cotton. Ginning machinery is so adjusted that crushed seed passes into the ginned cotton; seed or unginned cotton is placed inside ginned cotton; the kappa is not always passed through an opener and even when it is, fans are often stopped purposely to allow the dust to be blown out to fly back into the cotton"—a truly formidable arraignment. The Committee is opposed to a *laissez faire* policy in this matter and proposes drastic action. In the main, these relate to the licensing of presses and ginneries and to the restriction of the transport of waste and of cotton except under scrutiny. The conditions of licensing are pretty strict; we refer readers to the report itself for details.

Organization, Staff and Cost.—The Committee has also recommended the formation of two organizations, one under Royal Charter, to be called the East Indian Cotton Association on the model of the Liverpool Cotton Association and another a Central Cotton Committee. The first would be Central Commercial Body which would keep the Indian cotton trade in responsible touch with cotton trades and associations abroad. The second will be more in touch with the business of cotton growing, advising Government on matters of policy, making recommendations regarding the development of long staple or other cotton in particular areas, dealing with the licensing of gins, with cotton statistics, advising about the merits of new varieties of cotton and so on. This latter Committee will also have a cotton technologist on its staff.

The Committee contemplate the expansion of the different Departments of Agriculture, the appointment of more Deputy and Assistant Directors, Entomologists, and so on; the cost of these as well as that of the Central Committee proposed is estimated at sixteen lakhs of rupees which it is proposed to meet by a cess of eight annas a bale on all cotton used in the mills in India or exported.

We have been able to do little more than draw attention to some of the salient points of the Report in this brief review. The report is so thorough and so full of up-to-date information with every aspect of the cotton industry throughout India, that we would commend it as a book of reference to all interested in the subject.

MYSORE ECONOMICS.—II

AGRICULTURE: INCREASE IN TOTAL OUT-PUT.

BY K. SUBBA RAO, B.A.

THE immediate and urgent need of the country would seem to be a mighty and sustained effort to increase the total out-put of crops. In spite of the inscrutable decrees of Heaven, victimising millions of people in wars and epidemics in the past few years, the daily wants of these yet left behind in the land of the living are growing imperative. At the rate at which food-crops are now selling, it must be exceedingly difficult for large sections of the population to provide themselves with food grains enough for full sustenance. Increased out-turn continually for a number of years is the only remedy for the high prices at present prevailing and the almost depleted stock of food grains. The larger the quantity of food grains we grow, proportionately more will be available for local consumption and more for export outside.

The next point for consideration is what are the main factors to be kept in view, for increasing the total agricultural out-put of the State. They are in brief two.

The first is to increase if possible the out-turn from lands under cultivation by the adoption of improved methods, improved appliances and the application to the land of more manure. The agricultural department is publishing the results of its experiments and advising ryots on the proper methods to be adapted in a variety of ways, e. g., ploughing the land in time and more effectively, the selection of seeds, the kind and quantity of manure to be applied, transplantation, the particular kinds of implements suitable for the particular crops, how to guard against crop pests, etc. What is wanted is that by sympathetic and incessant supervision the ryots should be persuaded and aided to bring into practical use the

advice tendered in the publications of the Department. This is being done now, but may have to be done on a larger scale.

In talking of increased out-turn, it must be understood that human skill can aid us to some extent only and a great deal depends on the adequacy of rainfall in suitable seasons.

This is one of the mightiest factors which defy all human calculations. This is an eternal equation and while bearing it in mind, the other factors which lie within the effort of man need not be neglected. While on this subject it may be relevant to refer to the high prices that dry crops now command and the increased profits which dry crops are bound to yield.

The tapping of the underground water-supply deserves more systematic attention than that hitherto bestowed upon it. In some of the more advanced and progressive parts of the world, wells are dug 300 to 400 feet deep and the water is pumped out from the very bowels of the earth. In Mysore Geological investigations would appear to bear out the advisability of sinking deep wells.

The deeper the wells, the more assured is the water-supply. A department purely for sinking wells in suitable localities to increase the supply of water for drinking purposes and for irrigation is an urgent want and has to be supplied without loss of time. Our ryots and the general public are keenly alive to the great advantages of sinking wells and increasing their number. But it is not within their means to spend money on experiments and they cannot command the necessary technical skill and costly instruments. If the Government would undertake the purely experimental portion of the work and the supply of the necessary implements and skill, the people would gladly bear the entire cost of construction. The Government are exceedingly solicitous of the welfare of the ryot population and of prosperous seasons. The Taccavi loans go some way. The more

direct help in sinking wells will be an effective auxiliary to the *Taccavi* loans, and if by the sinking of deep wells on a larger scale, the underground water-supply can be utilised, increased out-turn in several food crops and vegetables and fruits can be relied upon to a larger extent than at present.

A question may arise as to whether all the lands under occupation are cultivated. A portion is not. Land requires rest and a portion may be left fallow. If this were the only consideration and criterion, then such portions of the occupied land as are not cultivated but are held as a reserve, in the long run help the total output. But I am afraid there are instances of lands occupied, not being cultivated because the owners could not command the necessary agricultural labour and capital. Notions of family or personal dignity, attachment to estates acquired by ancestors, hope of better days and such considerations have stood in the way of men selling the portions of land which they are not able to cultivate. They pay the *Kandayam* but do not reap any benefit. Such cases deserve to be investigated. Even in the most enlightened countries, lands are held as all other property, for the best use that could be made of it. With increasing difficulty for food grains, it is not unrighteous to hold that every one who holds cultivable land fit for the plough, should use it for the best advantage of himself and the public, instead of allowing it to lie idle year after year, merely because he pays the Government assessment. More important than the *Kandayam* to Government is an adequate food supply for the people. It would be well if the Revenue Department and the Agricultural Department will keep this prominently in view and investigate into such cases and by acts of persuasion and assistance, enable ryots to make the best use of their entire holdings in tracts in which there is laxity in this respect. It is here that Taluk Progress Committees and the District Committees and Co-operative

Agricultural Societies can play a very useful part. It is only the spread of sound economic ideas and co-operation and help that can eradicate this evil. Ryots' associations, if they could be formed, would be most useful agencies. Every owner of arable land, poor or rich, must be made to understand that every bit of land fit for raising agricultural produce which is left waste, means so much loss to the country by a diminution of the total output.

The second factor is the vast extent of assessed waste lands available for cultivation, i.e., lands which the Survey Department have thought fit to assess but which the people have not taken up. It may be that a good deal of it is mere *Kharab*. But there is no doubt that in this vast extent there are lands which can be made fully remunerative. Some conception of its vastness may be formed from the fact that it is nearly a million acres. Portions of it must be suitable for dry cultivation, for fodder crops, for rearing sheep and cattle. There are also *Amritmahal Kavals* to be released for cultivation and those already released. Similarly the date reserves contain in the popular imagination lands which can be, without loss to the Excise Department, thrown open for cultivation. These sources at present furnish a large area of land which may be newly brought under cultivation and which may be therefore usefully employed in increasing the agricultural output. But what stands in the way is the want of agricultural labour and capital, also difficulties of transport and locomotion in the Malnad. Some years ago an European traveller well versed in continental methods of agriculture and sericulture, travelling with me in the Kadur District, was struck with inexpressible wonder at the paucity of population and the stretch of beautiful expanse of land awaiting the hand of the labourer for giving plenty of useful crops. Mysore has thus immense potentialities for increasing food supply and it must be the devout prayer of all well-wishers of the State that immediate steps should be more actively pursued with the single aim of bringing about this great end. Land, climate, scenery, the monsoons in spite of their vagaries and inconsistency, are all in our favour. Capital, appliances, labour, supervision, sympathetic and systematic guidance, are urgently needed. To some of these I shall refer later on.

CO-OPERATION IN THE UNITED PROVINCES, 1917-18.

BY "RUSTICUS."

THE Report of the Registrar of Co-operative Societies in the United Provinces on the working of his Department in 1917-18, is anything but cheerful reading. Figures are not, in themselves, an altogether satisfactory criterion of progress or the reverse especially in the case of the co-operative movement where, in recent years, consolidation has been far more important than expansion. None the less, where they reveal a distinct drop for the first time, they show that things are not as they should be. The number of societies in the United Provinces fell, in 1917-18, from 3,245 to 3,090, the number of members from 114,165 to 101,626, and the working capital from about Rs. 120½ lakhs to Rs. 111½ lakhs. The drop in working capital is especially regrettable for, as is pointed out in the Local Government's review of the Report, the cultivator now needs more capital for his ordinary requirements than he used to do when prices were lower and the value of money was correspondingly higher. The amount due to central banks at the close of the year was Rs. 39'40 lakhs, of which Rs. 20'15 lakhs or 51'1 per cent were over-due against 4'12 per cent at the end of the previous year. Primary Societies were in even worse plight. The total arrears in their case amounted to 64.2 per cent of the out-standings, the highest figure recorded in any of the Reports we have so far reviewed.

It is evident that by no means the larger share of the blame for this unsatisfactory state of affairs can be laid at the door of the unfavourable agricultural season though that was undoubtedly a contributing cause. The Registrar, Mr. Makbul Hosain, has some outspoken comments on the situation as it

appears to him. Bad societies founded in the early days of the movement when, in the United Provinces, as elsewhere, enthusiasm much too frequently outran discretion, are being gradually extinguished. But this, in his opinion, is not sufficient, and, even in their case, something might have been saved from the wreck if there had been more supervision and sympathetic control. Mr. Makbul Hosain pleads for greater effort on the part of Government and the non-official public alike. The harvest would be plentiful, but there are far too few labourers in the vineyard. The Government staff is small and almost all its time is taken up by audit. The number of non-official workers is, in itself, not inconsiderable but very many more are required. The plea for additional staff for propaganda work is met sympathetically by the Local Government which promises to appoint more inspectors shortly and hints that the post of Joint Registrar will be made permanent. On the question of stimulating the interest of the educated public and enlisting its services in furthering the progress of the movement, it offers no comments.

Of the 3,245 societies in existence in the United Provinces, 3,008 are agricultural primary societies and it is, therefore, on the successful working of these that the stability of the movement depends. This being the case, we may be pardoned if we give a few of the figures which relate specially to them. Compared with the previous year, the advances were lower by Rs. 6.48 lakhs, the collections smaller by Rs. 5.48 lakhs in principal and nearly a lakh in interest and the arrears, including postponements, larger by over Rs. 3 lakhs. The only satisfactory feature was that the proportion of the share capital and the reserve fund to the total out-standings increased from 37.6 to 46.5 per cent. For the depression into which the primary societies have fallen, Mr. Makbul Hosain holds the central banks responsible in that they have not sufficiently supervised their primary societies. It is not a matter

of one year or even two but of several. The longer arrears are allowed to accumulate, the more difficult becomes their recovery. Another factor which has contributed but for which the central banks are in no way to blame is the slowness of liquidation and arbitration proceedings. At the end of the year, there were no less than 345 liquidation proceedings pending. Sixty-four only were completed during the year and, at this rate, it will take about $5\frac{1}{2}$ years to deal with the remainder. It is obvious that, where liquidation proceedings are disposed of at this pace, liquidation can only be used in the very last extremity and the fear of it is not a very powerful deterrent to bad societies. However, a great improvement in this respect is in sight for the Local Government have decided to introduce a bill into the Legislative Council, the effect of which will be very considerably to shorten the proceedings.

As for central societies, the Registrar considers that very few of the smaller central banks served their purpose satisfactorily. Six of them had to be closed. The main obstacle to their successful working is the attitude of the paid managers who are given far too free a hand by the Directors and resent any interference from the District Banks to which they are affiliated or even from the Registrar and his staff. The only remedy is a Directorate which is capable of taking a more active and intelligent interest in the working of the institutions at present only nominally in its charge—in other words, education and yet more education. Various alternatives to the smaller central banks have been tried but none of them appears at all promising. One guaranteeing Union has worked well in Bijoor but the guaranteeing Union is no more popular in the United Provinces than it is in Bengal or Bihar and Orissa as societies are unwilling to shoulder any risk but their own. In these cases, branches of District Banks have been opened, the branch being in charge of a supervisor or an assistant manager under the control of a Director.

The chief business of these branches is the receipt and custody of money and the early disposal of loan applications, a limit being fixed to the amount they may grant on loan. This system can only prove successful if the Director of the District Bank takes a close interest in the societies to whose need the branch under his control ministers and this at present is not the case. The third system, that of a supervising and organizing committee under the District Officer or Sub-Divisional Officer was only tried in one place where it broke down owing to the transfer of the Sub-Divisional Officer. It hardly seems worth while pursuing it if its success depends so entirely on the interest displayed by an individual officer.

We notice, with regret, that the Registrar, against his better judgment, allowed some of the larger banks to make use of a part of their overdue interest in distributing profits to their preference shareholders. Mr. Makbul Hosain admits that this is unsound finance and that the only argument which has been adduced in its favour which is that, unless there is some distribution of profits, the shareholders and the public will take fright, has no cogency, the true remedy being to get in the overdue interest without further delay. He expresses a hope that no further applications of this kind will be made to him. They certainly will not be if he announces at once that, in no circumstances, will they be entertained. He states that the dividend allowed was at a much lower rate than had been distributed in previous years. The amount of the dividend does not affect the question of principle and it is to be hoped that Mr. Makbul Hosain will steel his heart in future and will not permit any misplaced sympathy for the troubles of banks, which have only themselves to blame, to induce him to sanction a thoroughly unsound procedure.

Of the non-agricultural credit societies in the United Provinces two blanket weavers' societies, a few weavers' societies and a

bangle maker's society were the only exceptions from the general stagnation. Agricultural societies for purposes other than credit fared very little better. Four ghee societies are doing fairly well but their operations are on too small a scale at present to enable any definite opinion to be formed as to their eventual success. The Allahabad Dairy is reputed to be flourishing, mainly because of the interest taken in it by Mr. Fremantle, a former Registrar. Here again the operations are on a very small scale as the value of the milk supplied by the members who number 49 was less than Rs. 6,000. The cattle insurance societies in the United Provinces are only four in number and are not prospering. The main difficulties, as described by the Registrar, are the frequent changes made by the members in their cattle, their unwillingness to deprive the village leather workers of their customary right to appropriate the carcass in return for a pair of shoes or a leather bucket and, above all, their lack of comprehension of the working of their societies and of faith in them. In these circumstances, it is hardly surprising that Mr. Makbul Hosain does not anticipate any early results. A few of the distribution stores did well, the most successful being the Sandila Yarn Store, which increased the value of its sales to over a lakh of rupees and made a profit of Rs. 8,155.

There is only one Co-operative Society in the United Provinces for the purchase and sale of agricultural produce and that worked at a loss. A large number of central banks, however, furthered the cause of agricultural development by spreading the cultivation of Pusa wheat, Mauritius sugar-cane, Jaunpur maize and Aligarh cotton. The experiments in the co-operative use of machinery deserved a better fate. Oil engine water lifts were established in three places, but, owing to war conditions, when anything went wrong, spare parts were not available and the rise in the price of oil made economical working difficult. This was unfortunate as there are large tracts in the United Provinces in which there are great possibilities for tube wells and oil engines. We have, however, little doubt that neither the Agricultural nor the Co-operative Department will be deterred from trying again.

METHODS AND MACHINERY FOR THE EXTRACTION OF OIL FROM SEEDS, ETC.*

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OWING to the number of enquiries received recently for methods and types of machinery for the extraction or expression of oils from seeds, it is considered desirable to supply as much information as possible on this subject.

This article deals entirely with methods of extraction of what are known as fixed vegetable oils or fats, which are all derived from seeds of various kinds and does not treat of what are known as essential or volatile oils which are usually obtained by distillation, enfleurage or extraction by solvents from the flowers, leaves, stems or roots and occasionally seeds of plants. The fixed oils or fats are so-called, because they are not usually volatile in steam and cannot therefore be obtained by a steam distillation process. They are used for a variety of purposes, chief among which are their use for edible purposes, principally as a substitute for butter fat, for the manufacture of soaps and candles, for lubrication purposes in machinery of all kinds, and for the manufacture of paints and varnishes. The volatile or essential oils are used directly or indirectly as the basis of all scents, flavouring matters, essences, etc.

The chief representatives of vegetable edible fats are coconut oil and palm kernel oil, although cotton seed oil is also used extensively as is ground-nut or earth-nut oil.

Other vegetable oils are used to a lesser extent for adulteration purposes. Olive oil is also used largely as a salad oil and cotton

*With acknowledgments to the *Agricultural Bulletin of the Federated Malay States* for January and February, 1919.

seed oil is also used for the same purpose. First quality cold expressed castor oil is also used medicinally. Many fats and oils are used for soap and candle-making, in fact most of those from which the solid fatty acids are obtained in quantity and which cannot be used for various reasons for edible purposes. Castor oil, particularly the darker coloured oil, is used extensively for lubricating purposes, especially in tropical countries for heavy machinery—locomotives, etc. It is generally too viscous for similar use in cold and temperate climates. The development of the aeroplane industry, due to the present war, has increased enormously the demand for this oil, especially for a certain type of aeroplane engine. If this development is continued for commercial purposes the demand for castor oil is likely to be maintained.

The principal vegetable oil used for paint and varnish making is linseed oil the value of which lies in the fact that it can absorb oxygen from the air and forms by so doing a varnish-like film, being classed on this account as a drying oil. As is now generally known, rubber seed oil is also in this class although not as efficient a drying oil as linseed.

Practically all seeds contain more or less oil or fat but only seeds containing a comparatively large percentage are of value commercially as oil seeds.

A number of seeds from wild or forest plants and trees also contain valuable oils, e.g., the tree which yields Borneo tallow, Shea Butter, Tenkawang and Illipé fat (*Shorea* sp., *Hopea*, etc., vide *Agricultural Bulletin*, Vol. I, No. 4 of November, 1913,) which however are not of great commercial value owing to the irregularity in fruiting. It is possible that some of those in our Malayan forests might be worth cultivation as a source of oil, e.g., *Carapa Moluccana* and *Kapayang* (*Holigsonia heteroclita*?).

The fixed oil or fat is extracted from seeds by one of two methods (a) expression (b) extraction with solvents.

Since it is not intended to discuss in detail the latter process, it will be briefly described first.

EXTRACTION PROCESS BY THE AID OF VOLATILE SOLVENTS.

In the extraction of oil or fat from seeds by means of volatile solvents, the seed is crushed to a fine meal and placed in special extraction apparatus connected to the vessel containing the solvent. The solvent is boiled and made to distil into the vessel containing the seed meal. After the solvent has permeated the meal and dissolved a portion of the oil or fat, on reaching a level just above that of the surface of the meal, it is automatically syphoned back into the vessel containing the solvent. The process of boiling the solvent and causing it to distil and condense in the vessel containing the meal and then to syphon back into the vessel containing the solvent is continued until the solvent has extracted all the oil or fat from the meal.

The number of extractions required and the time taken depend chiefly on the character of the seed and the fineness of the meal into which the seed is ground. By tapping off the solvent from the meal container at intervals, tests can quickly be made to ascertain whether the oil or fat has been extracted thoroughly.

The solvent containing the oil or fat is then distilled off, leaving the pure fat or oil behind and the solvent can be used again for further extraction purposes.

The last traces of solvent are very difficult to remove from the oil or fat, which has to be purified by blowing air or some inert gas, e.g., carbon dioxide, through the heated fat.

It is said that the extraction process for separating oil or fat from seeds is becoming employed more extensively during recent

years and that for many purposes the extraction method has advantages over the expression process.

Its value compared with the expression process depends on the fact that practically all the oil or fat can be removed from the seed, whereas by the highest hydraulic pressure, usually about 6 to 8 per cent of oil is left in the oil cake or residual meal, representing a loss of about 3 to 4 per cent on the original seed or 6 to 8 per cent of the total oil content in the case of a seed containing say 50 per cent of oil or fat.

Although the yield of oil is higher by the extraction process, the residual cake is of less value for cattle feeding, etc., since it contains little or no oil.

Further, seed which has been extracted by means of solvents is often not of any use for feeding purposes, owing to its non-palatability, due to traces of the solvent, which are difficult to remove. Such cake is very suitable for fertilizing purposes, but its monetary value is less for such a purpose than as a cattle-food.

In other respects, the comparative value of the extraction and expression processes depends largely on the loss of the volatile solvent in the former. With efficient condensation and distillation apparatus, the amount of solvent lost is small.

The solvents largely employed are carbon bisulphide, carbon tetrachloride and trichlorethylene. Any very volatile solvent of oils or fats may be used, and the liquid employed depends largely on cost.

Owing to the relatively high temperature in this country, it is probable that an extraction process would not compare favourably with an expression process, on account of unavoidable losses of solvent due to the difficulty of efficient condensation in the recovery of the solvent.

In some cases, e.g., in the preparation of castor oil, both the extraction and expression processes are combined, the latter being

employed first in order to obtain a high class medicinal oil by cold pressing of the seed, followed by chemical extraction to remove the remaining oil. This combination, however, is not carried out in all factories in which castor oil is manufactured.

PROCESS OF PREPARATION OF OIL FROM SEEDS BY EXPRESSION.

The expression process for the extraction of oils from seeds is very ancient; the wedge press and the large wooden pestle and mortar in which the pestle is rotated usually by bullock-power are well-known in the East.

These crude processes, however, are not efficient or economical, owing to the comparatively low pressure which is obtained and can only be used where labour is cheap. The ordinary bullock-driven pestle and mortar press leaves about 15 per cent or more oil in the residual cake compared to about 6 per cent in the most efficient modern hydraulic presses.

In modern oil-pressing factories the pressing system has resolved itself into two—the Plate (Anglo-American) system and the Cage system. The expeller system, as represented by the Anderson oil expeller, is a more recent development and will be discussed later.

In the case of both systems, the preliminary treatment of the oil-bearing material is similar, apart from different treatment in respect of decorticating or removal of shells or husks, which must vary of necessity with different types of seed.

It is not intended here to discuss the special methods which have to be employed to remove the shell from such different seeds as say the coconut, palm nut, castor seed, etc., since this would necessitate a description of details of many special machines, but to describe only such machines as are employed generally after the seed has been decorticated, or before, in such cases where the whole seed may be treated.

In the case of seed from a plantation, e.g., castor seed, para rubber seed, coconuts, etc., preliminary screening to remove impurities,

is not usually required. By decorticating, however, twice the amount of seed can be treated in a given time compared with undecorticated, in the case of a seed containing 50 per cent of shell or husk, since the shell or husk rarely contains oil.

Disintegrators.—The first operation, which can be dispensed with in many cases, is to break up the seed into small pieces or into a coarse meal, which is carried out in a machine known as a disintegrator. A number of different types of machines are used, but a common type consists of revolving grooved discs between which the seed is drawn and broken up by the discs, one of which may be stationary or both moving in opposite directions. Another type consists of rollers with blunt knives. Copra is a well-known example of a seed which requires treatment in a disintegrator in order to break it down into small pieces before passing to the crushing rolls.

Crushing rolls.—The next operation, after disintegrating, is to pass the coarse meal or small seeds, whole or decorticated, through crushing rolls where the seed is ground or pulverised to a fine meal. This operation is of importance since the fineness of the meal and the breaking up of the oil cells has an important effect on the efficiency of the subsequent expression of the oil. The seed must also be of a suitable dryness before passing between the rolls of the machine, otherwise "spueing" takes place and clogging. The machine consists usually of a set of five superimposed rolls, the top roll being corrugated or grooved horizontally. A small horizontally-grooved feeding roller is also attached to feed the meal on to this top roll. A hopper is attached to the top of the machine to receive the meal. In all large factories the disintegrated seed is fed on to the crushing rolls by means of a conveyor or chute, and the crushed meal from the bottom roll falls into a pit or chamber from which it is again removed by means of suitable conveyors to the steam kettle.

(NOTE.—In the case of cold pressing of seed, e.g., of castor seed, in order to obtain the highest quality medicinal oil, the seed is not crushed but taken whole to a "Cage" press. The residual meal from the once cold pressed seed is, however, after removal from the presses, passed through crushing rolls.)

Steam kettle.—The next process, unless a cold pressed or cold drawn oil is required, is to convey the crushed meal to a "steam-kettle" which consists of a large open cylindrical steam-jacketed pan, provided with a damping arrangement by means of which steam can also be passed direct into the meal in the kettle in order to moisten it sufficiently. The kettle is also provided with a stirring arrangement to keep the meal thoroughly mixed. Crushed meal is continuously being fed into the kettle from the crushing rolls and removed for the presses. The temperature to which the crushed meal is raised in the steam kettle depends on the seed and the nature of its oil content. Usually, however, the temperature is in the neighbourhood of 139° to 140° Fah. The heating or "tempering" of the crushed meal is obviously to render the oil content of the seed more readily extractable, by increasing the fluidity of the oil and by breaking up the oil cells in the seed and also by coagulating some of the protein or albuminous matter, which would otherwise pass into the expressed oil.

Cake moulder or forming machine.—In the case of the open plate or Anglo-American presses, the heated meal from the steam kettle has next to be passed to a cake moulding machine in which it undergoes a preliminary pressing, sufficient to compress the meal into a cake or compressed mass which can be handled, but not sufficient to remove any oil. A box open at the top and bottom, which holds sufficient meal to form one cake, is placed beneath an opening in the steam kettle, which is closed by means of a small door. This box rests on a slide which forms the bottom and which runs from the steam kettle to the cake moulding machine, which

is always placed next the kettle. Beneath a rectangular opening in this slide attached to the cake moulding machine is placed a steel tray covered with the cloth in which the cakes are contained for pressing. The cloth is more than twice the length of the cake so that it can be wrapped round the meal longitudinally leaving only the long sides of the cake open.

The open box of meal is pushed by hand until it reaches the opening in the slide above the tray, into which the contents are dropped.

The cloth which overhangs the tray at each end is wrapped or lapped over the rectangular shape of meal and the tray holding the meal is slid on to the table on the ram of the cake moulding machine, actuating a lever which allows steam to force up the ram automatically and presses the cake against the top of the cake moulding machine.

The lever is then actuated by hand and the ram drops, allowing the operator to remove the tray and compressed meal which is then taken to the open plate press. The compressed cake is placed on a plate in the press, and the tray removed by sliding it from under the cake. The operation of producing cakes in the cake moulding machine is repeated until the press, which usually holds 16 to 18 cakes, is filled, when the press is raised as described below. In order to render the operation continuous, one cake-moulding machine usually supplies four presses, so that while one press is under pressure, the others can be filled and emptied.

NOTE.—In the case of the Cage press the cake moulding machine can be dispensed with, since the meal is enclosed in a cylindrical cage, and formed into cake in the press itself.

Anglo-American Presses.—The Anglo-American or plate press consists of a series of superimposed strong steel plates separated from each other by suitable means and

resting on a powerful ram. The ram is raised by means of hydraulic oil pumps and accumulators and the plates between which the cakes of meal are placed, are raised and pressed against the top of the press. The cakes are thus pressed and the oil commences to flow at first slowly and subsequently more rapidly from the sides of the plate and is caught in a tray beneath the press plates and from thence can be led into a suitable chamber or pit beneath the press.

The press is slowly raised to the maximum pressure, which in the most powerful presses rises to 2—3 tons per square inch, and left at this pressure for a period of 5 to 15 minutes, until the oil ceases to flow. The pressure is then removed and the ram drops, enabling the cakes to be removed by hand.

As the expressed cakes are removed, fresh cakes are placed in the press till again filled and the operation repeated. By means of suitable distribution valves, each press in a battery can be placed under pressure and released independently, enabling the operation to be continuous. Pressure on the ram is obtained from hydraulic oil pumps worked by means of an engine or motor.

It should be stated here that the press plates are corrugated or grooved on each side in order to allow the oil to flow away more readily. They are also concave on each side in order to prevent the meal from being squeezed out, except in small quantities. This corrugation of the plates gives the well-known corrugated appearance to all oil cakes. In the Anglo-American or plate presses the edges of the cake always retain a fair proportion of oil, owing to squeezing of the cake at the edges of the plates. The cakes are therefore removed to a cake-paring machine, in which the edges are pared off and the parings again passed through the crushing rolls and the steam kettle.

The pared cakes can then be stacked in suitable racks to enable them to cool down before storage.

All seeds requiring a single pressing are usually treated in these presses. Many seeds require twice pressing, especially those in which the first pressing, for special reasons, is carried out on cold pressed meal.

Copra and other seeds containing a high percentage of oil are almost invariably pressed twice, both pressings being on heated meal.

Cage Presses.—In some oil mills, cage presses are used exclusively. As stated above, in the case of the cage press, which is an enclosed press, the cake moulding press can be dispensed with, since the cakes are made direct by pressure in the press. These presses are often built under the steam kettle. The ram is raised nearly to the top of the press and a definite amount of heated meal from the steam kettle regulated by a chamber beneath is dropped on to a press plate on top of the ram, the press plate being covered with a mat or cloth. Another cloth and press plate is then dropped on to the meal and a further cloth and then more meal, so that each lot of meal is placed between two press cloths and two steel plates. The ram is slowly lowered at a rate corresponding with the rate of feeding in the meal.

When the press has been filled in this manner a massive slide is moved over the top of the press and the ram is raised. The oil is squeezed out through the sides of the press, which consists of a perforated cylinder or more usually a series of stout steel bars, while the cake is retained. In order to prevent squirting of the oil, these presses are usually surrounded with a thin galvanized cylindrical sheet of metal. The oil flows into a tray beneath the press.

It is generally intended that the cakes from these presses should be again reduced to meal and repressed in other cage presses or in an Anglo-American press.

It is, I believe, the general opinion that the Anglo-American presses can be subjected

to a considerably higher pressure than the cage presses since the pressure capacity of the latter depends on the strength of the steel bar cylinder or cage. In this country, however, we have mills for the manufacture of coconut oil from copra working entirely with Anglo-American presses and others with cage presses only. One mill, with only Anglo-American presses carries out only one hot expression while another with cage presses carries out two hot pressings.

One manufacturer of oil machinery also states that the Anglo-American or open plate presses are not satisfactory for seeds yielding more than 35 per cent of oil at first pressing. This, however, is not borne out by practice.

It may be stated here, that the advantage of a second pressing, where the first has been fairly efficient, depends largely on the capacity of the mill and the price of oil. If the capacity of the mill is small and the price of oil high, it would be more profitable to carry out only one pressing.

Usually the cage press is of a circular type and produces a round oil cake but square presses are now made.

In some cage presses, used for the manufacture of castor seed oil, in which whole seed is fed into the steam kettle and raised to a temperature of only 90° Fah. (this is obviously in a temperate climate) with a first cold pressing and with a pressure of three tons per square inch on the ram, the amount of oil left in the cake has amounted to less than 10 per cent. Four of such presses can be operated by two men, each press having a capacity of 5 cwt. of seed per pressing or a total of two tons per hour for the four presses with two pressings, or three tons with three pressings per hour. The ordinary rate of working is from four to six presses per hour.

One advantage of the cage press is the saving in the expensive press cloths or mats, which probably amounts to over 50 per cent compared to the plate or Anglo-American press.

One oil machinery firm gives the following list of seeds as suitable for pressing in Anglo-American presses—linseed, cotton, soya beans, ravisson rape, mustard, sunflower and similar seeds. This firm states that the Anglo-American system is adopted in all modern mills for the above seeds and gives the best results in respect to economy of labour and maximum oil expression.

The following seeds—palm kernel, copra, castor, gingelly, ground-nuts, poppy and East Indian rape seed or seeds which require twice pressing are said to be more suitable for treatment in cage presses for a first pressing, followed by the Anglo-American press for second pressing.

Cake-paring machine.—A cake-paring machine is required only with the Anglo-American or open plate hydraulic press, in order to cut or pare away the edges of the cakes which contain a fair proportion of oil. It is not necessary here to describe this machine in detail.

Hydraulic pumps and accumulators.—To supply the necessary pressure to the hydraulic presses whether of the Anglo-American or cage type, hydraulic oil pumps driven by a motor or engine are required. In the case of large installations accumulators are recommended by oil machinery manufacturers, as giving a more steady even pressure, and being less liable to give an undue excess of pressure through the locking of safety valves common to hydraulic pumps. The accumulators act as safety valves to the hydraulic pumps which supply the necessary pressure.

Press cloths.—Press cloths are essential in the Anglo-American or open plate press for enclosing the cake. These cloths are very expensive and require renewal fairly frequently owing to bursting by the pressure in the hydraulic presses. They are usually made of camel hair and apparently few suitable and more economical substitutes have been found. In the cage press, they are usually employed between the plates, but

can be dispensed with. In any case they lie flat on the press plates and are therefore not subjected to any pressure at the edges as in the open presses where they are folded round the cake.

Filter presses.—In order to avoid the use of large settling or subsidence tanks, all modern oil mills are equipped with filter presses, in order to filter and clarify the oil from "foots" almost immediately after the oil is pressed from the seed and thus render it suitable immediately for marketing. Storage tanks are then required only for the filtered oil. The "foots" can be returned quickly to the steam kettle and presses to remove any oil retained. Special filtering cloths are required in these filters, which work under pressure.

One oil machinery firm states that a filter with 45 plates, each 32 inches square will filter about 150 tons of crude oil, before it is necessary to remove the filter clothes. These cloths can then be removed, cleaned and used again several times. The oil is forced through the filter by means of special pumps.

Fats which are solid at ordinary temperature obviously require heating to render them fluid before filtration.

Oil pumps.—Rotary or other type of suitable pumps are required to pump the oil from chambers or pits beneath the hydraulic presses or filter presses to suitable storage tanks.

Conveyors.—In order to minimise the amount of handling, special conveyors consisting of warm shafts, bucket conveyors and chutes are necessary for conveying the seed from the disintegrators to the crushing rolls and thence to the steam kettle.

Engine or Motor.—A suitable engine or motor is required to drive the disintegrators, crushing rolls, hydraulic pumps and stirring gear in the steam kettle.

Boiler.—A suitable vertical boiler is required to supply the necessary steam to the steam kettle and for actuating the ram in the cake-moulding machine.

Transport of oil to markets.—Hitherto most oils manufactured in the tropics have been transported in tins, barrels or other containers. Formerly, all the coconut oil manufactured locally was shipped in the well-known kerosene tins packed in pairs in wooden boxes. These being now unobtainable in quantity, barrel packing has been adopted.

The writer, however, is of opinion that the most satisfactory method of export is by means of tank steamers, using either bilge tanks or steamers with specially constructed tanks for the purpose. It appears probable that this system will be adopted in the future. It is said to be already in the Philippines for the export of coconut oil to America. In the case of oils which solidify in a cold climate, e.g., coconut oil, it will be necessary to heat the tanks before arriving in port, in order to be able to pump the oil into receiving vessels. This, however, presents no special difficulties.

The above is a detailed outline of the machinery necessary for the manufacture of oil from all oil seeds by the hydraulic press system, which is at present almost the universal system throughout the world in modern factories. The names of well-known manufacturers of hydraulic oil-pressing machinery are given at the end of this article.

THE ANDERSON EXPELLER.

A comparatively new machine which differs from the hydraulic press system has been in use for some years in America, especially for the expression of cotton seed oil. This machine is known as the Anderson oil expeller and is manufactured only by the V. D. Anderson Co. of Cleveland, Ohio, U. S. A. A machine working under the auspices of the Agricultural Department in St. Vincent, W. Indies, has also given good results with cotton seed, expressed on behalf of small-holders by the Agricultural Department. Information published by the

Agricultural Department of St. Vincent led the writer to make enquiries concerning this machine and it was ascertained that during the last few years, a large number had been imported into the Philippines for expressing coconut oil from copra (*Vide* paper "Coconut Products in the Philippines" by Mr. W. S. Cookson in *The Agricultural Bulletin*, Vol. VI, No. 11, September and October, 1918.)

Further enquiries elicited the fact that an old machine was actually working in Singapore and the writer has twice visited the small factory run by Chinese, in which this machine was found expressing oil at different times from ground-nuts, gingelly and Illipé seeds.

Tests carried out by the writer on the residual cake from this machine also showed its efficiency in expression, although it was not possible to spend a sufficient time in the factory to ascertain its capacity and output.

Information, however, since received from the makers shows that the capacity of the machine is very satisfactory and from the information available it would appear to be very suitable for use in the tropics, more especially, for the softer variety of oil seeds, although it appears to be giving satisfactory results also with copra in the Philippines.

If worked according to its maximum economical capacity, however, the amount of coconut oil expressed from copra is somewhat less than that obtained in hydraulic presses. If worked to obtain the maximum amount of oil, the capacity or output is said to be rather low.

According to Mr. Cookson who visited the Philippines early in 1918 there are nearly 200 of these machines treating copra in the Philippines and the demand has been such that machines have fetched seven and eight times their actual cost from the makers.

According to information contained in a recent number of the *West Indian Agricultural News*, this machine is also working satisfactorily on castor seed in Mysore,

extracting as much as 443 per cent of oil from seed containing 472 per cent yielding a cake containing only 5'05 per cent of oil.

Description of machine.—The expeller consists essentially of a horizontal cylindrical press, with sides constructed of steel bars, similar to the cage press. Pressure, however, is obtained by means of a screw working against a cone-shaped opening at one end of the machine. The screw carries along the crushed meal which is pressed against the sides and end of the machine and the cake is ejected in irregular pieces from the end of the machine. The meal is fed in through a hopper and the machine works continuously and automatically. A tempering apparatus consisting of a steam-heated trough is attached if necessary for heating the meal to the necessary temperature—the meal passes along this trough continuously. This tempering apparatus is evidently efficient, since Illipé fat is solid at ordinary shade temperature in this country (85° Fah.)

The necessary accessories consist of a motor or engine to turn the screw and to drive crushing rolls. The expeller itself requires about 15 h. p.

It is stated that the seed need not be crushed as finely as for hydraulic presses. In the factory visited by the writer a set of small crushing rolls was in use, for grinding the seed. Filter presses, storage tanks, etc., are obviously required for the oil and also a boiler to provide steam for the tempering apparatus, unless a steam engine is used for motive purposes, and it would be advisable to have a press, in a large factory, to convert the irregular lumps of oil cake into a solid circular or square cake for purposes of export.

Since the expeller works automatically, very little labour is necessary and, provided the machine is in proper working order, very little expert supervision is required.

The following details of the cost of the machine with accessories, were obtained

from an annual report of the Department of Agriculture, St. Vincent.

Expeller with "foots" elevator and "tempering" apparatus	£500.0.0
Crude oil engine 30 h.p.	300.0.0
Huller to grind seed	26.0.0
Shafting, pulleys, conveyors, belting, etc.	60.0.0
Total	£886.0.0
Add 20 per cent freight	177.0.0
Cost of erection of machinery, buildings, oil tanks, etc.	500.0.0
Total	£1,563.0.0

The price of the machine, as quoted by the makers at the end of 1918 was as follows:—

Cost of Expeller plus tempering apparatus	£3,525 gold.
Cost of Expeller Box packing, etc.	75 gold.
Cost of Expeller plus tempering apparatus plus motor	\$4,150 gold.
Cost of Expeller Box packing, etc.	90 gold.

This machine should be capable of treating about $\frac{1}{2}$ ton of seed per hour. From the above information, the number of expellers required to treat any given quantity of seed can be ascertained, together with the necessary power required. It may be stated that large seed crushing rolls will probably require about 10-12 h. p.

The advantages of this machine are its automatic and continuous treatment of the meal, minimising handling, and its low initial cost.

HYDRAULIC OIL MACHINERY MANUFACTURERS.

Two of the best known oil machinery firms in England are the well-known and old-established firm of Messrs. Rose, Downs and Thompson of Hull and Messrs. Greenwood and Batley of Leeds. The former

firm was the originator of the Anglo-American press system in England.

A well-known American firm would appear to be the French Oil Machinery Co., Piqua, Ohio, U.S.A. No information is available as to oil machinery firms in France, except those referred to in a recent article on palm oil manufacture in the *Agricultural Bulletin*.

It is at the present time of little value to publish details of cost of machinery supplied by oil machinery manufacturers, since the present prices are, approximately, double those of normal times.

The following details, however, of estimated machinery requirements in the case of coconut oil mills may be of value and interest in this country.

Capacity 2 tons of copra per hour. (Approx.) = 1.2 tons of oil per hour.

SCHEME (1).

1. Seed bin, capacity 30 tons copra.
2. Shaking distributor.
3. Two sets breaking rolls.
4. Four sets Anglo-rolls.
5. Two hydraulic compressor extractors with extraction gear for cakes.
6. Two steam kettles with strickling gear.
7. Eight hydraulic finishing cage presses.
8. Eleven perforated pressing boxes with press plates for above.
9. Two travelling carriages.
10. Two sets low and high pressure distribution boxes.
11. Eight sets patent automatic pressure distribution valves for finishing presses.
12. Two oil receiving and settling tanks.
13. Two sets oil collecting troughs.
14. Two drip tanks under presses.
15. Two rotary oil pumps.
16. One cake breaker.
17. Three sets hydraulic pressure pumps.
18. One exhaust oil tank and one pump suction tank.
19. One set of high and low pressure accumulators.
20. Three elevators.
21. One scraper conveyor and six screw conveyors.

22. Twenty cake racks on wheels.
23. Two thousand woolen press mats.
24. Two hydraulic filter presses.
25. 1,000 yards filter cloth.
26. Two duplex steam pumps for filter presses.
27. Four tanks. Two for crude oil and two for filtered oil.
28. Two rotary oil pumps for pumping filtered oil to oil store tanks.
29. Two oil tanks.
30. One engine.
31. Two Lancashire boilers, 250 lbs. pressure. Working pressure: 150 lbs.
32. Piping, shafting, belting, etc.

SCHEME (2).

1. One attrition mill.
2. Two sets crushing rolls.
3. One steam-jacketed kettle.
4. One meal measuring and cake forming box.
5. One cage filling press.
6. One cage discharging press.
7. Four finishing presses.
8. Six movable pressing cages.
9. One travelling carriage.
10. Six sets press plates.
11. Six sets high and low pressure distribution valves.
12. One double cake breaker.
13. One cake trimmer.
14. Two power pumps.
15. One oil strainer tank (570 gallons.)
16. One pair low and high pressure accumulators.
17. Two 150 h.p. horizontal tubular boilers.
18. One engine.
19. Two oil storage tanks (each 5,000 gallons).
20. Feed pumps, feed water heaters shafting, belting, etc.

SCHEME (3).

Similar to Schemes (1) and (2) but hydraulic presses to consist of four cage presses and eight Anglo-American or open plate presses of meal. Complete accessory machinery for filtering, etc., and storage not quoted.

NOTE ON INDIAN HEMP.*

THE true hemp, *Cannabis sativa* (Russian hemp) is not grown in India for fibre, though a certain amount is cultivated, under strict supervision, for the sake of the drug it contains. Practically the whole export of Indian hemp consists of the fibre of *Crotalaria juncea* (Sann Hemp), though small quantities of Sisal Hemp (*Agave rigida* or *Agave cantala*) are also exported. The fibre of *Hibiscus cannabinus*, sometimes known as "Brown Hemp" but more commonly as "Bimlipatam Jute" is included under the heading "jute raw" in the Indian Trade Accounts. This fibre is mainly exported from Madras, the chief market being the United Kingdom.

"Sann hemp is a widely spread Indian crop and the plant is a papilionaceous legume; as is well known, it collects atmospheric nitrogen, through the agency of bacteria, which attach themselves to its roots. The Indian cultivator recognizes sann hemp as a crop which enriches his land and extended use for the fibre would involve a corresponding addition to the agricultural resources of the country. Indeed, under certain circumstances, the crop may realize the ideal, long aimed at by agriculturists, of combining a green manure with a revenue crop. So far indigo is the only crop which has approached such an ideal, but the possibilities of sann hemp in this direction have already been recognized by the Government of India." (*Industrial Hand-book*, 1919).

STATISTICS OF AREA AND YIELD.

There are no official forecasts of the hemp crop. A special enquiry was instituted by the Department of Statistics, India, in 1917 with a view to arrive at an estimate of the production of the hemp fibre in British India.

* With acknowledgments to the *Indian Trade Journal* dated May 30, 1919.

in 1916-17. The following table gives the result of the enquiry:—

	Area	Outturn	Average outturn per acre
	(Acres)	(lbs.)	(lbs.)
Madras ...	197,900	137,836,200	696
Bombay and Sind	150,900	111,674,900	740
Central Provinces and Berar *	161,100	119,240,600	740
United Provinces...	176,900	106,117,200	600
Bengal ...	32,300	21,229,700	657
Punjab ...	49,200	20,280,700	412
Bihar and Orissa...	15,200	7,143,400	470
Burma ...	600	164,300	274
North-West Frontier Province ...	700	147,400	211
Delhi ...	500	177,700	355
Total ...	785,300	524,012,100	667

* No estimate of average yield being available the outturn has been calculated at the rate for Bombay.

THE PREPARATION OF THE FIBRE.

Indian Hemp fibre is stripped from the stalks of the plant. The stalks when cut are soaked in water then bruised with stones, then resoaked and so on until the fibre strips off easily. It is only in tracts where water is plentiful that the hemp can be soaked in clean water and the fibre obtained free from mud. In tracts where water is not plentiful, the stalks can only be soaked in muddy pools, with the

result that the dried fibre is found to be impregnated with dust.

THE ADULTERATION OF INDIAN HEMP.

The adulteration of Indian hemp has, for several years, been the subject of complaint from importers in the United Kingdom. In 1913, with reference to a representation from the London Hemp Association, the Government of India expressed the opinion that the remedy for the unsatisfactory quality of much of the hemp exported from India rested to a great extent with the buyers; and that, if a higher price were paid for clean hemp, and if hemp which contained impurities in appreciable quantities were refused, the evil complained of would disappear in due course. This opinion was endorsed by the commercial public, and the London Hemp Association was eventually informed that the only effective means of ensuring improvements in hemp exported to the United Kingdom from India was that buyers should insist on getting the clean article and be prepared to pay higher prices for it; and that the Government of India were unable to take any action in the matter.

Towards the end of 1916, the question was raised by the Home Office in correspondence with the India Office. The suggestion was made that Indian hemp could be more thoroughly cleaned before export than is the case at present, and that the grading might be controlled by legislation on the lines of the regulations in force in New Zealand and Manilla. The Government of India came to the conclusion, however, after consulting local authorities, that it was neither practicable nor necessary to have recourse to legislation in the matter. The Indian hemp crops vary considerably in character while the New Zealand and Manilla crops are more or less uniform, and it would, therefore, be necessary to prescribe in India an inordinately large number of grades. Moreover, it is understood that the

present system by which the buyer relies upon the established private marks of the better known shippers to guarantee him consistent grading, works satisfactorily. It was, however, considered desirable to discourage the shipment of dusty hemp as far as possible. It was no doubt the case that the dustiness of Indian hemp which was most marked in the grades known to the trade as "philibit" and "chandausi," was mainly due to retting in muddy water, and there might be difficulties in improving the facilities for washing the hemp in the districts where it was grown. The most feasible course to adopt would be to encourage the backing or combing of hemp before export.

No suitable machinery for the hacking or combing of hemp appears to exist; and the cleaning has therefore to be done by hand hacking. Hacking is already done on a fairly extensive scale at Bombay, and the industry has received an impetus from the improved prices recently obtained for combed hems. The results of this combing are fourfold:—

- (a) The fibre is freed from dust.
- (b) The fibres are evenly retted by the combs and each Bundle or Hank after combing contains fibres of nearly equal length so that the hemp is thus ready to be worked.
- (c) The short ends of the hemp are combed out and are known as Tow. This article is essential to several industries and particularly to Shipbuilding.
- (d) Tonnage space is saved to the extent of the dust extracted.

EXPORTS FROM INDIA.

The following table, compiled from returns published by the Department of Statistics, India, gives a fair idea not only of the quantity of hemp fibre exported from India during the past five years and of the money value such exports represent, but also of the manner in which the trade is distributed among the various foreign markets:—

Exports of Raw Hemp from British India.

		QUANTITY. Twelve months, 1st April to 31st March.				
		1914-15	1915-16	1916-17	1917-18	1918-19
		Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
Hemp, Raw, (chiefly <i>sann</i>)—		442,084	514,414	657,462	225,951	384,962
To United Kingdom	...	42,118	...	...	...	...
" Germany	...	79,275	3,172	14,599	2,038	34,183
" Belgium	...	27,636	75,992	33,956	8,869	1,004
" France	...	50,337	...	8,111	49,948	40,625
" Italy	...	...	14,689	18,085	19,910	28,646
" United States of America	...	28,777	...	...	...	...
" Other countries	...	...	...	...	...	...
TOTAL.....		670,227	608,267	732,213	306,126	489,420
Share of Bengal	...	353,425	327,666	341,197	126,735	268,597
" Bombay	...	270,172	233,585	344,956	151,797	174,812
" Sind	...	675	6	46,060	45	46,011
" Madras	...	45,955	47,010	...	28,139	...
TOTAL.....		670,227	608,267	732,213	306,716	489,420

		VALUE. Twelve months, 1st April to 31st March.				
		1914-15	1915-16	1916-17	1917-18	1918-19
		Rs.	Rs.	Rs.	Rs.	Rs.
Hemp, Raw, (chiefly <i>sann</i>)—		66,72,086	89,14,122	1,47,26,777	65,21,452	1,21,40,54
To United Kingdom	...	7,32,081	...	...	...	...
" Germany	...	10,77,514	...	...	46,000	8,98,06
" Belgium	...	4,11,889	35,705	2,89,005	1,43,467	14,31
" France	...	6,43,997	10,72,902	5,93,063	8,71,331	6,88,53
" Italy	...	...	...	1,67,775	3,61,774	9,38,1
" United States of America	...	4,05,767	2,11,013	3,33,236	...	...
" Other countries	...	...	...	...	...	...
TOTAL.....		99,43,334	1,02,53,742	1,61,11,856	79,44,024	1,46,79,4
Share of Bengal	...	46,76,744	52,80,149	69,71,098	25,00,642	56,81,7
" Bombay	...	45,41,490	41,87,879	81,87,538	48,10,453	79,53,4
" Sind	...	9,180	300	...	1,225	...
" Madras	...	7,15,920	7,85,414	9,53,220	6,31,704	10,44,7
TOTAL.....		99,43,334	1,02,53,742	1,61,11,856	79,44,024	1,46,79,4

Exports from Calcutta.

The Sann hemp exported from Calcutta is classed in the trade under three grades, viz., (1) Benares Sann Hemp, (2) Green or Raigarh Hemp, and (3) Bengal Sann. It is estimated that in normal times about 100,000 bales (350 lbs. each) of all grades are exported annually from Calcutta, the approximate quantities of each grade exported being as specified below:—

- (1) Benares Sann Hemp. Normal exports about 85 per cent or 85,000 bales; obtained from Benares and certain districts in the United Provinces.
- (2) Green or Raigarh Hemp. Normal exports about 10 per cent or 10,000 bales; obtained from Raigarh and the Central Provinces generally.
- (3) Bengal Sann. Normal exports about 5 per cent or 5,000 bales; obtained from certain districts in Bengal.

The bulk of export trade is handled between October and May.

The standard qualities of each grade as exported from Calcutta are as follows:—

Sann Hemp	...	No. 1.
		No. 2.
		No. 3.
		No. 4.
Green Hemp	...	No. 1.
		No. 2.
		No. 3.
		Tow
Bengal Sann	...	No. 1.
		No. 2.
		No. 3.

Exports from Bombay.

About 80,000 full pressed bales of 3½ cwt. each are exported annually. The following descriptions are exported:—

Philibit.
Central Provinces and Raigarh.
Devgad.
Gulbarga and Warangal.
Khandeish.
Godra.

They are classified under the following grades:—

Philibit Fine, No. 1, No. 2.
Central Provinces—Fine Etarsi.
Fine Sewnee.

Extra Fine Jubbulpore.
Fine Jubbulpore.

No. 1 "
No. 2 "

Devgad— Extra Fine.

Fine.

No. 1.

No. 2.

No. 3.

Salsi P. L.

Gulbarga—

Fine.

No. 1.

No. 2.

All descriptions of hemp are combed in Bombay and exported under private marks, in the form of Combed Hemp and Tow. Certain descriptions are exported as combed and tow only.

The proportions are roughly as follows:—

Central Provinces and Raigarh.	50 per cent.
Philibit	... 20 "
Devgad	... 17 "
Gulbarga and Warangal	... 5 "
Khandeish	... 3 "
Godra	... 3 "

The proportions borne by each subdividing grade depend on the crop. In a good year there is an abundance of Fine and Extra Fine, and in a bad year a large proportion of No. 1 and No. 2.

Exports from Madras.

The following varieties or descriptions of hemp are exported from the Madras Coast:—

Upper Godavery from Sirivansa and Dumugudem District.
Gopalpore from Gopalpore.
Warangal " Warangal.
Cocanada " Districts South of the Lower Godavery.
Singarem " Rajahmundry.
Palinara " Narsapur.

A rough estimate of the proportions borne by each grade to the total exports from Madras is as follows:—

Upper Godavery	... 8 per cent.
Gopalpore	... 35 "
Warangal	... 20 "
Cocanada	... 38 "
Singaram	... 1 "
Palinara	... 1 "

Upper Godavery varieties are usually packed separately; the hemp from Siravansa District being both longer and of lighter colour than that from Dumugudem. Dumugudem hemp is a good variety but usually short. Gopalpore in cleaning usually gives—

Fair	...	75 per cent
Brown	...	15 "
Shorts and Two	...	10 "

under which descriptive marks the hemp is usually packed.

Warangal, Cocanada, Singarem and Palinara varieties are not assorted in cleaning, the colour being very uniform; but the Tows and Shorts are packed and shipped separately.

Sann hemp as a substitute for flax.

At the time when the shortage in flax was being severely felt, the use of suitably prepared sann hemp as a substitute for flax in canvas was advocated by the Fibre Expert to the Government of Bengal. The *Industrial Hand-book* (1919) issued by the Indian Munitions Board, says:—"In contrast to jute, sann hemp has the advantage of being a fibre of the same class as flax, and articles made from sann hemp would, therefore, while probably not so good as those made from flax, be of a markedly more durable nature than jute goods. The necessary samples were prepared and the opinions expressed, while by no means universally favourable, leave no doubt that softened sann hemp is capable of being made into a decidedly better class of canvas than jute. Moreover, two large commercial concerns have taken up the matter and one of these has arranged for the importation of flax spinning machinery, which is to be used for the working of sann hemp and, in part, for flax when it becomes available. It is necessary to state that the uses of sann hemp will extend to all the coarser materials which have hitherto been made from flax, such as hose pipes, belting, canvas and, possibly, shoemaker's thread. There seems little doubt regarding any of those, excepting the thread, for the making of which flax has a considerable advantage in its longer ultimate

filaments (flax : sann = 25 : 10). Encouraging results have, however, been obtained. Thus a new industry is likely to be brought to the banks of the Hooghly as a direct result of the war."

Future Prospects.

The *Indian Trade Journal* of September 10, 1915, (p. 412), published an article on "The Hemp Trade and the War." It was stated therein that, prior to the war, the United Kingdom's requirements of hemp were mainly supplied (in order of importance) by the Philippine Islands, New Zealand, India, Russia, Italy and Germany. It may be explained that the imports into the United Kingdom which are classed as hemp include several different fibres. Those from Russia and Italy are true hemp, those from the Philippines and Manilla are known as "Manilla hemp", those from India are of different species but mainly Sann hemp, those from New Zealand are known as "New Zealand hemp," *Phormium tenax*, and those from Mauritius "Mauritius hemp," *Furcraea gigantea*. True hemp is obtained from the plant *Cannabis sativa*. The fibre is a satisfactory substitute for flax, and except for the finer linens, is used for medium grades of nearly all goods commonly made from flax. It is also largely used for cordage, ropes, and in the manufacture of carpets and rugs. It was also pointed out that it was not unlikely that the world would look to countries such as India for the supply of fibres which may be used as substitutes for the European varieties of hemp, owing to anticipated difficulties in the preparation of the hemp crops of Russia and Hungary. In view of the political events which have taken place in Europe since the above article was written, it may be taken that the world's markets cannot in future reckon with any certainty on the Russian product. The future prospects of the Indian Hemp Trade are good, in the absence of competition from Russia, provided that the fibre is exported in a clean condition free from sand and dust.

MYSORE ECONOMIC CONFERENCE AND ITS WORK.*

By P. G. D'SOUZA, B.A., B.L.,
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THIS is a brief survey of the Conference work done by the Committees of the conference since its inception. It has been published at the request of the members of the Standing Committee with a view to explain succinctly some of the outstanding results achieved by the activities of the Conference and to enable the members to take stock of the work already done and make suggestions regarding the development of work in the future. Further detailed information as to the several schemes investigated by the Committees and the general work under each year's programme is given in the annual reports presented at the various sessions of the Conference and the monthly proceedings of the Committees.

General Conference.—The first session of the Conference was opened by His Highness the Maharaja in June, 1911. Including the session of 1918 there have been in all nine sessions. At the first session the preliminaries of the work to be done by the Conference and the Committees were settled and at the subsequent sessions several schemes and subjects of importance were discussed and resolutions thereon submitted to Government.

The General Conference and the Central Office have mainly attended to the organization and co-ordination of the activities of all the agencies connected with the Conference and the distribution of work among the various groups.

The existing procedure for the work of the Conference is as follows:—

At the annual session programmes of work are prepared for each of the Central Committees and the District Committees and

some understanding is arrived at with the allied Departments regarding the subjects to be taken up by the Departments and the Committees respectively for investigation during the year. All important schemes after being completed are placed before the Standing Committee and submitted for orders of Government with the recommendation of that Committee. Proposals coming from the District Committees are first dealt with by the Central Committees. Members of the Conference are allowed to send up propositions individually for consideration at the Conference. If details have to be worked out, the proposals are referred to the Committees concerned with the approval of the Conference. The Committees also appoint Sub-Committees from the members of the Committees and others. In this way the association of a large number of persons with the activities of the Conference has been secured. For investigation of special subjects, Committees have the power to appoint experts and have engaged them on a few occasions. In some cases, Committees have undertaken experiments to develop schemes included in their programmes.

A list of subjects discussed and recommendations made by the Conference and its Committees from the year 1911 to 30th June, 1917, was circulated to the members at the last Birthday Session. This will be revised as soon as the present session is over and published so as to provide the members with a permanent record of the recommendations made by the Conference.

The total number of subjects discussed is 580. Of these, recommendations were submitted to Government on 370 subjects, the other subjects being incomplete were referred to the Committees and Departments concerned for further investigation. The total number of subjects which after discussion and investigation took concrete shape and resulted in fully developed schemes being

*A note prepared for the tenth session of the Mysore Economic Conference.

adopted is 210. The most important amongst them being:—

1. Industrial survey of the State.
2. Organization of a Department of Industries and Commerce.
3. Establishment of the Bank of Mysore.
4. State aid to industries.
5. Establishment of the Chamber of Commerce.
6. Development of Hand-loom Weaving.
7. Industrial and Commercial Museums and Bureau of Commercial information.
8. Development of Sericulture.
9. Horticulture.
10. Dairy Farming.
11. Improvement of Live-stock.
12. Large Landed Estates.
13. Establishment of the Mysore University.
14. Establishment of Public Libraries.
15. Improvement of the Education of Backward and Depressed Classes.
16. Development of Technical Education.

Standing Committee.—Thirty-six meetings of the Standing Committee have been held since December, 1913. Since July, 1915, all the three Committees meet as an Enlarged Standing Committee for about an hour or so before the Central Committee meetings. The primary function of the Standing Committee has been to take stock of work done by the Central and District Committees every month, co-ordinate the work of the Departments and the Committees and consider subjects falling under the purview of more than one Committee.

Central Committees.—The outlines of work done by each of the Central Committees and important schemes brought into operation at their suggestion and recommendation are referred to below.

Education Committee.—The Committee has been constituted to deal with problems relating to Education and enlist the co-operation of the people in the investigation of important questions bearing on the development of education in the State.

The activities of the Committee may be classified as follows:—

- i Keeping in touch with educational developments throughout the

world, studying educational methods and organization and investigating and formulating improvement schemes.

A list of questions that may be usefully taken up for study and discussion is maintained and arrangements have been made to work them up progressively.

- ii Carrying on experiments with new schemes.
- iii Collection and publication of useful information.

Government having decided upon a policy of rapid educational expansion in all the grades, the Committee has specially co-operated in suggesting measures for increasing literacy throughout the State in encouraging the education of Backward and Depressed Classes and evolving a system of properly co-ordinated education in all the grades, the development and extension of technical and professional education and the spreading of enlightenment among the masses by means of books, pamphlets, bulletins, lectures and visual instruction.

Up to the end of April 1919, sixty-seven meetings were held by the Committee.

The following are some of the important schemes investigated by the Committee.

Establishment of the Mysore University.—The scheme was first taken up by the Committee and some of the preliminary details were also worked out by them.

Primary Education.—On the recommendation of the Committee, increasing facilities were given for developing primary education and large grants were made by Government for the purpose. A Regulation for the introduction of compulsory education was passed on the lines of the Bill drafted by the Committee and the scheme is being developed gradually. A detailed scheme for the education of adults was also prepared by the Committee.

Industrial and Technical Education.—A comprehensive scheme for the development of Industrial Education was submitted to Government in the year 1912. As a result of these recommendations the Mechanical Engineering School was established at Bangalore and the Chamarajendra Technical Institute was also developed. A scheme of Practical Instruction was sanctioned. District Industrial Schools were opened at Bangalore and Mysore and similar schools have been sanctioned for other District Head-quarters and some have been opened. The Committee also attempted to teach some industries to adults by opening special classes in towns and cities. A scheme for Commercial Education was also drawn up by the Committee.

Women's Education.—A scheme for the remodelling of women's education so as to enable them to complete their higher education in Kannada and to suit the curriculum to their requirements in life has been prepared. Proposals were also submitted for the improvement of the Maharani's College, the training of women teachers and the provision of scholarships to encourage education among women, for starting hostels and improving the efficiency of women's education in all the grades.

Education of Backward Communities.—Recommendations were made by the Committee for increased facilities for the education of Backward Classes and a special grant was sanctioned by Government, for award of scholarships. The scheme in the initial stages was worked out by the Committee with the help of the District Committees and Taluk Progress Committees.

Visual Instruction.—A comprehensive scheme for providing useful general instruction not only to the young but also to the adult population, especially the illiterate in the districts and for creating interest in mechanical devices and appliances was submitted to Government and has been sanctioned.

Public Libraries.—On the recommendation of the Committee, Public Libraries and Reading Rooms were established in the cities of Bangalore and Mysore. The scheme has since been extended to smaller towns and rural areas and portable libraries are also being circulated from village to village. Separate sections for the use of ladies with small museums for the benefit of children in the two cities are being organized.

Publication of Books.—A scheme for the publication of books for general education in Kannada was prepared. Arrangements have been made for publication of books with the co-operation of the Karnataka Sahitya Parishat and the Kannada Popular Science Association.

Science Education and Popular Lectures.—Arrangements were made by the Committee through the help of the Kannada Popular Science Association for delivering lectures on various subjects at Bangalore and Mysore.

Home Industries.—The details of the scheme which was initiated by the Industries and Commerce Committee were transferred for further development to the Education Committee. The Institute at Bangalore and Mysore aimed at helping the existing home workers in the cities by supplying raw materials at cheap rates, collecting and selling the finished articles and demonstrating the use of improved implements and methods. The scheme was transferred to the Department of Industries and Commerce with effect from 1st April, 1919.

Vocational Guidance.—An expert Committee was appointed last year; forty-one applications for vocational advice were disposed of. A manual of courses and careers was also issued and some of the chapters of the manual are being translated into Kannada. A pamphlet "The Schools of Public Life in Mysore" is in the press.

Miscellaneous.—The other schemes investigated by the Education Committee are the introduction of the Boys Scout movement, Medical Inspection of Schools, Improvement of Physical Culture, Religious and Moral Instruction, School Excursions, the systematisation of scholarships and education in Fine Arts, the starting of a ladies' magazine, the starting of a children's magazine, hostel accommodation for Anglo-Vernacular Schools, the establishment of a Music School, etc.

In addition to investigations and deliberative work, the Committee was also entrusted with the working of several special schemes such as the Home Industries Institute, Home Education Classes, the management of Public Libraries at Bangalore and Mysore and the development of District and Rural Libraries. The Committee also supervised the work of the Itinerant Lecturers at the Cities of Bangalore and Mysore and in the Districts.

Agricultural Committee.—The Committee was constituted to study problems connected with Agriculture and carry on in co-operation with the Department, investigation into schemes relating to the improvement of Agriculture in the State and the amelioration of the economic condition of the raiyat.

Up to the end of April, 1919, seventy-two meetings were held by the Committee.

The subjects dealt with by the Committee may be classified as follows :—

1. Introduction of improved methods of Agriculture.
2. Development of Sericulture.
3. Growth of commercial crops.
4. Relief of Agricultural indebtedness.
5. Improvement of live-stock.
6. Fruit growing on profitable lines.
7. Establishment of nurseries for fodder and fuel.
8. Statistical and economic enquiries.

9. Collection and spreading of information.

Introduction of Improved Methods of Agriculture.—A scheme has been formulated for increasing agricultural production, in the State by 50 per cent during the next ten years. A scheme for the formation of large landed estates was sanctioned at the instance of the Committee, and blocks of land not less than fifty acres in extent are being granted by Government on the recommendation of the Deputy Commissioners of Districts on condition of improved methods being introduced thereon. The question of the consolidation of holdings is being investigated. Schemes for the improvement of commercial crops such as sugar-cane, cotton, tobacco, mulberry, etc., and their cultivation on a large scale have been formulated.

Development of Sericulture.—Prior to 1912, little attention was paid to the development of Sericulture. The Committee took up the subject that year. At the instance of the Committee, an Italian Expert was appointed and a scheme for the development of the industry in all its branches on up-to-date lines was prepared. Steps have been taken for the establishment of a large number of demonstration farms, the opening of a Central and other Schools, supply of disease free seed on a large scale, the improvement of rearing and reeling. The Committee attended to sericultural development until June, 1916, when a separate department was constituted. During the five years the Committee was in charge of the work the industry was able to regain much of the ground it had lost owing to disease among silkworms and other causes.

Horticulture.—The development of fruit cultivation has received special attention from the Committee. Arrangements have been made to train sons of raiyats owning lands and others in the cultivation of fruits and vegetables. Rules for granting loans, supplying plants, expert advice and other

concessions to encourage the extension of the industry have been passed. Fruit cultivation has also been introduced into several new localities.

Improvement of Live-stock.—A comprehensive set of rules framed by the Committee for the encouragement of stock breeding has been approved by Government. The appointment of a live-stock expert has been sanctioned. Experiments in sheep-rearing have been conducted with success.

Rules for the encouragement of dairying by the grant of loans have been sanctioned and applications have been dealt with by the Committee. Of these three Dairy Farms are reported to be working satisfactorily.

Nurseries for Fodder and Fuel.—The Committee have worked a scheme for developing village forests and recommended the starting of nurseries at District Headquarters.

Relief of Agricultural Indebtedness.—An enquiry was conducted in the Districts at the instance of the Committee on the economic condition of the raiyats and information collected as to the resources and debts of raiyats in typical villages.

A scheme for the development of Agricultural Co-operation has been prepared. Proposals have been submitted for the starting of a Land Bank.

Growth of Commercial Crops.—Special measures have been adopted for the encouragement of tea and camphor cultivation and improvement of other crops such as, coconut, sugar-cane, etc.

Miscellaneous.—Estimates of agricultural production have been compiled and standards of development in agriculture framed. Vernacular courses in agriculture have been introduced at the Hebbal Agricultural School on the recommendation of the Committee. The establishment of an Experimental Farm under the Krishnarajasagara for the development of sugar-cane cultivation was suggested by the Committee.

A scheme of Agricultural Education in the Middle and Higher Grades was also considered by the Committee.

Bulletins on local agricultural practices have been issued from time to time and interesting selections from technical Journals have been circulated in print.

Industries and Commerce Committee.—The Committee has been constituted for dealing with problems connected with the development of Industries and Trade in the State. There was no separate Department of Industries and Commerce before the Committee was appointed. In fact, one of the most important questions dealt with by the Committee was the organization of a Department of Industries and Commerce, which was sanctioned by Government in the year 1913 at its instance. The Committee has taken an active part in the investigation of questions relating to the development of industries and trade in the State and the initiation of several important schemes. Its main functions are :—

- i. Carrying on preliminary investigations, enquiries, demonstrations, experiments in connection with the development or pioneering of industries, obtaining expert advice wherever necessary and preparing special schemes for the sanction of Government.
 - ii. Framing of schemes for financing industries and recommending to Government financial aid to deserving bodies or persons who intend starting industries
 - iii. Encouraging the formation of industrial and commercial associations.
 - iv. Collection and publication of industrial and trade statistics.
 - v. Spreading information by bulletins.
- Up to the end of May 1919, seventy-two meetings were held by the Committee and

forty-six Sub-Committees were constituted to investigate and work the details of the several schemes.

Among the larger schemes brought into existence at the instance of the Committee may be mentioned—

- i. Establishment of the Bank of Mysore, the preliminary details of which were worked out by the Committee.
- ii. A scheme for financial assistance to industries in which definite suggestions were made regarding the various modes of granting State aid to industries and introducing a system of Takkavi Loans for industrial development.
- iii. Establishment of the Chamber of Commerce.
- iv. Industrial survey. Mr. Sambasiva Iyer was placed on special duty and an elaborate report has been issued.
- v. Development of handloom weaving. The establishment of a weaving factory was sanctioned and also a scheme for the demonstration and introduction of fly shuttle looms by supplying them at concession rates. The markets for woven goods were also investigated.

- vi. A scheme for an Industrial and Commercial Museum at Mysore and branch museums at District and Taluk Headquarters was sanctioned for the improvement of industries and trade in the State. Opening of an Industrial Depot to assist skilled artisans in the State to improve the quality of articles made by them and extend the market for such goods was recommended by the Committee.

- vii. Establishment of Pharmaceutical works, a Soap Factory, and development of the Paint industry.

- viii. Improved methods of Jaggery production by means of power-driven sugar-cane installations and use of power appliances in connection with Agriculture.

- ix. Development of the oil industry by the introduction of Anderson's Oil Expeller, Hydraulic Presses and Chemical Extraction Plants.

- x. Extension of State Life Insurance to the general public and the scheme of Village Savings Banks.

- xj. Development of Cottage, Rural and Home Industries, Industrial Training and establishing District workshops.

- xii. Improvement of Weights and Measures.

The Committee has also made suggestions regarding the establishment of the Sandalwood Oil Factory, Cotton and Wool-Spinning Mill, Paper Manufacture and development of large chemical and mineral industries.

Among other important industries investigated by the Committee are the following:—

- i. Manufacture of paper, bamboo pulp and matches.
- ii. Establishment of Pencil Factory.
- iii. Development of leather industry.
- iv. Establishment of laundry industry.
- v. Development of lac cultivation.
- vi. Manufacture of Catchu.
- vii. Further development of Minor Industries.
- viii. Establishment of the Straw Board Factory.
- ix. Financing industries and external trade in Mysore.

Propagandist Work.—Thirty-nine bulletins have been published on various subjects.

Dasara Exhibition.—The management of the Dasara Industrial and Agricultural Exhibition is also vested in the Committee and four All-India Exhibitions and one Local Exhibition have been held under the direction of the Committee.

Economic Journal.—For the dissemination of useful information in connection with the activities of the Conference, monthly journals both in English and Kannada were started in January, 1915. The Kannada Journal was converted into weekly in February, 1917. The receipts and expenditure of the Journal are shown under General Conference. The net expenditure to Government on the Journal before the weekly was started was Rs. 6,741 per year. Since the weekly journal came into existence the expenditure has risen to Rs. 10,247 part of which is due to abnormal conditions such as the cost of paper and enhanced rates for printing.

District Committees and Tuluk Progress Committees.—These Committees with the help of the District Economic Superintendents investigated local wants, disseminated useful information and worked out the following schemes for the Central Committees:—

1. Extension of primary education, by the opening of new schools, increasing the attendance of the existing schools, opening night schools, practical instruction classes and home education classes.
2. Administration of the Backward Classes Scholarships.
3. Popularisation of improved methods of Agriculture by the introduction of improved implements, supply of good seed, manure and the holding of demonstrations.
4. Formation of large landed estates.
5. Sericulture.
6. Horticulture.
7. Dairy Farming.
8. Stock Breeding.
9. Development of Commercial Crops.

10. Installation of power plants.
11. Development of hand-loom weaving by demonstrations and supply of fly-shuttle looms at concession rates.
12. Establishment of tile factories.
13. Improvement of Cottage and Rural Industries.
14. Collection of Essential Statistics.

A great deal of the awakening in the districts and some of the practical results attained have been due to the activities of these bodies. They have also played an important part in raising funds for educational and other purposes in the districts.

Expenditure incurred by the General Conference and the Central Committees.—The expenditure incurred by the General Conference and the Central Committees is given in Appendix A, B, C, D, E, and F.

Conclusion.—From the above retrospect, it will be seen that in arousing interest in economic questions, in suggesting new lines of development, in concentrating attention on practical schemes and in helping Government to give effect to their policy regarding the material and moral advancement of the people, the Conference and the agencies connected therewith have proved themselves of great value both to the Government and the allied departments. Its constitution has enabled it to work in entire harmony with the departments concerned and it has successfully co-operated with them in investigating new questions and in preparing the ground for the introduction of schemes and improvements of far reaching importance.

The scope for the introduction of new schemes and original investigations being limited, the functions of the Committees in future are likely to become more and more advisory in character. As changes in the world conditions have brought forward many new problems for solution and altered the aspects of many old questions, there is much work to be done of a substantial character in the future in consolidating the activities already commenced, in keeping in touch with development elsewhere and bringing the resources of the entire organization to bear on the attainment of the best practical results.

APPENDIX A.
General Conference.

Items of Expenditure		1911-12		1912-13		1913-14		1914-15	
		Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
<i>Head-quarters.</i>									
1	Salary	Rs.	Rs. 556	Rs.	3,040	Rs.	12,264	Rs.	11,205
2	Establishment	...	243	...	4,910	...	12,264	...	11,205
3	Travelling allowance	...	504	...	1,700	...	2,666	...	3,301
4	Experiments	...	...	...	1,293	...	2,195	...	2,119
5	Grants to Progress Committees	...	...	...	...	...	2,400	...	...
6	Subvention to Kannada papers	...	...	...	...	...	...	...	...
7	Hon. for translation	10,000	...	...	...	...	...	...	...
8	Do short-hand	...	...	...	10	...	...	...	...
9	Printing charges	...	...	...	...	...	...	...	...
10	Library and Mss. charges	...	2,630	...	3,572	...	579	...	1,398
11	Contingencies	...	...	...	...	...	2,038	...	4,652
Total.....		10,000	3,993	10,800	9,117	22,000	22,262	24,700	25,293
<i>Up to end of March</i>									
		1915-16		1916-17		1917-18		1918-19	
		Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
1	Salary	13,800	12,084	9,400	9,432	9,900	8,695	9,900	8,175
2	Establishment	3,460	3,463	3,800	4,027	5,100	5,100	5,436	5,436
3	Travelling allowance	7,850	7,034	6,000	4,569	7,000	5,425	6,300	3,084
4	Experiments	...	...	...	...	6,000	2,120	8,000	1,840
5	Grants to Progress Committees	5,000	3,000	3,000	5,470	5,000	2,300	5,000	2,000
6	Subvention to Kannada papers	...	...	...	...	1,600	1,360	...	...
7	Hon. for translation	300	773	1,000	861	...	...	...	...
8	Do short-hand	100	...	...	...	...	...	...	...
9	Printing charges	500	...	5,000	5,678	5,000	5,651	4,514	870
10	Library and Mss. charges	2,000	6,485	...	...	...	...	...	...
11	Contingencies	1,000	...	...	...	...	...	...	...
Total.....		34,000	32,839	28,200	30,217	30,600	29,644	39,150	17,426

APPENDIX B.

District Committees and District Economic Superintendents.

Items of Expenditure		1911-12		1912-13		1913-14		1914-15	
		Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
1	Officer	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
2	Establishment	...	...	5,760	3,594	12,750	6,363	20,050	18,286
3	Travelling allowance	...	...	3,240	3,628	6,800	3,425	5,700	9,433
4	Small experiments	...	...	4,000	3,956	9,550	5,858	12,469	16,137
5	Progress Committees	11,500	...	3,000	1,349	2,000	...	...	...
6	Hon. for lectures	...	...	...	...	...	2,400	4,300	4,200
7	Contingencies	...	...	...	...	...	...	...	...
8	Conference charges	...	...	2,000	2,468	4,000	2,304	5,840	5,006
Total.....		11,500	4,278	18,000	14,995	38,100	20,250	46,300	53,082
		1915-16		1916-17		1917-18		1918-19	
		Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
1	Officer	24,400	22,070	24,400	25,026	25,000	24,849	26,520	17,658
2	Establishment	7,200	12,484	12,000	10,321	20,000	17,815	15,830	9,888
3	Travelling allowance	22,000	20,609	21,900	26,839	26,000	30,497	32,880	18,354
4	Small experiments	6,000	5,424	5,000	4,960	5,900	4,879	...	...
5	Progress Committees	5,000	4,600	4,000	3,800	2,800	4,700	5,000	2,000
6	Hon. for lectures	...	...	5,900	5,676	4,000	5,562	3,120	3,537
7	Contingencies	5,000	4,879	7,100	4,568	7,000	9,701	9,000	3,831
8	Conference charges	...	...	...	...	600	600	600	375
Total.....		69,600	70,966	80,300	80,990	91,300	98,603	99,550	55,703

APPENDIX C.
Mysore Economic Journal.

Items of Expenditure	1911-12		1912-13		1913-14		1914-15	
	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1 Salaries	5,580	5,580	6,300	5,942	8,040	6,480	7,080	6,086
2 Establishment	1,860	1,859	2,136	2,512	3,396	3,164	3,400	2,268
3 Travelling allowance	300	300	300	199	600	276	700	329
4 Travelling charges	4,750	4,224	3,450	3,655	5,000	3,918	4,000	3,845
5 Printing paper	2,200	4,043	3,300	1,313	4,500	5,215	5,000	4,464
6 Blocks and illustration	720	757	700	189	2,064	736	1,000	175
7 Advertisements	...	...	100	...	...	...	...	...
8 Hon. to contributors	2,060	1,810	2,100	2,130	3,500	1,825	2,320	1,943
9 Contingencies	1,225	940	950	1,013	1,800	830	1,300	1,983
Total	18,635	10,294	19,336	16,953	28,000	22,444	24,800	19,893
Up to end of March								
1918-19								
Budget grant Actuals Budget grant Actuals Budget grant Actuals								
Rs. Rs. Rs. Rs. Rs. Rs. Rs. Rs. Rs.								
1 Salaries	5,580	5,580	6,300	5,942	8,040	6,480	7,080	6,086
2 Establishment	1,860	1,859	2,136	2,512	3,396	3,164	3,400	2,268
3 Travelling allowance	300	300	300	199	600	276	700	329
4 Travelling charges	4,750	4,224	3,450	3,655	5,000	3,918	4,000	3,845
5 Printing paper	2,200	4,043	3,300	1,313	4,500	5,215	5,000	4,464
6 Blocks and illustration	720	757	700	189	2,064	736	1,000	175
7 Advertisements	...	...	100	...	...	...	...	...
8 Hon. to contributors	2,060	1,810	2,100	2,130	3,500	1,825	2,320	1,943
9 Contingencies	1,225	940	950	1,013	1,800	830	1,300	1,983
Total	18,635	10,294	19,336	16,953	28,000	22,444	24,800	19,893

APPENDIX D.

Education Committee.

Items of Expenditure		1911-12		1912-13		1913-14		1914-15	
		Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Salary	...	6,049	7,300	7,000	4,500	5,400	4,500	5,236
2	Establishment ...	...	939	1,300	1,297	1,300	1,346	2,000	2,370
3	Travelling allowance	...	1,272	1,500	945	2,000	1,492	2,500	1,899
4	Printing charges	...	...	...	80	100	164	1,000	699
5	Hon. for translation	...	...	...	...	100	136	500	226
6	Do lectures	...	...	...	...	100	264	1,500	430
7	Payment for expert opinion	...	...	700	...	240	168	1,500	1,490
8	Contingencies	...	1,179	...	536	1,460	1,080	2,000	1,850
9	Public library	...	...	...	...	...	...	...	...
10	Public libraries	...	...	...	...	...	...	...	...
11	Rural libraries	...	...	...	...	...	...	...	...
12	Travelling libraries	...	...	...	...	...	...	...	...
13	Home Industries Institutes, Bangalore and Mysore	...	...	...	...	...	...	...	...
14	Cottage and Home Industries, Bangalore and Mysore	...	...	...	...	...	...	...	...
15	Higher Industrial Schools	...	...	...	...	...	...	...	...
16	Backward Scholarships	...	...	...	...	...	...	...	...
17	Vocational guidance	...	...	...	...	...	...	...	...
18	Physical culture class	...	...	...	...	...	...	...	...
19	Pop. Science lectures	...	...	...	...	...	...	...	...
Total.....		17,000	9,439	11,200	9,858	9,800	10,010	14,500	14,107

Note.—The extra expenditure was met out of allotments made in the Education and Industries and Commerce Departments.

APPENDIX D—*contd.*

Education Committee.

Items of Expenditure	1915-16		1916-17		1917-18		1918-19	
	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1 Salary	7,200	7,200	5,600	5,456	5,800	5,784	6,000	4,500
2 Establishment	5,600	5,600	9,500	9,654	5,800	5,039	7,300	4,183
3 Travelling allowance	1,600	1,527	2,800	2,628	2,900	3,374	2,700	1,600
4 Printing charges	1,000	1,000	1,000	1,984	2,200	2,654	2,200	3,110
5 Hon. for translation	600	366	800	78	400	248	300	193
6 " lectures	...	...	800	251	300	291	...	...
7 Payment for expert opinion	1,000	750	800	964	1,600	1,544	...	...
8 Contingencies	2,400	1,158	2,400	2,354	2,600	2,469	4,300	3,378
9 Public library	...	24,405	...	23,437	...	23,084	...	14,044
10 District libraries	...	...	...	...	...	5,000	...	300
11 Travelling libraries	...	...	...	6,455	...	7,493	...	...
12 Home Industries Institutes, Bangalore and Mysore	...	...	...	...	...	5,716	...	9,810
13 Cottage and Home Industries, Bangalore and Mysore	...	...	...	22,843	...	25,801	...	18,378
14 Higher Industrial Schools, ...	...	...	...	9,771	...	9,583	...	9,063
15 Backward Scholarships	...	...	...	...	...	408	...	1,195
16 Vocational guidance	...	...	...	...	...	78,217	...	...
17 Physical culture class	...	...	...	...	...	996	...	1,467
18 Pop. Science lectures	...	...	...	1,457	...	128	...	868
19	...	...	...	...	...	...	...	1,093
Total.....	19,600	39,621	22,900	87,333	21,000	180,719	22,800	73,132

Total.—The extra expenditure was met out of allotments made in the Education and Industries and Commerce Departments.

APPENDIX E.
Agricultural Committee.

Items of Expenditure		1911-12		1912-13		1913-14		1914-15	
		Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
1	Salary	Rs.	2,700	Rs.	4,200	Rs.	8,838	Rs.	12,547
2	Establishment	...	1,541	...	3,000	...	7,900	...	11,608
3	Travelling allowance	...	1,466	...	3,400	...	8,000	...	9,271
4	Printing charges	...	...	...	1,500	...	2,020	...	1,837
5	Payment for expert opinion	...	...	...	1,000	...	462	...	404
6	Hon. for translation	...	...	...	1,000	...	248	...	399
7	Experiments, etc.	...	387	...	5,000	...	5,050	...	2,632
8	Fodder and fuel plantations	...	21,000	...	...	...	...	...	...
9	Implement depots	...	1,042	...	2,000	...	1,642	...	3,046
10	Agricultural Associations	...	795	...	...	...	1,909	...	1,170
11	Scholarships	...	955	...	5,500	...	3,906	...	5,240
12	Preparation of bulletins	...	...	...	1,000	...	632	...	2,506
13	Contingencies	...	2,158	...	2,400	...	3,820	...	1,509
14	Other charges	...	...	...	7,000	...	...	...	7,520
Total		21,000	11,044	37,600	20,606	42,200	42,845	55,000	59,709

APPENDIX E—*concl'd.*

Agricultural Committee.

	Items of Expenditure	1915-16		1916-17		1917-18		1918-19	
		Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Salaries ...	6,600	4,085	4,200	4,684	4,800	5,014	4,800	3,600
2	Establishment ...	11,700	3,640	4,000	3,946	7,200	7,623	7,800	5,917
3	Travelling allowance ...	7,700	6,528	6,400	5,753	10,000	9,711	6,000	4,909
4	Printing charges ...	...	1,905	1,700	2,928	2,000	1,611	2,000	1,157
5	Payment for expert opinion ...	1,000	...	...	30	...	...	1,000	...
6	Hon. for translation ...	1,500	209	500	573	400	163	400	154
7	Experiments, etc. ...	...	...	400	262	2,000	3,075	3,150	2,059
8	Fodder and fuel plantations ...	...	...	...	...	...	...	7,500	245
9	Implement depots ...	4,500	...	...	47	1,000	485	1,000	436
10	Agricultural Associations ...	...	...	...	...	1,000	...	1,000	253
11	Scholarships ...	4,000	...	...	...	600	663	500	...
12	Preparation of bulletins ...	700	2,705	2,500	2,791	2,500	1,029	2,200	2,075
13	Contingencies ...	2,000	2,629	2,600	2,506	1,800	1,696	1,800	660
14	Other charges ...	9,600	...	...	...	...	...	...	...
Total		49,300	22,101	22,300	23,520	31,300	31,070	39,150	21,445

APPENDIX F.
Industries and Commerce Committee.

	Items of Expenditure	1911-12		1912-13		1913-14		1914-15	
		Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Salary	...	7,700	9,550	8,525	6,490	6,492	11,300	10,769
2	Establishment	...	1,126	2,000	1,745	2,180	2,271	2,460	2,561
3	Travelling allowance	...	566	1,800	1,149	2,250	3,200	5,370	4,885
4	Experiments	...	476	10,000	3,650	1,000	...	5,000	5,151
5	Payment for expert opinion	...	2,234	...	637	1,500	...	3,000	1,448
6	Special establishment	...	...	33,800	47,977	...	19,757	12,650	...
7	Printing charges	...	...	...	714	800	...	2,000	2,239
8	Stipends	...	40,500	...	...	...	...	...	...
9	Library and other charges	...	...	...	...	700	...	500	873
10	Deputation to foreign countries	...	...	...	...	...	...	...	...
11	Mysore Chamber of Commerce	...	...	...	...	...	...	...	...
12	Special schemes	...	...	...	...	...	...	...	...
13	Hon. for translation	...	...	...	...	200	...	900	207
14	Preparation of bulletins	...	...	...	...	6,500	...	200	26
15	Contingencies	...	...	...	...	1,280	2,497	4,020	2,356
	Total.....	40,300	17,561	62,200	68,245	22,900	34,217	47,000	30,615

APPENDIX F—*concl'd.*
Industries and Commerce Committee.

	Items of Expenditure	1915-16		1916-17		1917-18		1918-19	
		Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals	Budget grant	Actuals
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Salary	5,400	6,400	6,300	6,300	7,200	8,250	7,800	3,150
2	Establishment	2,960	3,024	2,800	3,191	7,800	6,615	6,550	3,760
3	Travelling allowance	2,200	2,693	3,800	2,814	2,300	1,295	2,300	1,714
4	Experiments	7,000	...	...	10,154	10,100	10,479	7,000	842
5	Payment for expert opinion	940	975	1,000	66	500	...	500	...
6	Special establishment	2,700	...	...	...	...	...	...	...
7	Printing charges	1,800	3,276	3,200	2,303	2,450	1,063	2,000	1,343
8	Stipends	2,000	45	1,000	1,604	1,000	1,243	1,500	830
9	Library and other charges... ..	...	541	2,150	403	600	231	600	157
10	Deputation to foreign countries	...	...	20,000	8,478	5,000	3,706	5,000	174
11	Mysore Chamber of Commerce	...	...	750	1,400	750	750	850	850
12	Special schemes	...	...	...	1,516	1,000	111	7,000	1,312
13	Hon. for translation	200	...	...	...	...	...	...	...
14	Preparation of bulletins	100	...	...	...	...	...	...	...
15	Contingencies	2,100	1,752	2,000	1,901	2,500	3,091	2,000	617
	Total.....	27,400	18,706	43,000	40,130	41,200	36,834	43,100	14,749

SOME ASPECTS OF THE BRITISH BUDGET, 1919-20.

BY THE EDITOR.

THE British Budget for 1919-20 presented to Parliament by Mr. Austen Chamberlain marks a notable departure from the customary statement made annually in that House. Its outstanding feature is the definite adoption of a policy of Imperial preference. Though its application is limited, it may be taken that preference will play an important part in the Imperial Economic System in the years to come. From the statement made by Mr. Chamberlain, it is clear that preference will in the beginning apply to only a small number of articles. It is not apparent that it will extend to raw materials as well. It was a cardinal point of the original scheme propounded by Mr. Joseph Chamberlain that it did not stop short of articles of food; it extended to raw materials as well. The list of articles included in the present Budget for purposes of preference does not include raw materials as such. The articles it actually includes are:—Tea, Coffee, Cocoa, Sugar, dried fruits and Tobacco, all of which may be classed under the head of articles of food. Then there are the following articles:—Motor spirit, Cinema films, Clocks and Watches, Motor-cars and Cycles and musical instruments which are all manufactured articles. These two classes of articles exhaust the list. They do not include, as will be seen, raw materials, in regard to which the Dominions compete in the British markets with foreign countries. Will preference in the coming years be extended to these as well or as now kept within strict limits? Will it mean to the people of England not only dear food but also dear raw products for manufacturing purposes? It will be interesting to watch the future development of preference in the British Budget.

The mode in which preference is to be given is by reductions of duty in favour of Imperial products rather than by increase of taxation in the case of commodities coming from foreign countries. This is likely to give an impetus to British enterprise in the Dominions and to the development of trade relations with Great Britain in the coming years.

What this preference means to the Dominion producers can be seen from the following table indicating the sources of England's supplies of the articles included in the preference list:—

Sources of Supplies Affected by the
Imperial Preference.

	From Foreign Countries	From British Possessions
	£	£
Tea	1,750,179	12,032,726
Raw Coffee ...	2,558,417	362,438
Cocoa (Raw) ...	1,119,998	1,162,775
„ Prepared ...	1,837,253	2,105
Sugar	22,135,688	930,933
Dried Fruit ...	3,464,325	23,699
Motor Spirit ...	3,018,188	785,209
Wine	3,930,938	147,205
Tobacco (Manufactured).	1,272,108	51,372
Tobacco (Unmanufactured).	6,645,678	63,404
Watches	1,274,756	155
Clocks	499,307	5
Musical Instruments.	1,149,023	29,783
Motor Cars (Complete).	1,566,019	172,443
Motor Cars (Chassis).	1,892,293	2,172
Motor Cars (Parts).	1,214,300	6,133
Motor Cycles (Complete).	59,964	368
Motor Cycles (Parts).	105,543	146

In regard to tea, already nearly 90 per cent of it consumed in Britain is produced in the Colonies. Virtually preference in this case means reduction of the duty on tea—whether call such indirect reduction by the name of preference is a question. One effect, however, of preference will be to check speculation in the London market in connection with foreign tea. This tea has been brought over and kept in stock to release at a time when the price for common tea has touched a certain level. This speculation, if preference is persisted, will probably be killed. But it should not be forgotten that it only affects about 10 per cent of the whole tea imported into Great Britain, and that therefore the effect of preference on tea production in the Empire is not likely to be appreciably great. The case is very different in regard to coffee. 88 per cent of what is consumed in Great Britain is foreign grown and imported while, only 12 per cent is Empire Grown. As to cocoa, half of the total quantity consumed comes from the Dominions, while the other half foreign. In regard to sugar, the position is somewhat different. Cane-sugar industry has been practically killed by the German beet root product. As much as 96 per cent of what is consumed in Great Britain is imported from foreign countries—mostly from Germany and Austria-Hungary—and only 4 per cent is British. Preference here is likely to act beneficially if it is followed with (or rather backed by) action in the Dominions and in India. It is a truism to say that India grows as much cane as can be required to meet its needs; but the methods of pressing are so primitive that the sugar actually turned out from it is hardly sufficient to suffice its wants. It has, therefore, become the largest importer of sugar in the world. Whether preference will have any effect on the Empire production of sugar is difficult to say. Suitably backed by the Dominion and India Governments, the people of

the Dominions and India ought to be able to grow more cane and what is of intimately greater importance extract the sugar from it in a less wasteful manner. Preference must be followed by *action* by Governments and *enterprise* on the part of the people in the Dominions and in India. At present the quantity of sugar available in the Empire for import into Great Britain is only 7 per cent of its total imports. Great Britain is an exceptionally good customer for sugar, and there is no reason why the quantity required by England—which cannot grow its own sugar and has perhaps the largest confectionary trade in the world—should not be supplied by the people of India and the Dominions. Unlike the United States, which grows its own sugar, England depends entirely on what it can import and the import has been mainly from Germany and Austria-Hungary. Nearly twenty-three million pounds worth of sugar were imported by her from these countries in 1913, the year before the war. During the period of the war, she imported first from Java and then from Cuba. The West Indies have supplied the 7 per cent imported into Great Britain; but obviously the industry cannot expand to any very great extent there. British Guiana might supply a good portion of what is needed by Britain but it has still to be opened up. Queensland in Australia is a cane-growing country but the want of labour there might stand in the way of the development of the industry. Thus India is the one country from which Britain can expect unlimited supplies. India could supply more than the quantity if only the cane grower in this country can be induced to extract the juice from the cane he grows a little less wastefully. As Dr. Hopkins remarked the other day in the House of Commons the amount of sugar-cane produced in India is more than adequate to supply its own needs, and not only that but also the needs of the whole of the United Kingdom and the British Empire. That is also

the declared view of the *Statist*, provided, of course, as we have said, the juice extraction is done on more prudent lines. A great effort in this direction is necessary and it should be put forth in the coming years. The following table which has been more than once published in the *Statist* shows the total production of cane-sugar in the British Empire in the season 1917-18:—

	Tons.
Demarara ...	120,000
Trinidad ...	75,000
Barbados ...	65,000
Jamaica ...	20,000
Antigua ...	30,000
Other British West India Islands	10,000
Total British West Indies ...	320,000
Australia ...	380,000
India ...	3,200,000
Egypt ...	120,000
Mauritius ...	250,000
Natal ...	110,000
Total for British Empire ...	4,380,000

In regard to the other articles included in the preference list, little need be said. 80 per cent of motor spirit imported into Great Britain is foreign; similarly 90 per cent of the motor-cars (complete) is foreign. Clocks have been imported almost entirely from Germany and watches, except for a trifle, from Switzerland. The imports of motor-cars from the Colonies into Britain was slight before the war, but probably in view of the development of this industry in Canada, preference may, perhaps, lead to better trade relations in this matter between England and that part of the Empire.

Two other features of the British Budget may be referred to before we conclude. One is the reduction of the excess profits duty by exactly 50 per cent—from 80 per cent to 40 per cent. When we remember that this duty was largely instrumental in raising prices all round its reduction cannot but be welcomed. We are, however,

more concerned with the principle involved in its imposition rather than the magnitude of the import itself. That the taxation of capital is not favored to-day in England may, perhaps, be inferred from the reduction. What the Government gained by it—nearly £300,000,000—it more than lost in the heavier prices it paid for its purchases. Whether the tax will be abolished in the future is a matter for speculation, in view of the cry that has been raised against its reduction. Already critics of the Budget have said that while the middle-classes were unable to live before it, now millionaires will be unable to die! Probably it will remain with us in an attenuated form for some years to come, if not like the income-tax stay with us for ever, the friend of every Chancellor and the foe of every tax payer. The abandonment of the luxury tax is another point to note. It is, as the *Times* puts it, one of those taxes which looked exceedingly promising on paper but when brought down to practicalities proved unworkable. Its failure in France was not lost on British financiers.

The vastness of the British Budget is disclosed in the figures. We give below the same in a succinct form for the benefit of our readers. The total revenue expected is £1,201,100,000 as against a probable total expenditure of £1,434,910,000, thus leaving a deficit of £233,810,000.

ESTIMATED REVENUE, 1919-20.

Customs as in Table V ...	£117,650,000	
Proposed net addition, as in Table VII ...	£1,350,000	£119,000,000
Excise, as in Table V ...	£80,900,000	
Proposed net addition, as in Table VII ...	37,600,000	118,500,000
		£237,500,000
Estate, &c., Duties, as in Table V ...	£31,000,000	
Proposed net addition, as in Table VII ...	2,500,000	£33,500,000

Stamps	...	12,000,000
Land Tax	...	600,000
House Duty	...	1,900,000
Income-tax (including supertax)	...	354,000,000
Excess Profits Duty, &c.	...	300,000,000
Land Value Duties	...	500,000

£702,500,000

Total Receipts from Taxes ... £940,000,000

Postal Service	...	£30,000,000
Telegraph Service	...	4,000,000
Telephone Service	...	7,000,000

£41,000,000

Crown Lands	...	650,000
Receipts from sundry Loans, &c.	...	9,750,000
Miscellaneous	...	209,700,000

Total Receipts from Non-Tax Revenue ... £261,100,000

Total Revenue ... £1,201,100,000

Deficit ... 238,810,000

£1,434,910,000

ESTIMATED EXPENDITURE, 1919-20.

CONSOLIDATED FUND SERVICES.

National Debt Services:—

Inside the Fixed Debt Charge	...	£29,800,000
Outside the Fixed Debt Charge	...	330,200,000

£360,000,000

Payments to Local Taxation Accounts, &c. 9,763,000

Land Settlement ... 5,000,000

Other Consolidated Fund Services ... 1,832,000

Total Consolidated Fund Services £376,595,030

SUPPLY SERVICES.

Army	...	£287,000,000
Navy	...	149,800,000
Air Force	...	66,500,000

Civil Services as in

Table IV ... £445,804,000

Add, Supplementary

Estimates to be presented ... 60,000,000

505,804,000

Customs and Excise, and Inland Revenue

Departments ... 8,537,000

Post Office Services ... 41,274,000

Total Supply Services £1,058,315,000

Total Expenditure £1,434,910,000

FINAL BALANCE-SHEET.

1919-20 (Estimate).

Expenditure	...	£1,434,910,000
Revenue	...	£1,201,100,000

Deficit ... £238,810,000

1918-19 (Actual).

Expenditure	...	£2,579,301,000
Revenue	...	£889,021,000

Deficit ... £1,690,280,000

CHANGES IN TAXATION.

The following changes were proposed in taxation:—

The duties on spirits to be increased from 30s. to 50s. per proof gallon. (A bottle of whisky to cost 10s. 6d.)

The beer duty to be raised from 50s. to 70s. the standard barrel. (Beer prices to remain as at present.)

Excess profits duty to be reduced from 80 per cent to 40 per cent.

Death duties on estates exceeding £15,000 to be increased to a scale ranging up to 40 per cent on estates of two millions sterling.

Motor spirit licence duty of 6d. per gallon to be abolished.

Benzol to be exempted from taxation.

Luxury duty proposed last year to be abandoned.

Income-tax rates unchanged. Wound pensions and demobilisation gratuities not to be taxed.

IMPERIAL PREFERENCE.

It was further proposed that a preference be given to Empire products on existing Customs duties. The preference to be One-sixth of the duty on tea, coffee, cocoa sugar, dried fruits, tobacco and motor spirit one-third of the duty on cinema films, clock and watches, motor-cars and motor-cycle musical instruments. A preference of 6d. to 1s. per gallon was proposed on Empire wines and of 2s. 6d. on spirits. The preference to take effect from 2nd June for tea and from 1st September for the other goods. The Excise duties on chicory, sugar and tobacco to be reduced so as to correspond with the Customs duties on similar articles produced within the Empire.

PROSPECTS OF THE OLEO-RESIN INDUSTRY IN MYSORE.

BY RAO SAHEB M. RAMA RAO,

Special Forest Officer, Mysore State.

AMONG the indigenous forest trees, the following yield Oleo-resins:—(a) Yenne-mara, (b) Dhuma, (c) Sambrani, (d) Kai-dhupa, (e) Sal-dhupa and (f) Jalari-dhupa.

(a) *Yenne-mara of Manjarabad Ghats.*—This tree occurs only in the Manjarabad Ghats, but to what extent has not yet been definitely ascertained. For several decades past, the trees are tapped occasionally for small quantities of the Oleo-resin which is locally used as a rough varnish. It contains a valuable *Essential Oil* and resin, both of which are used for varnish and the oil as a substitute for *Copaiba balsam* in medicine. Mr. S. G. Sastry (Industrial Chemist) has recently valued the oil at Rs. 5 per lb., for experimental use in his soap works. It is, I believe, worth more when used as a substitute for *Copaiba balsam*.

We have to find out definitely our resources of this Oleo-resin by first ascertaining the existing number of tappable trees by a regular enumeration and secondly the annual quantity of Crude Oleo-resin that can be collected, by experimentally tapping sufficient number of trees in all the seasons of the year to determine the most suitable season and then decide whether sufficient quantity will be available for starting a Distilling Factory. The resin has a dirty green colour. If decolorised, it may be suitable for sizing paper, when our Paper Mill becomes an accomplished fact.

(b) *Dhuma Tree.*—Lakhs of this tree are reported to exist in the Shimoga

and Katur Ghat forests. I have seen some gigantic trees in the Agumbe Ghats. The tree yields an Oleo-resin containing an Essential Oil and resin. As in the case of Yenne-mara, we have to ascertain by enumeration of trees and Experimental tapping what annual quantity of Oleo-resin can be collected from this tree.

The Indian Institute investigated Oleo-resins of this and Yenne-mara and has published the results. The essential Oil and resin are useful for making varnishes and in other minor industries.

(c) *Sambrani Tree.*—This occurs in gregarious patches in a few dry stony localities in Chamarajnagar and Heggaddevankote Taluks, in Chitaldrug District and elsewhere. Its resources have not yet been ascertained. It yields a gum-oleo-resin which contains a *gum* useful for sizing cloths, *turpentine* which is said to be as valuable as American turpentine, and *rosin* which is believed to be suitable for sizing paper, for preparing Shellac from Crude lac and for other purposes. Dehra-dun Forest Research Institute has investigated the subject and published recently a Bulletin on the methods of manufacture, uses of the products, etc.

(d) *Kai-dhupa*, and (e) *Sal-dhupa.*—These trees occur in the Ghat Forests of Hassan, Katur and Shimoga. They yield the *black dammar* and *white dammar* of commerce. Both are used in varnish, for caulking boats and other purposes.

(f) *Jalari-dhupa.*—The Jalari occurs both in the Maidan and Semimallnad districts, and yields a valuable Oleo-resin. At present, its Oleo-resin is not regularly collected

except in petty quantities for domestic use as incense. The Oleo-resin contains turpentine and resin.

All the foregoing Oleo-resins require the same kind of treatment in distilling and separating essential oil or turpentine and rosin and in refining those products, except in the case of Gum Oleo-resin of *Boswellia* in which the Gum has to be separated off by a different apparatus before its Oleo-resin is distilled. Should the supply of raw material of any one of the above six kinds be insufficient for starting a distilling Factory, then all of them may be worked in one Factory. I understand that the minimum quantity of Oleo-resin required annually is ten tons for starting a Factory on a Commercial Scale.

We have no data available in the Forest Department or elsewhere as to what quantities of Oleo-resin can be annually collected from each species. Regular tapping experiments have to be conducted and the Oleo-resins distilled and their products put on the market to ascertain their Commercial values before any scheme for working the Industry on a Commercial basis can be prepared.

Experiments, made in the past, on the tapping of Yenne-mara and Dhuma, were conducted in a crude and desultory manner and no reliable data as to yield per tree, cost of extraction, etc., are forthcoming.

For conducting the experiments in a systematic manner on scientific lines on each of the six species and to collect reliable data a Special Staff consisting of a trained Gazetted Officer and a couple of trained Rangers with a few subordinates and labourers will be necessary.

For distilling the Crude Oleo-resin and refining the products thereof in sufficient quantities for being commercially valued, a trained Chemist and necessary Laboratory facilities will be required.

On the whole, the preliminary experiments in collecting the Oleo-resin and its chemical investigation in the Laboratory may cost about Rs. 10,000.

ECONOMICS IN THE WEST.

Industrial Expansion in India.

London, 24th April, 1919.—More than once I have referred in these columns to the widespread ignorance that exists here as to the great industrial expansion that is taking place in India. In no direction is this weakness more manifest than in the comments that have been made on the International Charter of Labour which has issued from the Peace Conference. If we accepted some of the opinions expressed at their face value we should believe that we are moving rapidly towards a new heaven and a new earth in which Labour all the world over will be governed by a set of amiable regulations which will ensure for the worker a maximum of pay for a minimum of effort with abundant and well paid leisure. Ever Mr. Barnes, the President of the International Commission from which the Charter emanated, seems to share the delusion the West having given its edicts in these matters will henceforth find a docile world to respond to its behests. In an interview recently published in speaking of the question of the duration of employment he argued that it was immaterial whether the hours labour should be identical in all cases. I proceeded: "In the East, for example where people work in a lackadaisical way without system or organization, and use somewhat patriarchal methods the hours elastic, irregular and often protracted, they are not so productive as in highly developed, organized countries." Mr. Barnes was unacquainted with the East or he would not have talked in this strain. A visit by him to the Cotton mills of Bombay the Tata or Bengal Steel Works or a number of other centres that might be indicated would speedily convince him that lack of organization or lackadaisical

methods are not the serious handicaps to modern Indian industry that he imagines. Equipped with the latest appliances of mechanical science the Indian artisan is, in truth, a very formidable rival of the British trade unionist with his rules restricting production and his often unfriendly attitude towards labour-saving machinery.

It cannot, of course, be denied that Indian and indeed all Eastern labour is less efficient man for man than labour in Western countries. If it were not so Western industry would be in a parlous condition. The question is whether the difference is a permanent one and whether it applies to so marked a degree where machinery is extensively used. My own impression is that the introduction of modern conditions is propoundly influencing the problem. Where machinery does the work it matters little whether the tender is an Oriental or an Occidental. One may not keep as good time as the other—though even on that point there is room for argument. But the output of the machine will be practically the same in one case as in the other. The Japanese have shown us what can be done with up-to-date equipment in the shipping line by turning out big ocean lines in what would have been record time in England a few years ago. What Japan is doing India can and will do. There must be no mistake on that point.

POST-WAR DEVELOPMENT.

Evidence accumulates of the wide reaching and beneficial effects of the war in stimulating industrial research and production. A case in point is laboratory glass. Before the great upheaval in 1914 there was not a single manufacturer of laboratory glass in this country. To-day practically all the laboratory glass used here is produced in Great Britain. The welcome change that has been made in the industry is due to the public spirited action of the Sheffield

University authorities who, as soon as the need was discovered, made plans for covering the deficiency, and worked with such resolution and scientific skill as to bring into existence a department of Glass Technology which proved the efficient instrument of production called for by the crisis. Now that the strain of the war period is relaxed there is a desire that the good work that has been done shall be carried forward in an industry established on more or less permanent lines. At present the cost of producing the laboratory glass in Sheffield is higher than the pre-war German standard and probably if left entirely to itself the nascent industry would wither and fade away before the blasts of foreign competition: but the Government probably will see to it that the Sheffield experiment is not thus disposed of, and we may confidently expect that if the promoters are given a little time to put their house in order they will be able considerably to reduce the cost of manufacture. However that may be there is an influential movement afoot for financing the industry on generous lines. The Government are expected to participate in this but the main sinews of war will be provided by Sheffield capitalists who have faith in the undertaking.

We have heard so much about the reluctance of British capitalists to embark upon new undertakings owing to the industrial unrest that it was quite refreshing to read in the columns of the *Times* a day or two since a long and interesting account of the manner in which the old munition factories are being connected to industrial purposes. If not literally a case of turning swords into ploughshares it is in some instances very near it. For example, one factory which a few short months since was turning out by the thousand Stokes bombs is now manufacturing ploughs and spare parts of agricultural machinery. Others are producing dynamos and electric fittings, "art" bronzes, drop

stampings, oil engines, and, the voracious reporter adds, "even lace." Ingenuity is a leading feature in these post-war developments. For example, one factory in the North-West area is converting fuse cases left over from war contracts into ornaments. This is accomplished by the addition of three legs and a coat of electro-copper. It is gratifying to find that female labour is not being left out of the account in these activities. There is a distinct desire to utilise as far as possible the services of all women who have proved themselves capable in the war period. In one instance where an aircraft factory is being re-adapted for civil uses and there is a necessary interregnum the women have been kept on making blouses pending the time when they will be able to resume their mechanical operations.

An unsinkable ship has long been the dream of the enthusiast, but it really seems to have come at last in sober earnest. Of course, the notion emanates from America. It is, however, satisfactory to add that it is from the British part of the continent that we are to have this novelty. The "unsinkable ship" promised is in reality a huge bundle of timber equipped with propelling machinery and given the outward form and some of the adjuncts of an ordinary steamer. A description of the vessel shows that timber is to be built upon a simple foundation tier above tier until the pile reaches a certain height when a joist and foot will be provided in which rooms and comfortable accommodation will be found for captain, officers, and crew, and spaces for kitchen galleys and for the motor engines driving the twin screws which are to supplement sails. When fully completed this curious "ship" will have a cargo of 5,000,000 broad feet of timber, will displace 9,000 tons, will be 250 feet long, have a beam of 60 feet and a depth of 36 feet. The voyage from British Columbia to Great Britain via the Panama Canal is expected to occupy a month. Should the experiment prove successful we may

expect more of these unsinkable ships to appear upon the seas. There would seem to be room for them even in the Indian trade.

The operations of the great War served to bring into great prominence the value of iron ore deposits. It is, indeed, not too much to say that Germany was only able to prolong the war to the extent she did by her being able to tap Swedish sources of supply when her carefully built up reserves were exhausted. Now that we are able to survey the portion in the light of experience it is possible to congratulate ourselves on the fact that the British Empire possesses finer ore deposits than any country in the world. A writer in the Industrial Supplement of the *Times* gives an interesting account of these Imperial assets, and urges that as a matter of policy we should develop and utilise British ore wealth rather than rely for our raw material upon foreign sources. India is given a conspicuous place in the writer's article, and he shows very plainly how tendencies are rapidly carrying the country forward as a great iron and steel producing centre. But India is not alone in Imperial steel development. Canada is taking a leading share in the struggle and Australia is also well forward. Newfoundland, however, would seem to offer the best prospects as she has in her Wabana mines what are reputed to be the richest iron deposits in the world. "The ore here," the writer of the article says, "has a good percentage of iron and is low in sulphur though rather high in phosphorus which renders it unsuitable for the acid process of steel making. It is therefore used mostly for the production of basic steel." Even before the war Great Britain imported 1,00,000 tons of ore from Newfoundland. Under the new conditions there can be no doubt the resources of the oldest colony will be drawn upon to a much larger extent.

ARNOLD WRIGHT.

INDUSTRIAL NOTES FROM THE UNITED STATES.

Starving a Fire by Means of a Blockade of Steam.

Washington, D. C., U.S.A., 10th May, 1919—That the answer to a perplexing engineering problem is often a ridiculously easy one—after it has been found—involving merely the application of some perfectly well known principle, has seldom been better demonstrated than in the case of a huge Louisiana gas well fire recently. The well in question, which had been flowing at the rate of forty-four million cubic feet per day with a head-pressure of fifteen hundred pounds to the square inch, caught fire from an explosion in the well house. While the velocity and pressure of the gas stream were sufficient to hold the flames at a height of one hundred feet from the ground, they spread at that altitude over an area of several acres and were accompanied by a deafening roar and a heat so intense as to hamper the efforts of the would-be extinguishers below.

After futile efforts to cap the well it was proposed to dynamite it, with the idea of creating such a blast of air as would blow the head of flame off the stream of gas. But before doing this it was decided to give a New York expert a chance to put out the conflagration by less dangerous and destructive means. But when the latter arrived five days after the outbreak and proceeded with his preparations in a way that made it plain that he proposed to extinguish the fire by means of a jet of water from a house he was loudly jeered and was informed, seriously, that there was not enough water in the whole state of Louisiana to put out that fire. From their own point of view, indeed, his volunteer informants were correct, entirely; smothering the fire with water in the usual manner of the city fire departments

would have been a ridiculous undertaking. But the expert had no such scheme in mind.

What he did was simply to bring up two hose lines of moderate size and play them from opposite sides so that their streams met in the non-burning stem of gas issuing from the well.* They were then slowly elevated until they reached the base of the flames, where they were held. Within five minutes the cushion of steam formed was sufficiently heavy to cut off the gas supply from below and the fire was out!

While the general principle employed in this stunt is familiar to every high school student through the well-known experiment of holding a wire gauze over a Bunsen burner, lighting the gas above the screen, and observing how the flame will not communicate to the gas below this very flimsy barrier, its application to the gas well is a distinct departure, and one which takes much of the menace out of these conflagrations, which have been both frequent and destructive throughout the United States.

A KEYBOARD MACHINE FOR SORTING LETTERS.

There has recently been developed and is now in use in the New York and Chicago post offices a machine which, both in its manner of working and in its achievements, is to the business of letter distribution what the linotype is to the setting of type.

The operator sits at his keyboard, the letters flit in single file across his range of vision, he catches the post office or address on each passing envelope, strikes the proper key, and the machine attends to all the details of conveying that particular letter to the appropriate compartment, where it joins other letters having the same destination or routing.

In addition to the rank of compartments into which the letters are to be distributed, the machine consists of two essential parts—the key-board, and the erect carriers attached in a long series to the endless conveyor-belt

that passes over these compartments and back again under them. Each carrier has a row of triggers along the bottom, at the upper edge of each compartment stands a tripping mechanism. This mechanism occupies a different position on each compartment, while all the separate triggers on each carrier are independently adjustable. The letter drops out of the carrier only when all the triggers which have been set are tripped, and of course it is possible to set the triggers on any carrier so that they will be tripped at a given compartment, and at that compartment only.

This indicates clearly the general *modus operandi* of the machine. Just as every key of a typewriter is connected alike with the space bar and with its own particular type bar so that each stroke performs the general operation of spacing and the specialized one of printing, so in this machine each key is connected with the general mechanism for sliding the letter over into the carrier which happens to be standing opposite the board, and also with its own particular apparatus for setting the triggers upon that carrier to the particular combination that pertains to that key and to its corresponding compartment.

Once inserted in its carrier and the triggers on the latter properly set, the letter proceeds by jerks as each subsequent key is struck. It passes without recognition all the wrong compartments, but as it reaches the right one, for which the triggers holding it in place are set, it is released by the tapping of those triggers, and falls out and down into the compartment.

In the machine each carrier has four triggers, each capable of assuming four different positions, making possible sixty-four different combinations, and hence as many different sortings. Plainly, however, the principle is susceptible of infinite extension, both by increasing the number of triggers and the number of positions which each can take. The same mechanism on the

compartment's edge that trips the triggers restores them, after the letter has been dropped out, to the normal position in which they must be found by the setting apparatus as they pass the key-board on their next round. The machine is thirty feet long. Of course, the power for operating it is furnished by electric current; the pressing of the key in each case simply closes the circuit, as in the electric adding machine or typewriter. While so far it is used only on letter mail, it is planned eventually to construct machines for use in sorting newspapers and parcels.

THE AUTOPLANE—A LIMOUSINE FOR LAND AND AIR.

A luxurious limousine with a highly-finished body and with its three occupants sitting in elaborately and comfortably upholstered seats, dashing along a road or even over a field at the rate of 45 miles an hour, and then, with a slight increase of speed, taking to the air by virtue of its short wings and soon reaching a speed of 65 miles an hour and showing all the ease of maneuvering which belongs to the modern airplane—all this would seem to be a description of the perfected aerial bus or autoplane of a decade hence. Yet it is the delineation of the autoplane which was exhibited at the recent Pan-American Aeronautic Exposition held in New York, and which, from the popular standpoint at least, might well be regarded as the big surprise of the occasion.

The autoplane has been designed by Glenn H. Curtiss and his engineers, and is undoubtedly the first attempt ever made to combine automobile engineering with aerial practice in order to develop a vehicle for practical and fashionable use. The machine is a modified triplane, with the planes slightly staggered. The two upper planes have a span of 40 feet 6 inches, while the bottom plane is 23 feet 4 inches; and the chord of the former is 48 inches, and that of the latter is 42 inches. A gap of 39 inches is left between the planes, and the stagger is 11 inches.

The all-over height is 10 feet, length 27 feet, and the possible load 710 pounds.

The body of the autoplane is of aluminum, while the windows are of celluloid. The interior, with its elaborate upholstery and tapestries, compares favourably with that of the high-priced limousine; so, with the single exception of a slight reduction in size, the appointments leave nothing to be desired.

The body has been somewhat streamlined in order to reduce the head resistance, and if anything this adds to its smart appearance.

The power plant—a 100-horsepower, eight cylinder motor—is placed under the hood in front of the autoplane, following usual automobile practice, and the shaft is extended to the rear of the body where the power is transmitted by a chain-drive to the four-bladed propeller located on a line with the top of the body. The circular radiator, which provides water cooling for the engine, is placed in front of the hood and adds greatly to the automobile-like appearance of the machine. Still another feature in this direction is the thermometer cap of the radiator and the starting crank.

The autoplane travels over the ground much in the same manner as the conventional motor car, and can be steered by means of the front wheels which are equipped with the usual steering mechanism. The front wheels move in unison with the aerial rudder; and all four are sprung on concealed rubber shock absorbers, which adds to the running qualities of the machine during land travel and alighting. Despite its apparent bulkiness, the autoplane has been demonstrated to be quite practical for the purpose intended.

CEMENT FROM SUGAR BEETS.

Extensive experiments in this country have resulted in the production of an excellent cement as a by-product of beet-sugar refining. The first step in the production of sugar from beets is boiling them. It has heretofore been customary to throw away as valueless the scum formed on the cauldrons.

But, through a series of experiments, it has now been discovered that this scum contains large quantities of carbonate or lime. It has been found that 5,000 tons of the carbonate can be recovered from every 70,000 tons of the beets. To this quantity of the carbonate 1,100 tons of clay are added, the resultant product being a cement which, according to competent authorities, is of "perfect quality." The beet-scum is pumped into large reservoirs and allowed to evaporate for a certain length of time before being mixed with the clay. It is then stirred or beaten for an hour before being fed into a rotary oven such as is used in making Portland cement.

AUTOMATIC FILM WINDER FOR HAND CAMERAS.

While it is true that the amateur film camera of to-day has been developed to a point where it is merely necessary to "press the button," and the rest of the photographic process usually takes care of itself, the fact remains that the film must be turned following the pressing of the button. If this is not done, the next exposure is superimposed on the first, and the two exposures are ruined. With a view of eliminating the bother incident to turning the film there has just been patented an ingenious automatic "film shifter" for cameras. Briefly stated, this device consists of a spring mechanism for shifting the film to bring a new surface into position, and a means for connecting this mechanism with the shutter so that it will operate immediately after the functioning of the latter. With this handy mechanism in use it will become possible for the photographer to snap two or more views in quick succession, which is often desirable but not practicable with the present manually-wound film cameras.

ELECTROLYSIS IN PIPES AND CABLES.

The damage done annually to pipes and cables, underground, as well as to metal structures in the United States by electrolysis amounts to many millions of dollars.

There are very few water, gas or lead cable systems that are not more or less subject at some points to electrolytic damage from stray currents. Moreover, the loss does not consist merely in the shortening of the life of such structures; electrolytic damage is one of the causes of the leakage of water and gas from distribution systems. The failure of such systems on account of electrolytic action may also involve various dangers to the life and health of human beings.

According to the United States Bureau of Standards, more than twenty-five separate and distinct methods of dealing with the electrolysis problem have been proposed and experimented with from time to time. Some of these methods are said to be useless and even harmful. The Bureau of Standards has been studying the subject of electrolysis mitigation for the past seven years, and has aided in installing complete mitigating systems in several cities of the country. The bureau makes somewhat detailed tests in each of these places at least once a year to make sure that the protective systems are being properly maintained. An extended series of experiments has recently been undertaken in the city of Springfield, Massachusetts, with the so-called three-wire system of electric railway operation—a system which offers considerable promise for the mitigation of electrolysis troubles under certain conditions frequently met with in cities.

AN ELECTRIC HEATING UNIT THAT LOOKS LIKE A TWO-FOOT RULE.

To light up a remote dark corner or a detached building it is a simple matter to extend an electric lighting circuit and add another lamp or group of lamps, according to the conditions and amount of light desired. This same feature of flexibility and ease of extension can be taken advantage of, in the way of heating such places as crane cabs, pump and valve houses, signal and watch houses, theater ticket booths, and various other locations where, because of exposure

or physical conditions, heat (or additional heat) is required. This has been made possible through the development of a rugged electric heater unit that looks more like a two-foot rule than anything else. These "units" are simply connected to a lighting or power circuit like so many lamps and may be distributed (like lamps) where they will do the most good. The entire nickel-chromium resistor or heating element is buried in an enclosure of mica, around which a steel jacket is placed and sealed under an hydraulic pressure of about twenty tons. Two insulated eyelet holes are provided for mounting and two connector posts serve for the making of connections to the circuit.

Traffic officers, crane operators, and signal men have employed this type of electric unit for keeping their feet warm. It is possible to keep other parts of the body warm with heavy clothing, but the feet usually suffer. When units are used as above a heavy perforated metal plate is supported about two inches above the floor, with a unit or several units placed between, allowing an air space between the units as well as between the units and the surface above and below to permit circulation. A current of warm air then passes up through the perforations. The units, being only three-sixteenths of an inch thick and one and one-half inches wide, can be used in a very small space.

NEW PERMANENT MAGNET STEEL.

A new steel of considerable importance has been made in the United States for the past year, the direct outcome of the war. It is a new, permanent magnet steel, a substitute for the older steel, known as tungsten magnet steel, used exclusively for this purpose before the war. Not long after the war began and the price of tungsten advanced, efforts were made to find a steel that would be cheaper and also as efficient as the permanent magnet steel then being used, containing from five to ten per cent tungsten and sometimes even up to twenty-five per cent. This demand was insistent from both magnet makers and electric companies making electric meters, because the tungsten magnet steel was reaching prohibitive prices. It was even stated that automobile makers were substituting batteries instead of magnets because American steel makers could not make as good magnet steel as foreigners—manifestly an incorrect statement.

ALFRED T. MARKS.

NOTES.

The tenth session of the Mysore Economic Conference, held at Mysore during the Birthday week last month proved an eminently successful one. The President's Address first passed in review the work of the Conference since its inception and also briefly summed up what had been attempted in the industrial field in Mysore before its establishment. It then indicated briefly the scheme of organization proposed for the Conference as a permanent institution in the State. The discussions on the scheme lasted through the whole of the first day's sittings. Final orders on the matter have just been issued.

Sericulture is receiving much attention, in which connection the work of the Nankang University for improving the breed of silkworms should be noted. Endeavours are being made to introduce or to expand the industry throughout the province, every district having been ordered to start a training establishment for the purpose. Special attention is being paid to the matter in Chinkiang, where the rich waste lands are said to be very suitable; also in Yangchow and in Haichow. In the latter district some 800,000 mulberry trees have recently been planted. The chief obstacle to the extension of the industry is the arbitrary limitation of the number of cocoon hong in each district, which prevents the silkworm breeders from disposing of their cocoons to the best advantage and thus tends to restrict supplies.

A PRESS COMMUNIQUE dated Simla, the 28th May, 1919, says:—The Foreign Office have instructed consular authorities in countries concerned to cease the issue of Certificates of Interests. These Certificates will, therefore, no longer be required for goods

imported into British India. Certificates of Origin and Interest which are prescribed for goods imported from certain European countries will however continue to be required for goods imported into British India.

President Wilson in a cabled address to Congress on Tuesday said in part the question which stands at the front of every country amidst the present great awakening is labour. We cannot go further in the present direction. We cannot live our right life as a nation or achieve proper success as an industrial community if capital and labour continue to be antagonists instead of being partners. That bad road is no thoroughfare to real prosperity. We must find another leading not merely to accommodation, but also to genuine co-operation and partnership, based upon real community of interests and participation in control. The genius of businessmen and sound practical sense of workers can certainly work such a partnership out when they realise what they see and sincerely adopt a common purpose. The new spirit and method of organization are not to be brought about by legislation so much as by common counsel and the voluntary co-operation of capitalist, manager, and workman. Many great industries prostrated by the war wait to be rehabilitated in many parts of the world where what is lacking is not brains or willing hands but machinery, raw materials and capital. I believe that business men, merchants, manufacturers and capitalists will have the vision to see that prosperity in one part of the world ministers to prosperity everywhere. Our new merchantship may prove very welcome. Our great shipyards opened to the world will prove immensely serviceable to every maritime people in restoring the tonnage wantonly destroyed in the war.

In the House of Commons Sir Edward Nicholl suggested that following the introduction of Imperial Preference the Government might make representation to the Government of India that British manufactures entering India should receive reasonable preference over foreign manufactures.

Mr. Fisher replied that the Government of India would consider the bearing of Imperial Preference on their present tariff arrangements.

In the House of Commons, replying to Mr. Norton Griffiths, Mr. Fisher stated that including the hundred million war contribution the war expenditure of the Government of India to the 31st March was about £127,800,000 sterling. A further contribution was proposed by the Government of India and was at present under consideration. Indian Princes and others had contributed £2,100,000 sterling in cash, besides placing at the disposal of the Government of India considerable further sums for the purchase of horses, motors, comforts for troops, etc.

The *Times* Manchester correspondent dealing with the report of the Indian Cotton Committee says that Lancashire spinners point out that the staple will not improve unless the seed improves and the summarised report does not indicate the means by which the seed can be kept pure. Exception is taken to the statement in the report that cotton of $1\frac{1}{8}$ inch staple will spin 34's twist and 44's twist in Lancashire mills. It is asserted that staple for three yarns must be $1\frac{1}{8}$ inch.

The 'Bharat Itihas Sanshodhak Mandal' which was started in Poona in 1912 to encourage research work in Indian History and to collect material for such work, celebrated its seventh anniversary in Poona on May 30, and 31 and June 1. During these seven years of its existence the work of the association has been confined more or less to the History of the Mahrattas.

But even here the association has not been able to produce any research work of great value. Perhaps this is due to the paucity of workers of the right sort. The association has, however, done some good work in the matter of collecting material for the History of the Mahrattas. It now owns, says the last report, a collection of some 30,000 papers and a thousand other writings; some 125 pictures and photographs of historical interest; 10 copper plates; 150 coins and other articles. It also owns a library of some two thousand and more books. The special feature of this year's anniversary was the opening of the western wing of the projected building of the association. The ceremony was performed on the morning of May 30, by Shrimant Babasaheb Pantsachia the heir-apparent of Bhor. In a short neat speech the prince paid a tribute of respect to research workers like the late Mr. Kirtane, the late Justice Ranade and others and impressed upon the people assembled there the importance of research work in Indian History and promised his wholehearted support to the association. Among the papers read during the days of the anniversary were those written by eminent men like Prof. Rajwade, Dr. Gune and others.

The summary tables of the Agricultural Statistics of British India for the agricultural year 1917-18, just published by the Department of Statistics, India, show that the total area sown in the year 1917-18, was 265 million acres (including 37 million acres cropped more than once), the same as in 1916-17. This total area may be classified under the two main heads food crops (219 million acres) and non-food crops (46 million acres). Of the food-crops, the area under wheat increased by nearly one and a half million acres in 1917-18, that under gram by one million acres, and that under barley by half a million acres. The decreases are mainly under bajra ($2\frac{1}{2}$ million acres), jawar ($\frac{1}{2}$ million acres), rice ($\frac{1}{2}$ million acres), and other food-grains (one million acres). Among the non-food crops, the main increases are under cotton $1\frac{1}{2}$ million acres, linseed ($\frac{1}{2}$ million acres) and rape and mustard ($\frac{1}{2}$ million acres), while the area under sesamum decreased by about $\frac{1}{2}$ million acres and groundnut by $\frac{1}{2}$ million acres. The total area irrigated decreased by 2 million acres as compared with that of 1916-17.

The effect of the war on agriculture.

Agricultural year	Population (1911 Census) Millions.	Acreage (Million acres)			Average acreage per head of population		
		Food crops	Non-food crops	All crops	Food crops	Non-food crops	All crops
1913-14 (Pre-war year.) ...	240	202	44	246	'84	'18	1'02
1915-16 ...	240	215	40	255	'90	'16	1'16
1916-17 ...	240	220	45	265	'91	'19	1'10
1917-18 ...	240	219	46	265	'91	'19	1'10

As compared with the pre-war year the area under food crops at the end of the last agricultural year, June, 1918, was 8 per cent more than in the pre-war year owing to the increase on account of the war demands for wheat and gram. In regard to non-food crops the increase in the same period was 5 per cent, chiefly on account of demand for oilseeds, indigo, and fodder crops. The *per capita* acreage of foreign countries is also of interest. The figures for the United States of America, Canada, the United Kingdom, France and Germany before the war were as follows:—

United States of America	... 2'97
Canada	... 5'98
United Kingdom	... 0'39
France	... 1'49
Germany	... 0'94

The financial correspondent of the *Times of India*, writing on the great financial and industrial activities now progressing in Bombay, says that the latest enterprise talked of is a powerful British Indian combination for the production of finished steel goods from raw materials produced at Sakchi, and another scheme maturing is a project to connect the island of Bombay with the mainland opposite by means of a tunnel under the harbour and creating a new and bigger Bombay, there with docks and factories, drawing their motive power from the

vast hydro-electric power stations in the Western Ghats. Yet another is a project to manufacture aluminium out of bauxite on a commercial scale with the aid of the hydro-electric power. A big reclamation in Back Bay to relieve the congestion in Bombay is under the consideration of the Government of Bombay. There are daily rumours about the starting of new exchange banks and insurance companies, and all projects enumerated would cost well nigh Rs. 100 crores. It is felt in the city of Bombay that when all these projects are launched capital will be attracted from all corners of India, and there will be but little difficulty in raising the vast sums required. The support given to the recently floated companies has not been confined to Bombay city and Presidency, but has come from every part of India, and Bombay feels certain of the financial backing of the whole of India in all sound enterprises which it starts. The Indian industrial renaissance has begun, and Bombay seems destined to take a leading part in it.

The Department of Statistics has issued the following press notes regarding the prices of country produce and salt in India in the middle of May 1919:—The wholesale prices of cereals and pulses in India in the middle of May 1919, showed a rise of 4 per

cent as compared with the preceding fortnight, but it showed an increase of 88 per cent. (unweighted average) as compared with the average of the prices which prevailed at the corresponding date in the last three years. The weighted average showed a rise of 33 per cent. The price of rice rose by 60 per cent, Barley prices increased by 55 per cent, (unweighted average,) the weighted average showing a rise of 68 per cent. The price of jawar rose by 109 per cent, (unweighted average,) the weighted average showing an increase of 121 per cent, Bajra prices advanced by 111 per cent, (unweighted average,) while the rise by using the weighted average was 97 per cent, Gram showed a rise of 85 per cent. The average price of arhar dal increased by 87 per cent. The prices of ghi and raw sugar gur in India showed a rise of 37 and 57, respectively. The average price of salt in India advanced by 9 per cent.

The following is a summary of the available information relating to the Industrial resources of the Idar State in the Bombay Presidency:—*Stone quarries at Shivgadhi near Himatnagar.*—These quarries are the principal industry of the State; the stone is a superior kind of sandstone which is suitable for building purposes and finds a good market in Gujrat and Bombay.—Among the untapped resources of the State may be mentioned the following:—*Asbestos and Steatite.*—Deposits of these two minerals have been found in a hill between Kundol and Devni Mori in the Bhiloda Taluka of the State. *Mica.*—The mica mine is situated at Dobbada in the Vadali Taluka of the State. *China Clay.*—This exists along the bank of the Subarmati river near Eklara in the Idar Taluka of the State. *Manganese ore.*—This occurs near Bhemapur and Dhaniwada in the Meghraj district of the State. *Silica.*—At Vadali. *Granite.*—At Idar and Samlajee.

GLEANINGS.

In the trade returns of British for April, 1919, published by the Department of Statistics, India, imports amounted to £9,588,000, an increase of £439,000 and exports including re-exports to £15,021,000, an increase of £2,883,000, as compared with the corresponding month of 1918. There was a large decrease in the exports of food, drink and tobacco (mainly food-grains) which decreased by £2,303,000. Raw materials and articles mainly unmanufactured increased by articles wholly or mainly manufactured by £1,752,000 and £2,310,000. During April of the pre-war year 1914, imports amounted to £9,664,000 and exports including re-exports to £13,869,000.

According to a new Hungarian law, 80 per cent of war profits exceeding 100,000 kronen falls to the State. For sums not exceeding 100,000 kronen the war profits tax is as follows:—20 per cent on the first 10,000 kronen, 30 per cent on the following 10,000 kronen, and after that 40 per cent on then next 20,000 kronen, 50 per cent on the following 20,000 kronen, 60 per cent on the following 20,000 kronen, and finally 70 per cent on the next 20,000 kronen. Exemption from the increased war profits tax is granted to those persons whose yearly income does not exceed 25,000 kronen. The law comes into force as on 1st March.

Information has been received from His Majesty's Government that the Allied and Associated Governments have decided that after midnight of April 28th, all Black Lists of firms and persons which they have published or compiled shall be withdrawn and that all disabilities attaching to trade and communication with firms or persons on such lists shall cease to operate. The Allied and Associated Governments reserve right to re-introduce

all or any of such Black Lists should such action become necessary. The Statutory List and the China and Siam White Lists are accordingly withdrawn with effect from the 29th April, 1919.

Under the auspices of the American Asiatic Association it is proposed to hold an International Exposition of Asiatic Products in New York City in the spring of 1920. A pamphlet giving details of the exposition and its scope as well as information concerning the charges to be made for space, etc., has been received from the American Consulate-General, Calcutta, and may be seen at the office of the Director-General of Commercial Intelligence, No. 1, Council House Street, Calcutta, by parties interested.

It is announced for general information that the following instructions for the issue of licences for the export of mica have been issued to Collectors of Customs:—(1) Exports of mica of all descriptions are permitted under licence to the United Kingdom, as at present. (2) Exports of all sizes and qualities of mica splittings and block, other than first and second qualities of clear and slightly stained ruby block of all sizes, are permitted under licence direct to other British and to allied destinations.

Proposals are to be made for starting next session within the University of London, a special two years course for intending journalists and instituting a University Diploma in Journalism for such students. Leading members of the University have been formed into a committee for the purpose in conference with the Institute of journalists, the appointments Department of the Ministry of Labour and of the Board of Education.

A Press Note issued by the Department of Statistics, India, says:—The Government of India have just addressed local Governments and Administrations on the collection

of statistics of wages with special reference to agricultural wages and to the wages paid in India's chief industries. The collection and publication of these statistics will, it is proposed, be done annually in the Department of Statistics.

Sir Dinshaw Wacha has calculated that there were 13'6 yards of cloth for consumption in India per annum per head of the population in 1913-14, as compared with 9'28 yards, the annual average of the five years which ended on 31st March, 1910, or a shortage of 4'32 yards per year per head. The figures explain the cry of shortage and high prices of cloth.

It is now recognised that the hope of crippling Germany during the War by blockading her cotton supplies was illusory. From very early days in the War she relied on wood cellulose as a basis for her explosives. From wood pulp the German factories made the finest possible tissue paper, and by nitrating this converted it into explosive.

Germans are paying £7 for suits of clothes made from straw, paper, wood-fibre and peat. The cloth wears fairly well. Underlinen, bed-sheets and upholstery materials are now made from paper. Sweden is altering a number of cotton-spinning machines to be able to spin paper by German methods.

The Minister for Labour has ordered an inquiry into the measures realized or projected in French munition factories for changing their works from a war to a peace basis.

Japan exported 11,680,000 yen (say £1,168,000) of coconut oil and imported 13,050,000, or £1,305,000 worth of copra last year.

The number of paper-making mills in England is about 233 and the number of work people employed about 50,000.

SPEECHES AND PRONOUNCEMENTS.

INDIA AS A SUGAR PRODUCER.

Present High Price of Sugar.

The following is a note by Dr. C. A. Barber, Government Sugar Expert, on the Possibility of India Producing its own Sugar or Becoming an Exporting Country :—

There is a marked shortage in the supply of sugar all the world over. This appears to me to be due to two main causes. In the first place, there is a rapidly increasing consumption *per capita* in all countries, and, secondly, the huge supplies of beet sugar, hitherto exported from Germany, Austria, and France, and have been entirely cut off by the war. The world's pre-war consumption was about 18,000,000 tons yearly, and beet and sugar-cane were credited with about 9,000,000 tons each. The price of sugar is at present extremely high, and I regard as probable that the longer the war lasts the higher will it rise.

India has, as is well known, imported increasing quantities of sugar during recent years, the annual total reaching not far short of a million tons. This imported sugar used to come largely from Austria, more recently Mauritius entered the market, but at present it comes almost exclusively from Java. The world's shortage has made itself felt in India in that the retail price has nearly doubled. Can India, taking advantage of this, produce this sugar herself? Can she indeed look forward in the future to becoming an exporting country as she once was?

There are two basal factors to be considered before approaching this question. We do not know whether this rise in price will be more or less permanent, or whether, after the war, it will sink again to its former low level, and it is not an easy matter to start a sugar factory, and several years elapse before the solid foundations of such an enterprise can be laid. Sugar-making in India must be considered to a large extent as a new industrial enterprise, and the difficulties in the way are much greater here than in any tropical country where the cane is grown. A vital question is the price of sugar after the war. I have formed the opinion that it will take many years before it sinks to pre-war level, if it ever does. And I base this opinion on the following facts and considerations :—

- (1) There is a constantly increasing consumption of sugar in all countries and one effect of the war will be, I think, to give an impetus to this. I regard this

increase as a permanent feature for many years to come.

- (2) It seems probable that the British Government will take some steps to prevent the free dumping of sugar on the market by countries at present at war with us, and this will inevitably lead to an enhancement of the price.
- (3) There is a considerable dislocation in the beet-growing area in Europe, because the war has selected for its activities the particular area where beet is grown, and there has been a great and calculated destruction of property there. There will thus be less total sugar available. There is considerable shortage, even in Germany in spite of the cutting off of the whole of her export trade, and one of the lessons of the war will, I believe, be that it will be considered economical for much more sugar to be retained for internal consumption, both by man and beast, than was formerly done, in all beet-growing countries.
- (4) With one exception of importance, to be noted below, I do not apprehend any immediate great extension of sugar-cane tracts in the tropics. The following is according to my idea, the position of affairs. There are a very great number of countries in which the sugar-cane is grown, and great strides have been made, both in field and factory, during the last twenty years of agricultural revival. It does not seem likely that further improvements or extensions will be more than sufficient to keep pace with the normal increasing demand, with one possible exception. For the sake of brevity, I will merely consider Java and Cuba, easily the greatest producers at the present time. There are many reasons for thinking that Java has nearly reached the limits of its production, as the past few years, in spite of strenuous scientific control, have shown decreased out-turn on the estates, and it is generally conceded that practically all the good sugar-cane land has already been taken up. With Cuba it is different. It is a great unknown factor. But there are interesting figures available which show that this country is worthy of special attention,

It is, indeed, quite within the bounds of possibility that, in the near future, it may dominate the sugar position much as Brazil has done that of coffee. It has not, moreover, as yet been possible or necessary to bring to bear on it the laborious scientific work which has characterised the industry in Java, Mauritius, the West Indies, Louisiana, Hawaii and other places. It will be seen from the following figures that there is a great future in store for the Cuban sugar-cane crop.

Cuba's Sugar Production.

Before the war of 1898, it had reached 1,000,000 tons a year.

1897-1900	...	200,000 to 300,000 tons.
1901-1903	...	600,000 to 1,000,000 tons.
1904-1912	...	1,000,000 to 2,000,000 tons.
1913-1916	...	2,000,000 to 3,000,000 tons.

It is considered by some that the output this year may reach 3,500,000 tons. There are, I believe, great areas of rich land at present unworked, and capital and machinery are pouring into the country. There is little doubt that an important factor is thus introduced, which may have great influence on the future price of sugar.

THE DIFFICULTIES IN INDIA.

- (1) The class of canes grown in India. Roughly speaking, there are two great sugar-cane tracts in India, which differ fundamentally. The first is that in which thick tropical canes can be grown to maturity, often as well as in Java or the West Indies, the second is entirely given up to thin, hardy, fibrous, indigenous varieties generally unsuited for the economic production of sugar.

The first region consists of the Peninsula (Madras, Mysore, the lower parts of Bombay and the Central Provinces) and, curiously enough, Assam and Burma. This is the natural sugar-cane tract and is, in the main, in the tropics. The inclusion of Assam is due to its moist, equable climate, in which it resembles, perhaps more than any other part of India, the cane conditions of such a tropical island as Antigua.

The second region is extra-tropical. Bengal and Behar may be regarded as transitional, but, after passing the Rajmahal range of hills, a great change is noticeable in the character of the flora and the crops grown. We soon enter the wheat region, as contrasted with that of sugar-cane. This region includes the alluvial plains of the Ganges and Indus and extends into the north of the Central Provinces and probably of Bombay.

Now it is a curious fact, and a constant source of mystification to those not conversant with Indian conditions, that the acreage under cane in the sugar-cane tract is comparatively insignificant, and at least 90 per cent of it is to be found in what I have summarily termed the wheat tract. This is one fundamental difficulty in any extension of sugar-making in India. I am not prepared to discuss its causes in detail here, but would merely suggest that in the past, with comparative lack of communications and the presence of hardy indigenous kinds, the need of sugar or its equivalent gur caused the sugar-cane to become an integral part of the cultivation in North India, whereas the smaller populations of the south were more accessible from outside and had other sources of supply in their palm-forest. Furthermore, irrigation was necessary there, and the expenses generally of cultivating the thick tropical canes were out of all proportion greater than those of the northern kinds, and this undoubtedly checked expansion in the south.

- (2) Competition with gur. Besides the unsuitable character of the canes grown, a second difficulty in the way of extension of sugar-making in India is the fact that, beyond the importation referred to above, sugar is not an essential food of the people. They prefer jaggery or gur, an extremely impure form of sugar, which cannot, as a rule, be economically used as a raw material for sugar-making. The great mass of the sugar-cane grown in the country is used in the preparation of this commodity. The price is comparatively unaffected by the fluctuations in the world's sugar market, and the chief factors influencing the extension of cane cultivation are the general increase in population and the rise in the scale of living, the character of the season, and the prices of such other staples as are grown interchangeably with it. The relative profitability of the conversion of the cane juice into gur and sugar has therefore to be considered in each tract before any decision can be reached as to the possibility of founding a sugar factory there. I am not in a position to discuss this question, in its commercial aspects, but would merely draw attention to the fact that the contest between the two products is very unequal. Gur-making can be conducted by anyone who has the canes growing, accurate

tests regarding ripeness are unnecessary, no capital is required and the practice can be discontinued at any time. Sugar-making is a new enterprise in India, requires large capital and the difficult combination of many growers, can only be instituted after considerable preparation, and cannot be discontinued without serious financial loss.

- (3) Sub-division of the land. These difficulties are emphasised by the opinion, general in sugar-making countries, that for commercial success, the enterprise should be carried on on as large a scale as possible. A large block of land is needed, so compact as to reduce the heavy carting charges to a minimum, and the factory should have control over the fields so that it is kept constantly and evenly supplied with the canes. In the settled parts of the country, the holdings are small, and such sugar-cane as is grown is in scattered plots of small size. It is impossible to alienate the land for an enterprise of this kind, and it is difficult for any control to be exercised by the factory. This is a very important difficulty and practically rules out large areas in the sugarcane tract from the possibility of sugar-making.

- (4) Competition with other crops. The whole question of obtaining lands for sugarcane-growing will ultimately depend on the relative profitability of the crops usually grown. This will be referred to later, but it should be stated here that this rivalry varies with the tract, paddy being a serious rival in the irrigated parts of the Peninsula and in parts of Bengal, jute being the main rival in the sugar-cane land of Bengal and cotton in the canal tracts of the Punjab. These crops are not likely to be displaced and the extension of sugar-cane in such areas is therefore unlikely.

Summarising, the extension of sugar-making in India is handicapped by the extremely poor-character of the canes grown, by the unequal competition of gur where it has a steady and satisfactory market, by the relative cost of initiating gur and sugar-making, by the extreme sub-division of the land which renders it impossible to work a factory economically, and by the competition of crops already on

the land and which can be easily and profitably grown. We must turn to places where the price of gur is low, where the land is not fully settled, and where it is possible to introduce a better class of cane varieties.

PROSPECTS IN THE DIFFERENT PROVINCES.

I propose now briefly to pass under review the various tracts in India where sugar-cane is grown, in order to emphasise the fact that each has its own peculiar difficulties, and, incidentally, to see in which directions progress is more likely to be effected.

Madras can grow sugar-cane as well as any average place in the tropics. It, however, requires irrigation, and thus comes into competition with irrigated crops, mainly paddy. The latter crop is perhaps the easiest to grow in Madras, while sugar-cane is one of the most laborious and the most expensive. With present prices of paddy and the possibility of growing more than one crop in the year, it is not likely that sugar-cane will to any large extent replace it, even under favourable conditions. Where, however, large quantities of subterranean water are available, paddy competition is ruled out and the matter is less complicated, in that garden crops (those irrigated from wells) also require a good deal of labour. Ragi (Eleusine coracana), groundnut, and cholam (Andropogon Sorghum) may be regarded as typical of these. These are the new competitors, and the sugar-cane has a better chance, especially as the individual fields are larger. As an example of successful work in sugar-making in such a tract, I would refer to the sugar factory at Nellikuppam in South Arcot. Here, with a better class of cane introduced by the work of the Samalkota Government farm, with larges stores of subterranean water and an easily workable soil, sugar-cane cultivation has made great strides. By suitable advances, the distribution of manure, and the abundant supply of water by powerful engines, it has been found possible to induce the ryots to grow large fields of sugar-cane and bring the canes to the factory. But such areas are rare indeed in Madras, and it has always seemed to me as if a bit of the alluvial plain of the Ganges had been here-inserted between the hard red and stiff clay soils of the Peninsula. The tract is, in fact, composed of the alluvium of two rivers, the Gadilam and Ponniar, and is the centre of the groundnut cultivation in India. From what I know of the conditions prevailing in other parts of the Madras Presidency, I do not consider it likely that any great extension of the sugar-cane cultivation will take place, and the foundation of many sugar factories appears to be less likely still. I have dealt with Madras rather fully because it can grow

such good thick canes, and this fact is constantly laid hold of by those who wish to extend sugar-making in India.

Mysore.—I am not very conversant with the conditions in Mysore, but a good deal of sugar-cane is grown there. It is not a paddy country and the population is comparatively sparse. The rainfall is not great and irrigation is necessary. With the extension of irrigation projects or the discovery of subterranean water supplies, it is not inconceivable that sugar factories may be started, but I would defer to the opinion of the Director of Industries, who has, I believe, made a special study of the question.

Bombay.—Here the problem is again entirely different. The competition of paddy is removed. Excellent cane crops are raised on the rich volcanic soils, and the juice is very rich in sucrose. Yet the area under sugar-cane is insignificant. New Irrigation projects are nearing completion in unoccupied tracts, and it is expected that a large part of these will be planted with sugar-cane. Whether this is utilised for gur or sugar-making, will presumably depend on the prices ruling, but it should not be difficult to obtain large compact blocks if the latter is decided on and the capital is available.

The Central Provinces.—These are on the line of demarcation between the two great sugar-cane tracts in India, and excellent crops of thick canes can be grown in the southern part of the area. The population is sparse, and there is a considerable development taking place in opening up new irrigation works by which considerable areas will be available for sugar-cane-growing. There is indeed reasonable hope that a great deal more sugar-cane will be grown in the near future. But the amount grown is at present extremely small, the price of gur is very high, and the local Agricultural Department do not consider that sugar manufacture can be undertaken on the new land in competition with gur.

Bengal is a great paddy-growing country, but this is chiefly in lowlying land unsuited for sugar-cane. The higher land, with sufficient water to do without irrigation, is, however, fully occupied by jute, which has nothing to fear from competition with sugar-cane. Good thick canes can be grown in many parts but, in spite of this, the varieties are, on the whole, exceedingly poor and primitive. There is undoubtedly room for considerable improvement here, but the Agricultural Department is under special difficulties in Bengal. The population is very dense, and I do not think it likely that large blocks will be available for sugar-cane-growing, even with improved varieties.

Assam.—The unique geographical conditions of

Assam have already been referred to. The population is very sparse and there are large unoccupied areas in Lower Assam on both sides of the Brahmaputra. The unhealthiness of the country has, I believe, improved of late years, and there is some likelihood of the increasing masses of Bengal pushing their way into the Assam valley. An experiment on a large scale has been made by Government, to see if these great unoccupied areas can be utilised for the growing of sugar-cane. The first stage in this experiment has now been reached, and it is evident that, with certain precautions, thick canes can be grown with great ease over large areas of the grass land in Kamrup. There are special difficulties in the way, such as control of surface water, absence of communications, and scarcity of labour, which has to be introduced, but these are to all appearances being successfully overcome, and the prospect is distinctly encouraging. There is a very large amount of land of a nature similar to that on which the farm is placed. The local price of gur is, I believe, high, but the demand is not excessive, and it seems more probable that the limiting factor will be the prices ruling in the great Bengal market.

Behar.—The canes in North Behar are the thin indigenous ones common in North India, although there are some indications that selected thick canes may be grown with advantage. Behar is, in fact to some extent a transitional region between the great sugar-cane tract in North India and the more tropical area of Bengal and Assam. There are a number of sugar-cane factories working, and these, I believe are, in the main, successful. I am led to think that this success is largely due to the fact that the country is one in which the European planter has worked for many years. He has capital, a crop is needed to replace indigo, the people have long been accustomed to work with him and grow the crops for his factories; he has a certain amount of control over the crops grown and not infrequently a certain amount of land is attached to the factory to form a basis for cultivation. The price of gur, although rather high at present, is, I believe, as low as anywhere in India, so that, from the contiguous part of the United Provinces, it is sent as far as the Central Provinces and the Punjab. The pressing need in Behar is, to my mind, the suitable location of a first class sugar station where varietal and other experiments can be instituted with a suitable staff for combined work with the planters. I am told that the local agriculture leaves much to be desired and the canes certainly need replacing by better varieties.

United Provinces and Punjab.—The special conditions in Behar and Assam are absent further north-west, and the prospects become increasingly less satisfactory. The canes grown are excessively

thin and fibrous, the yield per acre is small, and the percentage of sucrose in the juice is often low. This would, further-more, greatly enlarge the area required for an up-to-date factory, with an increase in the cost of cartage. The fields are small and scattered and the cultivators are unaccustomed to sell their crops to a central factory. I do not think that there is much prospect of instituting sugar factories in this region, under present conditions.

WORK IN PROGRESS.

A great deal of work is being carried out on this crop by different Agricultural Departments, but this is scattered and deals with purely local problems. Two experts have been entertained by the Government of India, both of whom are located in provinces and under the local authorities. A Sugar Engineer is engaged in the United Provinces and a Sugar-cane Expert in Madras. With the work of the former I am not acquainted, and I propose here only to deal with the latter, in that I consider that the fundamental problem before India is the improvement of the class of canes grown. This is the problem for the solution of which the Cane-breeding Station has been started at Coimbatore. The main line of work is to replace the local North Indian canes by seedling canes and this, unfortunately, cannot be done in North India because the sugar-cane does not flower there. Attempts are being made to obtain new varieties by crossing thin indigenous canes with thick tropical ones, thus combining useful characters of the two classes. Hardy, moderately thin, rich canes are aimed at which will grow in North India to maturity and be able to withstand the local indifferent treatment at the hands of the ryot. That such an ideal is not unattainable is shown, in the first place, in that crosses have been obtained, although not at present in sufficient quantity or sufficiently studied for distribution, and secondly, because a trail of such a cross has been rendered possible by work in Java. A seedling cane raised there under the No. Java 36 was obtained in Madras and forwarded for trial by the Sugar-cane Expert to Shahjahanpur. It was obtained in Java by crossing the local Chunnee of Shahjahanpur with the rich Cheribon of Java. It has been tested now for some years at the Shahjahanpur farm by Mr. Clarke, and the latest accounts have been very favourable, in that last year all the available sets (some nine lakhs in number) were eagerly taken up by the cultivators. Another variety was introduced by the advice of the Sugar-cane Expert into the Partabgarh farm, and it has rapidly extended until, in the present year, some hundred acres are under it near that place. These two cases are given as a sample of the work which it is intended to carry out when the new varieties being evolved

at Coimbatore are ready for distribution. Altogether some 130,000 cane seedlings have been raised at the Cane-breeding Station, and it is confidently anticipated that, from among these, and those still being obtained, it will be possible to allocate suitable seedlings of every part of India. It has been estimated that the results of the introduction of new and better canes into Madras some years ago by the Samalkota Sugar Station have culminated in a gain of Rs. 25 per acre, totalling Rs. 25 lakhs a year. If the improvement in North India reaches the modest sum of Rs. 5 per acre, it will mean ten crores a year in the ryots' pockets.

It is perhaps needless to point out that if such an improvement can be brought about, the question of sugar-making in India will enter on an entirely new phase. The price of sugar would be regulated all over the country, and possibly considerably reduced by the greater yields obtainable, and there would be a surplus available with more suitable cane varieties for the flotation of sugar-making concerns. But the whole question has its complications, and I do not think that useful results can be obtained with certainty, unless a large view is maintained and the work is properly organized.

FOUNDING OF A SUGAR DEPARTMENT FOR INDIA.

For this purpose I would suggest the formation of a small Sugar Department for India, to be placed directly under the Agricultural Adviser to the Government of India. I would indicate some of its objects in the following manner, but it is inevitable that the relative importance of the different line of work would only be clearly understood as progress could be reported:—

- (1) The collection into one office of the scattered information recorded regarding the character of the sugar-cane tracts in India, the varieties grown, the methods of cultivation and of making the finished product.
 - (2) The collection of similar information regarding all previous attempts at founding sugar factories, with the reasons for their discontinuation.
- Much of this information (under 1 and 2) is now to be found in the files of various Secretariat and other officers in the provinces, but it is not available and it is desirable to get it together, collate it, and, doubtless in some cases to publish it in book form or otherwise to serve as a basis for future work.
- (3) A continuation of the work on improving the class of canes growing in different parts of the country.
 - (4) An organized investigation into the local practices of sugar-making throughout the

country, with the object of introducing improvements according to the local conditions.

- (5) A special study of the possibility of starting a sugar-making industry in the various tracts where sugar-cane is grown.

For such a Department to be effective I would suggest the attachment of the following experts:—

- (1) A Sugar factory Expert. He should be thoroughly acquainted with the conditions in India as regards factory work, labour difficulties, general cultivation and the use of by-products. It would be an advantage if he had a working knowledge of the factories and plantations in Java, where the conditions are somewhat similar to those in India.
- (2) An Engineer, for the study of existing installations and the preparation of new models and combinations for gur and sugar-making.
- (3) A Chemist for the study of the cane juice and fibre, to conduct ripening tests and *manurial experiments*, and to assist in the factory work.
- (4) An Agriculturist, whose main duty would be to study the local conditions of soil and climate as affecting the need of irrigation and drainage, the proper times for planting and reaping and the relative period of growth in different tracts.
- (5) A Botanist, for the study of the numerous articles existing, the transference of varieties from place to place and the raising of new seedling canes for each tract.

Such a Department would, at the outset, be largely engaged in collecting material already existing in the country, so as to gain experience as to the proper lines for work. It should therefore be in close touch, consultatively, with the Provincial Departments of Agriculture interested in the crop and should be prepared to assist and further any work now being carried on by advice or in any other way. Where local effort is considered insufficient it should inaugurate installations or experiments on its own initiative, but I would specially desire that local efforts should be encouraged, because the officers on the spot will of necessity have the most reliable *first hand information as to the conditions and possibilities of their tract*. The work at present being conducted on sugar and the sugar-cane is scattered and, for the best results to be obtained, I feel sure that it needs to be organized under one hand.

TRAVANCORE.

HOW TO EXTEND THE AREA.

Dr. N. Kunjan Pillay, M.A., B.Sc., F.H.D., Director of Agriculture writes as follows:—

Travancore is not a large sugar-cane-growing country. Sugar-cane is now cultivated only on the lands lying by the sides of some of the rivers, and the total area may not exceed 10,000 acres. But there are facilities for the extension of this cultivation. Some of the wet lands in North Travancore and the low lands lying scattered among the hills on the Eastern portion of the country can profitably be brought under sugar-cane, and arrangements are being made for extending the crop to these areas. In the north more than 50 persons have started sugar-cane cultivation under instructions from the Agricultural Department, and the successes that they are meeting with will surely induce many more to follow in their footsteps. In the hilly district also several persons have of late begun sugar-cane cultivation, and this year a joint-stock company has got registered 1,000 acres, the major portion of which is going to be put under sugar-cane. The increase in the price of sugar brought about by the war is opening the eyes of Travancore people to the profits that await them if they only take to sugar-cane cultivation, and as a result of the present activities one can look forward to an appreciable increase in the area under sugar-cane in the near future. The Agricultural Department is helping the cultivators by giving them instructions and advice and by supplying them with sets of good varieties of canes.

HOW TO INCREASE THE YIELD.

The present average yield of jaggery in Travancore will hardly be more than two tons per acre. This low yield is due to the defective methods of cultivation, particularly insufficient manuring. The manure that is commonly used for sugar-cane, if anything is used at all, is wood ash. The maximum quantity that is applied is not more than 6,000 lb. per acre. A good many cultivators use considerably less than this quantity, while not a few completely dispense with the use of manures. With a view to demonstrate the possibility of increasing the yield of jaggery by the use of proper manures the Agricultural Department carried out some experiments during the last two years. The experiments were conducted on one acre plots and the results shown below can therefore be considered reliable.

	Manures	Quantity applied per acre	Yield of jaggery per acre
1915—1.	Wood ash	6,000 lb.	5,520 lb.
2.	Wood ash	3,000 "	7,440 "
	Oil cake	1,800 "	
	Fish refuse	600 "	

1916—1. Wood ash ...	6,000 ..	6,160 ..
2. (Wood ash ...	3,000 ..	} 7,700 ..
Oil cake ...	1,800 ..	
Fish refuse ...	600 ..	

The ash used contained about 1.5 per cent of potash and 0.75 per cent of phosphoric acid. The oilcake used was that of *Hydnocarpus Wightiana* and contained 1.5 per cent of potash, 1.2 per cent of phosphoric acid and 4 per cent of nitrogen, and fish refuse contained 5 per cent of nitrogen and 4 per cent of phosphoric acid. Thus the ash plot received about 90 lb. of potash and 45 lb. of phosphoric acid, while the other plot received 92 lb. of potash, 67 lb. of phosphoric acid and 102 lbs. of nitrogen. It may probably be necessary to vary the composition of the mixture which can only be done after further experiments. The two experiments described prove clearly the advantages of the mixture over ash. The increase in the yield of jaggery was in the one case 1,920 lb. and in the other 1,540 lb. or on an average 1,730 lb. At the present market price of jaggery the value of 1,730 lb. is about Rs. 150, and the difference in the price of the manures used was only Rs. 25, the mixture costing Rs. 55 and ash Rs. 30.

It is clear from what has been stated above that by the use of proper manures an acre of sugar-cane will yield 3 to 3½ tons of jaggery. The average yield at present in Travancore, as already stated, is not more than 2 tons per acre. If all the existing 10,000 acres are cultivated with proper manures the total out-turn of jaggery can be increased from 20,000 tons to nearly 35,000 tons. The Agricultural Department is doing all it can to induce the sugar-cane cultivators to use the manure mixture which has produced such striking results. The Department has opened this year a manure depot in an important sugar-cane area, and the cultivators in the neighbourhood have purchased manures for nearly Rs. 1,000 in the course of 2 or 3 months. There would have been a much larger sale if arrangements had been made to sell manures on credit and to realise the price during harvest time. If such a system is introduced and manure depots are opened in other sugar-cane areas also, it is possible to make manures widely popular among sugar-cane cultivators and thereby bring about a substantial increase in the out-turn of jaggery in the country.

MYSORE.

EXPERIMENTAL WORK.

The following are the views of Dr. Leslie Coleman, M.A., Ph.D., Director of Agriculture:—

- (a) Testing varieties. The results of the past three years have shown conclusively

that Red Mauritius cane is a higher yielding variety than any of our local canes. This has been corroborated by nearly all the demonstrations held on private lands. Careful tests on the Hebhal farm indicate that we may anticipate an increase of yield of from 15 to 20 per cent by the introduction of this variety.

- (b) Manurial tests. The results of manurial experiments with different quantities of local oilcakes indicate that doses up to two tons of castor cake per acre are very profitable at present prices.
- (c) Spacing tests. Experiments have shown that the present planting distance for sugar-cane (rows 1 ft. to 1½ ft. apart) is too close and that yields at least as good can be obtained by planting twice the distance apart. This is of particular importance in the rapid introduction of new varieties.
- (d) Work on seedling canes. A large number of seedling canes have been tested and some of these are giving distinct promise. The most promising seedlings are those of White Mauritius, Striped Mauritius, and Red Mauritius. Seedlings are being selected for vigour, purity of juice, and high sucrose content. The weakness of Red Mauritius is the impurity of its juice and its comparatively low sucrose content; its strength is its great vigour. Some of the seedlings obtained from it promise to be just as vigorous as the present and to yield a very much richer and purer juice.

ESTABLISHMENT OF NEW FARMS.

Two new experimental farms which will be devoted largely to sugar-cane cultivation have been established within the past two years. One of these is situated under the Marikanave Reservoir where there is an area of about 20,000 acres, 10,000 of which could be devoted profitably to cane. The soil is rather poor and distinctly alkaline, and the work of this farm will have to do with the best means of improving the soil and preventing the increase of alkalinity. The other farm is situated under the new Kannambadi Reservoir where it is anticipated that we shall be able to increase our sugar-cane area by 30,000 acres annually. Here the function of the farm will be largely the testing of varieties, the supply of seed, and the demonstration of improved methods of manuring and cultivation.

On the former of these farms a power mill is being installed.

DEMONSTRATION WORK.

- (a) Introduction of new varieties. This work has, up to the present, been practically confined to Red Mauritius and an unnamed Java cane. We have been distributing cane in small lots from our central farm for several years, but it has been found that this is an extremely wasteful method as a great many of the sets become damaged in transit. A somewhat novel scheme is therefore being developed for the establishment of a large number of supply centres. Sugar-cane sets are supplied from our farms and are delivered to sugar-cane growers free of charge on the understanding that double the number of sets are returned the following year. These are then distributed under the same conditions the following year. By this method a large number of supply centres are being established and a very rapid introduction of improved varieties will result. As soon as tests on our farms reveal other varieties of outstanding merit they will be distributed in the same way.
- (b) Popularisation of the use of oilcakes as manures for sugar-cane. While the best sugar-cane-growing districts of the State use oilcakes in large quantities as a manure for cane, in over half our area the use of oilcakes was practically unknown till the Department took up the work of popularising their use three years ago. The scheme followed is an interesting one. Large quantities of oilcakes (about 100 tons) were purchased by the Department and were given out in lots sufficient for one or two acres in areas where the use of oilcake was rare or unknown. Those receiving the cake agreed to pay the cost at the end of their harvest season when the results of the manuring could be seen. The results were almost without exception favourable and the demand for manure increased. During the first two years the manure was advanced without interest, but during the present year interest at 6 per cent is being charged. As the price of local cakes

had increased greatly and as further more they were being taken up by local sugar-cane growers, the Department got into touch with oil-pressers outside the State in Bombay and Madras Presidencies with the result that we have been able to obtain our supplies at a much lower rate and at the same time have not in any way disturbed the local supplies. During the past year about 300 tons of groundnut and safflower cake, two cakes which have been practically unknown to Mysore sugar-cane-growers and which are much richer than our local cakes, have been distributed. A scheme is being developed for the crushing of the large supplies of oil-seeds (chiefly castor and groundnut) which are now being shipped out of the State. It is proposed to erect a large oil-seed-crushing plant under the control of Department of Industries and Commerce, the Department of Agriculture to take over the distribution and sale of the cake in new areas. The scheme contemplates the production of between 1,000 and 2,000 tons of cake per annum. If the scheme is successful similar plants are certain to be established by private agency, and it may perhaps not be too sanguine to anticipate that within the next ten years we shall find the bulk of the oil-seeds which are now being exported utilised in the State.

AGRICULTURAL EDUCATION.**Agricultural Middle Schools in Madras.**

The Madras Government have issued the following Order No. 844, Revenue (Special) dated 1st May, 1919:—

On a consideration of the recommendations of the Conference on Agricultural education held at Simla in June 1917, and of the Board of Agriculture held at Poona in December 1917, the Government decided to open two agricultural middle schools in the Presidency as an experimental measure and appointed a committee of officers of the Agricultural and Educational departments to formulate detailed proposals for the establishment of these middle schools. The Committee was also requested to consider resolution XIII of the Board of Agriculture, 1917, on the subject of the improvement of rural education based on rural needs in the Presidency.

2. The Committee has now submitted its report on the subject of agricultural middle schools. The Government have read with interest the careful and detailed proposals of the Committee and accept its recommendations, subject to the following remarks:—

(i) The Committee considers that two agricultural masters will be required for each school and that, as only two suitable men are now available only one school can be opened at the outset. The Committee proposes to locate the first school at Taliparamba in North Malabar. The Government fully appreciate the importance of inaugurating these schools under conditions which will give them a fair chance of success and accordingly approve the proposals for the opening of the school at Taliparamba in May 1920. The Government do not however consider that the opening of a single school will furnish sufficient data for the formation of any decided opinion as to the success or failure of the experiment. Moreover the Government have already undertaken to open two schools—one of which was to be in the Tamil country and the other in the Telugu tracts. In order therefore that a full trial may be given to the scheme, they request the Director of Agriculture to submit proposals at a very early date for the opening of two more schools at suitable centres in these tracts. Information should be furnished as to the earliest date when these two schools can be opened. The Governor in Council observes that a

fresh batch of agricultural diplomates will be available in June 1919, and another batch in January 1920, and it should be possible to spare four competent subordinates who, with a further training in pedagogy, can be posted to these two schools.

In view of the delay that has already occurred the Government attach great importance to the opening of the school at Taliparamba in May 1920, and the Director of Agriculture is therefore requested to submit as soon as possible, in consultation with the, Director of Public Instruction, plans and estimates for the buildings required at Taliparamba. The additional land which is needed for the purposes of the school should be selected at once and proposals for its acquisition should be submitted without delay.

(ii) In paragraph 11 of its report the Committee recommends that the candidates to be recruited for appointment as teachers in the agricultural schools should, while undergoing training both at the Agricultural College and subsequently at the training school, be granted a stipend of Rs. 20 per mensem. The Government are unable to accept the Committee's proposal in its entirety. They consider it sufficient to grant the stipend only during the period of training in pedagogy in the training school. No scholarships are at present awarded at the Agricultural College, Coimbatore, and it will be difficult to select students to be teachers at the agricultural schools before they have undergone any training at the agricultural college.

(iii) The Committee's proposal to charge an inclusive fee of Rs. 15 per term per pupil is approved, but as recommended by the Board of Agriculture in resolution XIV (iv), the desirability of making these schools as nearly self-supporting as possible should be steadily kept in view. The Director of Public Instruction is requested to report after some experience has been gained of the working of these schools whether the fees may be enhanced.

(iv) In paragraph 17 of its report the Committee suggests a staff of two agricultural teachers and one non-technical teacher for the school and recommends that the agricultural officers, one of whom will be the head-master, should get a local allowance of Rs. 30 and Rs. 10 per mensem respectively in addition to the pay of their grades in the regular line. A pay of Rs. 50 is proposed for the non-technical teacher. The Government accept the proposals as regards the strength of the staff and the pay of the non-technical teacher but are not convinced of the necessity for the allowance proposed for the agricultural masters. The two agricultural officers selected for the posts of teachers at the school to be opened at Taliparamba should begin their training at the secondary

training school attached to the Teachers' College, Saidapet, in July next. The Government doubt whether both these teachers will be required in the first year of the working of the school when there will be only one class with 20 pupils. The Director of Agriculture is requested to report whether it will not suffice to employ the second agricultural teacher in 1921 when the second year class opens.

The Committee has recommended the appointment of a matron on Rs. 15 per mensem for the school. The Government doubt the necessity for this appointment and would be glad if the Director of Agriculture will, in consultation with the Director of Public Instruction, report what duties are to be entrusted to the matron and whether such an appointment is indispensable at the proposed school.

The head coolie proposed by the Committee should, when appointed, be paid from contingencies.

(v) The recommendations of the Committee in paragraph 19 of its report on the subject of the preparation of the text-books on agriculture and nature study, mathematics and geography are approved. Mr. Wood having since been appointed as Director of Agriculture, the Government doubt whether he will be able to prepare the text-books on agriculture and nature study in addition to his duties as Director. In the event of his being unable to undertake the work, he is requested to report which officer should be entrusted with the preparation of the books.

The Directors of Public Instruction and of Agriculture are requested to report not later than 15th June, 1919, whether the officers whom they may select for the preparation of the text-books should be placed on special duty or whether the work can be undertaken by these officers in addition to their ordinary duties and without detriment to those duties. The suggestion of the Committee for the grant of a remuneration for the compilation of the text-books will be considered on receipt of the report called for.

3. The Committee have not expressed any opinion as to the age and qualification of the candidates seeking admission in the proposed schools. The Director of Agriculture is requested to report on these points.

TOPICS FROM ECONOMIC PERIODICALS.

QUEBEC'S PAPER AND PULP INDUSTRY.

An interesting review of the remarkable growth of the Pulp and Paper industry in Quebec and its prospects of further advancement is given by Mr J. C. Ross in the *Canadian University Magazine*. He mentions that the value of paper and pulp exported from Canada exceeds that any other of her manufactured goods with the exception of munitions, which is now a thing of the past. From the pitifully small \$122 worth of paper exported 27 years ago, the exports of pulp and paper now exceed \$96,000,000 and the end is not yet. Mr. Ross proceeds:—

The success which has been attained by the pulp and paper industry is not a matter of chance of haphazard effort. For the success of industry three essentials are required namely, abundant water power, large available forest resources, and a plentiful supply of labour. The province of Quebec possesses these to a remarkable degree. Out of the Dominion's total water power, amounting to 18,000,000 h.p. Quebec has 6,000,000 or one-third but only a seventh of this power has been tapped by Engineers. In addition to that the rivers and streams of the Province nearly all flow to the south which carry the products of forest and factory towards the great markets of the United States. In regard to the Forest wealth, over one half of the total pulp resources of Eastern Canada or 300,000,000 cords, are located in this province, while in the matter of labour the French lumberjack is without an equal in the world. Altogether its water power, raw material, labour, shipping facilities, and nearness to a great market, combine to make this province one of the world's great pulp and paper manufacturing centres.

The remarkable growth and expansion of the pulp and paper industry in this province is directly traceable to the far-sighted policy put into force by the Gouin Government. Legislation was passed a decade ago prohibiting the export of pulp wood cut from crown lands, and as a result of this policy American paper manufacturers, who formerly depended on this province for their supply of raw material,

were forced to move their plants to Quebec, and manufacture the pulp wood into paper on this side of the border. At the same time the Government adopted the most progressive measures in regard to conserving the water power of the province and safeguarding the forests by instituting thorough fire protective measures. In addition every possible assistance and encouragement is given to those who desire to go in for re-forestation and the scientific cutting of their timber resources, while the forest Products Laboratories at McGill continue to do a most useful work of an experimental nature.

To-day, as a result of wise legislation and favourable natural resources Quebec province has over forty pulp and paper mills located within her borders, or almost half of all those operating throughout the Dominion. While the growth of the industry has been most rapid in the last few years it is by no means of a mushroom nature. It has developed throughout the years until to-day, it is almost the most important manufacturing industry.

The United States is becoming more dependant on Canada for her pulp and paper. Quebec has the largest available supply of pulp wood on the continent, the greatest power resources, and as the nearest province to the large consuming centres of the Eastern States, it must continue as the great source of supply. The provincial authorities and the heads of the great paper mills in the province are fully alive to the situation and are prepared to "carry on" to a still greater extent. It is not only to the United States that paper men are looking for the markets; they find that there is a great demand for Canadian paper products in South America, South Africa, Australia and other parts of the world. In order to take care of the export business, the paper manufacturers have formed an Export Association which has for its object the closest possible relations between the manufacturers, thereby securing a standardised product and also greater efficiency in marketing and selling the output.

The pulp and paper industry of the Dominion is one of our great basic industries, and is not dependant upon artificial aids for its maintenance. Within the last few years it has gone upon a staple basis largely through the employment of technically trained men in its mills, through the adoption of conservation policies in regard to the care and cutting of its forests, as well as by the use of the re-forestation, the standardisation of its products, and the adoption of progressive measures of manufacturing and marketing until to-day it is not only the most important exporting industry, but is destined to be the most important of all Quebec's manufacturing industries. The development of the pulp and paper industry in

INDIAN EXPORTS TO GREECE

Possible lines of export.

Mr. D. T. Chadwick, I.C.S., Indian Trade Commissioner in London, has furnished this Department with some interesting particulars obtained from a reliable source, on the prospects of India's export trade with Greece. These particulars are summarised below:—

Cotton Yarn and Cloth.—Before the war cotton yarn was imported from India to all the Balkan States, but only in the lower counts from 4—12, the higher counts being found weak and consequently avoided; thus the demand for such higher counts was filled from Italy for 12—14, and from England for higher numbers. Now that Indian spinning mills have greatly improved the qualities of their higher counts, and are in a position to produce 20's and even higher counts, a considerable business may be anticipated. All the yarns exported to the Balkan States is made up in 10 lb. bundles, leareeled, each bundle cased in cardboard backs and wrapped in paper with the number stamped on the outside. There is also a large business transacted with the Balkan States in Extra Hard Twisted Yarn (Crape Yarn). Local spinners, in producing such yarn, from cotton grown in Greece (corresponding in quality to good Indian cotton) use it as a basis for the twist, the square root of the count multiplied by 7 or 8 instead of the $3\frac{1}{2}$ to 4 for water twist. Such hard twisted yarn is sold in Nos. 4 to 20 and higher.

Large quantities of yarn also imported bleached and dyed (blue and red principally).

As far as cotton goods are concerned, the Indian production is unknown in Greece. The class of goods which could be manufactured in India, and which would have a ready sale in Greece, would be cloths, sheetings, Cabots, etc. In view of the shortage of stocks in the Balkan States, a large business is to be foreseen in all lower classes of cotton goods.

Importation has recently commenced from Japan of Cabots and T cloths which have created a fair impression on the market.

Cleaning Waste—(from Cotton yarn).—Would be of great interest.

In all articles mentioned above full assortment of samples would be necessary:

Vegetable Oils.—All these are imported in large quantities (Linseed Oil, crude and boiled), Castor Oil both for medicinal and industrial purposes, other oils for soap manufactures, and would greatly interest Grecian markets.

Oil Seeds.—These would not be of great interest for the Balkan States at present as the oil producing industry (with the exception of olive oil) is still in its infancy.

Spices.—Pepper is imported in considerable quantities and would be of interest, and other spices also.

Indian Coffee.—This is practically unknown, the Brazilian article being exclusively consumed. The Greek Government recently imported a quantity of Indian coffee but it was not generally approved.

Tea.—Both Indian and Ceylon tea are largely consumed in the Balkan States.

Wheat.—At the present moment practically all the wheat consumed in Greece comes from India, but for the time being is a State monopoly.

Other articles, which would be of great interest to all the Balkan States and in which a large trade is transacted, are :

Hessian Cloths and Sacking, in all weights and widths.

Bags for various purposes.

Mineral Oil.—Large quantities are imported of Crude Oil, Lubricating Oil and all other petroleum products, which would be of interest, provided that, when transport conditions resume normal level, prices, in combination with freight, must compare favourably with those of American Oils.

Raw Hides are imported in large quantities to be tanned locally.

Before the war a great part of the merchandise from India for the near East, was carried by Austrian Lloyd steamers and landed and Trieste, thence transhipped to destination by steamers of the same company. Such a procedure, entailing considerable delay and extra expense, was naturally not conducive to the development of business with India. It is hoped that arrangements will be made permitting retranshipment of such goods at Port said in the future.

ECONOMIC NOTES.

AGRICULTURE.

Plantain Stalks as Fodder for Cattle in Famine Years.

The Bombay Department of Agriculture has issued the following leaflet (No. 1 of 1919):—

In years when fodder is abundant, a considerable amount of even good fodder, such as *jowar* stalks or wheat chaff, has no value to cultivators. But in years of scarcity, anything that will even barely maintain the life of cattle, becomes invaluable. Spear grass from the Mallad tract, which would not even be smelt by the cattle of the tract where wheat is usually grown, has now become the chief source of fodder in that tract. Leaves and pods of many varieties of trees are being used as fodder by cultivators to save their cattle. The use of prickly pear is being demonstrated as fodder in places where it is available. In times of scarcity in fact, such as the present, many things have to be used which would normally not be thought of. And the only question at present is to find material that is available and will keep cattle alive and in health.

Among the several kinds of fodders hitherto known in this part of India, in famine time, no mention seems to have been made of plantain stems, though its leaves, which are employed as dining plates, are sometimes given to cattle after their use. However for this purpose our experience this year has shown that plantain stems, their leaves, and even the roots, have been regularly fed to cattle in certain villages of Belgaum District as famine fodder without any injury to the health of the cattle. The way in which the feed is prepared from the stem, and the quantity given to work and other cattle, and its good or bad effects on the cattle fed, is indicated below for the information of such cultivators as may have plantain gardens of their own, or be able to get stems from other gardens:—

The stems of plantains, after the bunches are removed, are cut about six inches from the ground and are usually thrown in a pit without being used for anything. Instead of this they should be cut close to the ground, or dug out to a depth of about six inches below the ground. All dry leaves or the dry sheaths should be removed. The remaining

green stem, with the sheaths and its core should be cut into small slices by a sharp sickle or a *koyata*. This is easily done by cutting the stem crosswise. The pieces thus cut, can immediately be fed to cattle without any addition of salt or mixtures of other foods to the slices.

Buffaloes eat the slices very readily. Some cows and bullocks do not like them at first. Experiments conducted on Dharwar and Gokak farms, in feeding plantain stems to farm bullocks for one month, prove, that one meal during day time can safely be given to work cattle. The highest quantity given for each work bullock was up to twenty pounds per day. These bullocks received, in the evening, the usual quantity of kadbi (half the daily quantity) and the concentrated food, and the meal during the day time consisted entirely of plantain stems. The condition of the cattle was tested by actual weighments before and after the experiments of feeding plantain stems. There was not the slightest loss in weight.

It is a general belief among cultivators, that cattle fed on plantain stems may purge, and consequently lose condition. Actual experiments have proved that such is not the case. The dung of cattle, fed up to 35 pounds of stems daily, was as hard as the dung of the cattle fed on kadbi and chaff alone. Thus there is not the slightest risk in feeding plantain stems, to cattle in general and especially to buffaloes, cows, and young stock. The knowledge of these facts will be very useful in villages where there are plantain gardens, but the stems are now wasted. If all the stems are properly cut and fed to the cattle, it will be a great addition to the present stock of fodder, which would help to save a large number of cattle in a critical time like the present.

CULTIVATION OF MAIZE.

(*Zea mays*.)

The Mysore Gardens Department has issued the following leaflet (No. 3 of 1919):—

INTRODUCTION.

Maize is supposed to be indigenous to South America whence it was imported into Europe and later on into India. It is one of the larger and more important cereals of the world. Excepting rice, it is more widely cultivated than any other cereal. This plant furnishes the food grain of a great portion of the American continent. The crop is raised by seeds, and it is an irrigated one. The plant grows to a

height ranging from 4 to 12 feet according to variety. This crop requires a deep, moist and fertile soil manured richly.

PREPARATORY CULTIVATION.

The land should be brought into a fine tilth by ploughing or digging. About 25 cartloads of well rotted farmyard manure should then be worked into the soil.

SOWING.

The seeds should be sown in furrows 1" deep and 6' apart, the distance from furrow to furrow being 2 feet. The seed rate is about 10 lbs. per acre.

IRRIGATION.

The crop should be irrigated once a week in the absence of rains. Maize can be grown under sewage also.

AFTER CULTIVATION.

The plants should be earthed up and the crop should be weeded and stirred when the plants are 4" high. This operation should be repeated twice, i.e., when the plants have attained a height of one foot, and two and a half feet respectively. If earthing up is not done, the plants will lodge on the ground. The plants should be thinned gradually so as to leave a distance of 18" from plant to plant. All side shoots should be removed as often as they appear. This operation is necessary to prevent food materials required for cob formation from being taken away by the side shoots.

YIELD.

The crop is usually ready for harvest in two to three and a half months from the time of sowing, according to the variety. About 10,000 to 15,000 cobs or 2,500 to 3,000 lbs. of grain per acre can easily be obtained.

PROFIT.

The cost of cultivating an acre of maize amounts to about Rs. 60 and the gross income will be about Rs. 90.

OTHER USES.

The cobs may be used as a vegetable if gathered while tender. If maize is planted for fodder, about 40 lbs. of seeds per acre must be sown thickly mixed with a leguminous crop such as soybeans, cow peas, etc.

CONCLUSION.

The varieties known as *Manila Moro* and '*Hickory King*' are recommended for commercial gardening. For home gardening the variety known as '*American Sugar Corn*' is the best.

SERICULTURE.

Silkworm Rearing in Indo-China.

Monsieur A. Gachon, Inspector of the Agricultural and Commercial Services in Indo-China, contributes to the *Congres d'Agriculture Coloniale Government General de l'Indochine* (Hanoi Series, No. 7), a lengthy article on the silk industry of Indo-China. The following summary of the article appears in the November issue of the *Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, issued by the International Institute of Agriculture, Rome:—

The cultivation of mulberry and silkworm rearing has been practised in Indo-China since remote times and, in nearly all the countries of the Union, silkworm rearing might be greatly and rapidly developed. Many circumstances have contributed to making prosperous this essentially agricultural and home industry. The mulberry grows easily and develops well. The worms may be reared throughout the year in some districts and during the last eight months in the least favourable ones. Abundant cheap labour and the free time left by the small variety of crops grown are very important factors in the possible development of silkworm rearing.

France buys annually in the Far East raw silk to the value of nearly £8,000,000, manufactures it and exports most of it as silk materials throughout the world. Indo-China might supply France very largely, as is shown by the quotations, with material equal to the best products of Canton, of raw silk and waste prepared by European methods chiefly in Tonkin and in Annam. These goods are already appearing on the French market. These considerations led the Government of Indo-China to encourage the improvement and development of the silkworm industry by all the means in its power, in order to export the produce to France.

The author after describing the cultivation of the mulberry and silkworm rearing in Indo-China gives an account of the work done in the colony especially by the Administration, to develop silkworm rearing. In 1905 the Administration appointed a silkworm egg specialist and founded an establishment at Phulang-Thuong for the production of eggs selected by the Pasteur method. At the same time pamphlets of a kind to be understood by the natives were

drawn up in French, Quoc-ngu, and Chinese. They gave simple, rational and practical methods for improving silkworm rearing, spinning and the preparation of waste, and were widely distributed in the silk centres and in all the provinces where they might have a useful effect.

Model and experimental silkworm nurseries and two egg-production establishments, one at Bach-hat (near Vietri) and one at Kien-an (near Haiphong), were opened. The working of the egg-production centre of Phulang-Thuong, the oldest, best equipped and largest of the colony, was assured from 1907 to the end of 1916 by a commercial company enrolled by the Administration and prepared to supply 3,000,000 layings. The establishment was taken under direct control on January 1, 1917, and its production exceeded 3,500,000 layings in 1917. The Bach-hat egg-production establishment, the second in importance, has been managed by the Administration since its foundation in 1914. It distributed free of charge 600,000 layings in 1914, 1,000,000 in 1915, 1,650,000 in 1916, and about the same number in 1917. The Kien-an egg-production centre was only established in 1916 and its production has reached 110,000 layings; in 1917 it exceeded 250,000. When the Phulang-Thuong establishment was opened, a silkworm breeding research station was attached to it to study the introduction of foreign species, crossings, etc.

Of recent years Cochinchina, Annam, Cambodia, following the methods used in Tonkin, have opened establishments for egg selection by the Pasteur method, model and experimental silkworm nurseries and plantations, as well as workshops for studying improved methods of silk spinning, the preparation of waste, and weaving for the European market. Since about ten years the Administration, especially in Tonkin, has made great sacrifices in order to develop the silkworm industry.

The silk spinning basins have been altered and perfected giving as much consideration as possible to the native methods and customs. Many basins have been supplied free of cost to spinners who have thus been enabled to produce raw silk saleable in France either as they arrive or after a very simple system of re-reeling and re-boiling. The waste and by-products of the spinning industry prepared by a rational, more profitable method than formerly, may now easily be exported to France. A premium of \$0.80 per kg. (about 9ft. per lb.) was instituted in 1907 and continued till the end of 1915 in favour of steam spun or reeled raw silk exported to France, in order to help and encourage those engaged in the trade. There are three steam spinning mills in Tonkin: (1) that opened in 1906 at Nam-dinh, the

most important, with 100 basins; (2) that of Thai-bhat, opened in 1909, with 40 basins; (3) that of Kien-an, opened in 1915, with 60 basins. A fourth is to be built during 1918 at Vietri. Large numbers of improved direct basins, spinning for export have been set up in the provinces of Nam-dinh, Taininh, Ninh-binh, Hadong, and at Bach-hat. Certain mills, better equipped than others, have boilers for heating the water of the basins by steam, a more regular method than by wood, but the reeling apparatus is always on the model of that recommended by the Administration.

The European silk industry has been centred in Annam in the Binh-dinh, at Phuphong, near Quinbone, since 1903. A French company owns there a spinning mill with 100 spinning basins, a silk-twisting machine and a large weaving machine. All the products, raw silk, waste, and materials (crepe, crepon, pongee, etc.) are exported and sold in France.

The Annam Protectorate has installed, in various silkworm rearing centres, small egg-producing establishments managed by native agents of the local Agricultural and Commercial Services under the direction and supervision of French officials of the Service. As in Tonkin these small establishments work in co-operation with the model silkworm nurseries, or obtain their supplies from rearers who have specialised in egg-production.

In Cochín-China an Annamite company for spinning and weaving silk by European methods was founded at the beginning of 1914. A factory was built for receiving the material which has not yet been delivered, owing to present conditions. The Orphanage of the Sisters of Cu-lao-Gieng has a hand-weaving factory and a factory for crepons, pongees, figured silk and silk embroideries for the European markets. In spite of somewhat primitive equipment the products of this industry are very satisfactory and find a ready sale. The local body of the Agricultural and Commercial Services has two egg-production centres, one at Saigon and one at Tan-Chau, supplied by model silkworm nurseries belonging to the Administration and expert rearers. Many model nurseries and mulberry plantations, each having a small factory for silk spinning and weaving by improved native methods, have been established in silkworm rearing centres. Each year the Agricultural and Commercial Services of Cochín-China distribute gratis an average of one million selected layings. Cambodia has an egg-production establishment supplied with cocoons from model nurseries or produced in chosen centres by careful breeders. The selected eggs are distributed free of charge to all breeders who apply for them,

an annual average of one million layings being distributed among the silkworm districts of Cambodia.

A silk worm-rearing research station has been opened at Phompenh and has already given interesting results. Varieties of native worms have been most carefully selected and have given very strong white and yellow types of very pure colour. The experimental spinning and weaving factory has attracted the attention of the French and Cambodian populations, and a company was recently formed to start a steam silk spinning factory with 100 basins and, later, a factory for machine weaving.

The reduction of the taxes on mulberry plantations made in 1905 by Governor-General Beau has given good results but less far-reaching than was expected, by reason of the native communal organization and the payment of taxes by villages. The conferment of honorary rewards, of small grants and prizes given in competition, would appear to have more opportunity of starting a movement for the extension of mulberry plantations and the improvement of silkworm rearing methods and the silk export industry.

For several years the "Musée agricole et commerciale" of Hanoi, belonging to the Agricultural and Commercial Services of Tonkin, has given professional instruction to numerous Annamites. A model silkworm nursery and mulberry plantation a set of direct basins and several improved weaving looms, make it possible to follow the full cycle of the silk industry. This instruction has proved most useful, and many Annamites owe new means of earning to it. It has made possible small home industries which need no help from the Administration. Although the silk industry workrooms of the Hanoi Museum have had to make room for other trades, equally interesting as home industries, the instructors continue their work in the province and also in other countries of the Indo-Chinese Union (Cambodia, Cochín-China, Annam.)

All Indo-China is wonderfully well suited to the development of the silk industry. A large market for the products is assured as raw silk materials have taken first place among the exports of the Far East to France, and woven silk materials are the most important exports of France. The export of raw and woven silk to France did not exist about ten years ago; now its value exceeds 1 million francs (£39,649) for Tonkin and ½ million for Annam. Some Chinese merchants export native silk and silk waste to Hong-Kong, Malaya and Siam. This trade has decreased greatly in Tonkin and Annam, but is still flourishing in Cambodia and Cochín-China. It is to be hoped that it may be completely replaced by an industry exporting all its products to France.

INDUSTRIES AND COMMERCE.

Sisal and Henequen in Jamaica.

The following article by Wm. Harris, F. L. S., Government Botanist and Superintendent of Public Gardens, has been recently published by the Jamaica Department of Agriculture as a leaflet, and is here reproduced for the benefit of readers of this *Journal*. Social cultivation has been advised to be a profitable industry in Mysore by Mr. Chatterton:—

Sisal. (*Agave sisalana*).—Native of Central America and Mexico where it is cultivated to a small extent for fibre for domestic use, but not for export. Sisal is more widely distributed than any other fibre-producing *Agave* and is cultivated commercially in the Bahamas, Jamaica, Turks and Caicos Islands, Hawaii, Java, East Africa, Bengal, and Indo-China.

Plant.—The leaves are dark green or slightly glaucous, 40 to 60 per plant, each 3 to 4½ ft. long, 3 to 4½ inches wide at the middle, ½ to 1½ inches thick at the narrow part near the base, with a slender dark brown terminal spine about one inch long. Usually there are no spines along the margins of the leaves, but sometimes the edges are sparsely furnished with small spines pointing downwards.

It produces a flower-stalk or pole 12 to 25 feet high with slender branches curving upwards, yellowish-green flowers about 2½ inches long which are succeeded by young plants known as "bulbils," never by seed capsules. Bulbils are ready for gathering about five months after the pole produces flowers. The life of the plant is from five to ten years; the appearance of the flowering pole indicates the last stage of its life-history and it then dies.

Propagation.—As *Sisal* never produces seed, the "bulbils," or adventitious buds from the flowering pole, or "suckers" from the base of the plant are used for propagating the species. It has recently been pointed out that the suckers are apt to pole at the same time as the mother plant and it is, therefore, recommended that "bulbils" only be used for propagating purposes. A single pole will produce from one thousand to four thousand bulbils.

Nursery.—As soon as the "bulbils" drop off the flowering poles they should be collected and planted at distances of six to nine inches apart in nursery beds. The nurseries should be established

at convenient centres in the field where the plantation is to be formed as the cost of transport of plants for any considerable distance, when they are twelve to eighteen months old, is a somewhat heavy item of expense. The nursery beds should be kept weeded and clean until the young plants are big enough to go out in permanent positions in the field.

Soil.—It has been asserted that *Sisal* will grow and flourish anywhere, no matter how sandy, sterile, or impoverished the soil may be, but practical experience does not confirm this. Wet lands or rich lands are not suitable, for although the plants may grow quickly they are short-lived and the fibre from the leaves is poor in quantity and in quality.

In 1899 a plantation of *Sisal* was laid out at Hope Gardens in a soil of gravelly alluvium; the plant made excellent growth but began to "pole" when three years old just when the first crop of leaves should have been ready for cutting.

Dry limestone districts near the coast, with broken rocky surface and numerous crevices where humus and red earth have accumulated are suitable situations.

The plant delights in light and air and should be grown where it has full exposure.

In the coastal regions there are often large areas of fairly level or undulating land on the limestone formation where the underlying rock is broken and porous and where little, if anything of value, is now grown, and such lands, where easily accessible and of considerable extent should be planted with *Sisal*.

Small plantations in isolated situations, unless close to a factory, cannot pay and are not recommended.

Distances in Planting.—In very poor soils such as those of the savannahs of southern Manchester and St. Elizabeth where growth is not vigorous, we are finding that distances of 5 feet by 6 feet allow sufficient space for the plants to develop, and at these distances there are 1,452 plants to the acre. This, however, may be considered the minimum, and the fibre which will be obtained from the leaves of these plants will probably be short in length.

In the average *Sisal* soils of Jamaica distances of 6 feet by 6 feet or at the rate of 1,210 plants to the acre will be found to be good practice but in richer woodland soils it would be advisable to plant at wider distances, say, 6 feet by 8 feet, or at the rate of 908 plants to the acre.

Planting.—Having decided on the distances and lined out the field, holes just large enough to receive the bases of the young plants should be prepared by pickaxe, hoe, or digger. Then the young plants should be taken from the nursery as required, all roots should be carefully pared off close to the

stem, and each should be firmly planted in its hole, not deep enough to keep it in an upright position.

After-cultivation.—Clean cultivation is not absolutely necessary but it is well to keep down the grass and weeds along the rows of young plants and in most places two weedings a year will be ample. The growth of bush through the plantation should on no account be allowed.

In compact, sterile soil it has been found that loosening the surface round each plant, and mulching with the grass from between the rows has had a most beneficial effect, but there are few situations where this will be necessary.

Harvesting the Leaves.—The leaves are at first vertical in the centre of the plant and with the development of younger ones they gradually incline until they assume a horizontal position. The colour, too, gradually changes from a light green to a dark green. The exact age for cutting will, of course, depend on the rate of growth, and this again will depend on the fertility of the soil and rainfall. The average, however, may be put down at three to three and a half years after planting out in the field. There is no special season for cutting the leaves as they are maturing all the time, and it is generally understood that leaves are mature when they have reached an angle of 45 to 60 degrees with the groundlevel.

One grower here cuts leaves that are almost vertical and asserts that by so doing he encourages the rapid growth of the younger leaves and in this way is able to reap one leaf per plant each week.

But if the anatomy of the Sisal leaf is studied, it will be found that the *sclerenchyma* (derived from the Greek, meaning hard, stiff, in allusion to the comparatively hard, and thickened cell-walls) which is the source of the commercial fibre, is composed of cells.

Sclerenchyma is only one of several substances that are found in the leaf, but all are composed of variously-shaped, correlative and inter-dependent cells. These cells require time to grow and mature, and if the leaf is cut before the cells are mature it stands to reason that the fibre obtained will be deficient in quantity and in quality. Every vegetable product, such as root, fruit, wood, etc., requires a certain period of time to arrive at maturity, and the fibre of the Sisal leaf is no exception to this rule. The fact that the Sisal leaf has attained its maximum dimensions does not necessarily indicate that it has arrived at maturity; sugar-canes, for example, are fully grown long before they are considered to be fit for the mill.

On the other hand, when leaves are ripe they should be cut or they will begin to deteriorate and over-ripe leaves will yield a poor grade of fibre.

Fibre should be at least three feet long, and plants are ready for cutting when mature leaves of at least this length are to be obtained.

The first cutting will include all the lower leaves, many of which will be dead, and others too short or otherwise unsuitable for decorticating; but they should be removed close to the trunk; this is important, so that the butt end of the leaves shall be smooth and even, and watchful care will be necessary to prevent the cutters taking off immature leaves the fibre from which would materially depreciate the market value of the crop. When the leaves are cut they should be made up into bundles of convenient bulk, say 25 in each bundle, and removed to the cleaning machinery. As all operations are calculated and paid for at the rate of so much per thousand leaves, it will simplify counting if each bundle contains a fixed number.

Yield.—In the Caicos Islands 15 leaves per plant per annum is said to be the average yield during the life of a plant, each leaf weighing from $\frac{3}{4}$ lb to 1 lb. Elsewhere the average number of leaves produced by the plants before they produce their poles is 140 to 180 weighing $1\frac{1}{2}$ lb, and this agrees fairly well with our experience in Jamaica.

Taking the weight of each leaf at $1\frac{1}{2}$ lb and a minimum of $\frac{3}{4}$ per cent of extracted fibre, 1,000 leaves should give about 43 lbs of dry fibre in average soils.

Each acre of 1,452 plants (at 6 feet by 5 feet) in poor soil, yielding, say, 40 leaves per plant each year, calculating the weight at 1 lb per green leaf and the extraction of dry fibre at 3 per cent, should produce 1,742 lbs. of commercial fibre. The yield of fibre from plants at 6 feet by 6 feet in suitable soils in Jamaica may fairly confidently be put at $\frac{3}{4}$ to 1 ton per acre per annum, and the life of such plants after reaching the cutting stage should be 3 years; therefore, each acre of Sisal should yield from 2 $\frac{1}{2}$ to 3 tons of commercial fibre before replanting becomes necessary.

It is highly important that the fibre should be extracted from the leaves not more than forty-eight hours after they are harvested. When exposed to the sun and air after being cut, they lose their natural moisture, which is useful in cleaning them, and the juices set up a fermentation which, if long continued, will seriously injure the quality of the fibre.

Cutting the Young Pole.—It is recommended that as soon as the flowering pole appears it should be cut down, unless bulbils are desired, for if it is allowed to grow the upper leaves surrounding the stem will not develop and yield fibre.

Drying and Baling.—The fibre after it comes from the machine is hung on lines in the open air

for several hours, but rapid drying is to be avoided. During the bleaching process the greenish tinge disappears.

Grading.—If the Sisal is to obtain a good name in the market it must be properly graded. Buyers, especially in large markets, naturally desire to be certain of what they are purchasing, and this can only be secured by confidence in accurate grading. Having trust in their exporters, buyers will, on the strength of that confidence, be able to sell the fibre at good prices even before it reaches the market. On the other hand, a dealer distrusting his consignment is put to the trouble of unpacking, grading, and re-packing the fibre and this additional handling increases the charges to be paid by the exporter and does not add to the value of the consignment. It is of vital importance for ultimate and permanent success to insist on absolute honesty and integrity in grading the fibre.

Baling.—When the fibre is dried and has been carefully graded it is made up into bales of about 400 lbs. weight and 20 to 22 cubic feet measurement, and is then ready for shipment.

HENEQUEN (*Agave fourcroydes*, is a native of Mexico. It is the only species cultivated in Yucatan for the production of fibre for export. According to Professor Trelease, in Yucatan, Cuba, and elsewhere in Spanish America, the name "Henequen" (pronounced hen-e-ken) is used to designate the plant and also the fibre. In the markets of America and Europe the fibre is usually called 'Sisal.' It constitutes more than 90 per cent of the Sisal of commerce.

Plant.—It produces a trunk often 4 to 6 feet high; the leaves, 80 to 100 per plant are $4\frac{1}{2}$ to 5 feet long, straight and rigid, light bluish-green, 4 to 6 inches wide at the middle, uniformly spiny along the margins, the spines blackish, straight or gently curved upwards, with a terminal spine about 12 inches long. The flower-stalk or pole is 12 to 25 feet high, with stout, horizontal branches, bearing at the slightly upcurved ends dense clusters of yellowish-green flowers about 2½ inches long, succeeded usually by bulbils in Jamaica, but elsewhere seed-capsules are also produced.

Conditions of Growth.—Whilst the *Sisal* is suited for soils of the limestone formation, the *Henequen*, although naturally a limestone plant appears to be better adapted in Jamaica for gravelly alluvium, and in such situations it lives from 10 to 14 years, or longer, before poling.

Propagation, etc.—The methods of propagation, planting, cultivation, etc., recommended for *Sisal* apply also to *Henequen*, but as it is a larger growing plant than *Sisal* it should be planted at distances of

at least 7' 6" by 7' 6" apart in alternating rows, or about 774 plants to the acre.

Yield and Value.—*Henequen* is reputed to yield up to 5 per cent of clean, dry fibre, and although *Sisal* usually fetches a higher price in the markets the yield of fibre is lower. It is considered, therefore, that where *Henequen* succeeds it is the more profitable source of fibre of the two species mentioned.

Although the fibre plants have long been known in Jamaica, and a good deal of information has been published from time to time giving advice as to the best methods of planting, etc., it is only within recent years that their cultivation has been taken up seriously. We probably have much to learn to secure the best results under our local conditions; it is not advisable to blindly follow methods that are adopted in other countries where different conditions obtain and we can only hope to gain exact knowledge by experience.

MANUFACTURES AND INDUSTRIES OF BIHAR AND ORISSA.

The following particulars regarding manufactures and industries in each Division of the Province of Bihar and Orissa are taken from the Administration Report of that Province for 1917-18 :—

PATNA DIVISION.

The mica industry in Gaya enjoyed a prosperous year, and several new mines were started in the district. The mines at Sabaiya Tanr were bought by Government to secure for war purposes the high class mica obtained from them. There was a good demand for lac, and the *tasar* industry of Kadirganj in the Nawada sub-division in Gaya did well; similarly weavers at Bihar profited from the decline in the supply of foreign cloths, and their co-operative societies helped them to make the most of their opportunity. On the other hand, Messrs. Mukharji and Company's factory at Arrah was unable to work up to its full capacity, and the mills and iron foundries at Dinapur in Patna were closed down owing to the shortage of coal. The export of raw sugar in the Jahanabad sub-division was hampered by the difficulty of securing railway freight and there was a fall in the output exported by the four stone and lime quarries working in the south of Shahabad.

TIRHUT DIVISION.

The local industries of the Tirhut division, such as indigo, sugar, tobacco, salt and saltpetre generally

continued in much the same condition as in previous years. The boom in indigo prices, was not maintained during the year. Champaran and Muzaffarpur did not succeed in getting high prices, and in some cases had to hold up the last season's outturn but Darbhanga planters are reported to have done better. In Darbhanga, too, the sugar industry had a good year, while the area under cane in Champaran shrank from 21,300 to 18,500 acres. Both sugar and rice mills were adversely affected by the curtailment of railway traffic. A new rice mill was built at Narkatiagunj in Champaran. Tobacco leaf is prepared, stored and dried at three places in the Darbhanga district by the Indian Leaf Tobacco Development Company with its local head-quarters at Dalsingsarai, and the tobacco industry owes much of its development to that Company. Messrs. H. Dear and Company retained their timber concessions from the Ramnagar estate, and in the Rajpur Soheria forest of the Bettiah Estate catechu was manufactured to the value of about Rs. 40,000. Exports of sabai grass were made from the north of the Bettiah sub-division. A new factory for making mother-of-pearl buttons and chains for watches was started by Babu Lalita Prashad Sahu, a banker of Motihari. The Superintendent of the Salvation Army Settlement for Magahiya Doms at Chaतरwa started net-bag making on a small scale; and succeeded in producing from his looms dhotis, saris and Jharans of excellent quality. Export of red chillies was made on a large scale from parts of Roserah, Dalsingsarai and Samastipur thanas.

BHAGALPUR DIVISION.

The mica mines at Mahesari were worked to their full capacity under European supervision and are now employing over 2,000 workers a day. New mines have been opened at Paira and Jirulia, and also in Thana Chakri in this district. Slate quarrying by Messrs. Ambler and Company, Limited, prospered, and writing-slates are now being manufactured by the Company. Brick-making in Monghyr and the oil mills in Bhagalpur were affected by want of coal, and weaving by country looms in the former district by the high prices of materials. The weaving of coarse cloth by country looms received an impetus from the unusually high prices of the imported articles, and cultivators in Bhagalpur were reported to be interesting themselves in cotton cultivation. The Cigarette Factory of the Peninsular Tobacco Company at Monghyr continued manufacture on its previous scale, and *biris* of Jhajha and the *bafta* and *tasar* of Bhagalpur retained their place on the market. The two oil mills in Monghyr maintained production and local dyes did well. The dismantling of the Bhagalpur-Bausi Railway line during the year

for military purposes hampered local trade to a small extent.

ORISSA DIVISION.

As elsewhere country-made coarse cloth, owing to the high price of imported material, found its way in an increasing extent to the local markets. Silver filigree work and horn work were carried on as usual in the town of Cuttack. The boots, shoes and other leather articles produced by the Utkal Tannery at Cuttack, under the management of the Hon'ble Mr. M. S. Das, C.I.E., maintained their reputation in the market. The red oxide mine at Bhubaneswar did little business, as there was little demand for its produce by railways. The cocoanut trade, which is of much importance in Puri, suffered from the shortage of freight: stocks accumulated and could not be moved. Mica deposits were found in parts of Angul and prospecting operations were conducted by Messrs. Chrestien and Company of Hazaribagh. Ruby mica, suitable for Government purposes, has already been discovered in two places, and prospects are favourable. In Sambalpur also hopes are entertained of a further development of the mica industry. The Hingar-Rampur Coal Company continued to work and during the year a mining lease for coal was granted to Mr. T. P. Yeoman for an area of 1,300 acres. Applications for the extraction of *Chhui* (white earth) and for general prospecting leases for coal, iron, mica, etc., have been made, and prospecting for diamonds is being undertaken. Mr. Casy's sisal hemp plantation worked well, and is being extended. The alloy industry (*Kansa*) showed no perceptible development, owing to the indebtedness of the workmen.

CHOTA NAGPUR DIVISION.

It is in the exploitation of the rich mineral deposits of the districts of the Chota Nagpur Division that the greatest industrial development is to be found. The Tata Iron and Steel Company at Sakchi in the district of Singhbhum made a profit of one crore and eleven lakhs of rupees for the year ending June, 1917, against 68 lakhs in the preceding twelve months, and were busily engaged throughout the year in the supply of steel rails for Mesopotamia and other theatres of war. The coal industry in Manbhum was exceptionally prosperous, the total output being 10,287,909 tons. The Bengal Coal Company took up a large area in the Hutar coal-field from the Raja of Chainpur and started work preliminary to regular mining operations. The variety of minerals in Singhbhum illustrates the mineral wealth of that area. Iron and manganese ore are the most important: next comes copper followed in turn by gold, chromite phosphoric rock, phosphate of lime, yellow and red ochre, wolfram, china clay, lime, asbestos and limestone. The companies owning the

largest concessions in that district are the Bengal Iron and Steel Company, the Tata Iron and Steel Company and the Indian Iron and Steel Company. Messrs. Bird and Company applied for a prospecting interest in over 10 square miles for manganese. Copper deposits are confined to the Dhalbhum estate where the Cape Copper Company, who have acquired large interests in the Rajdiba Mining Company, hold large areas in the name of the Rakha mines. The Company had, however, difficulty both in obtaining proper plant and competent workmen and in securing adequate coal and coke for their purposes in competition with Government and other demands on the coal mines. Next to the Copper Company Messrs. Octavius Steel and Company have large interests in all minerals except copper and precious stones, followed by Messrs. Gillanders, Arbuthnot and Company, whose interests are confined to copper. The Dhalbhum Gold and Mineral Prospecting Company, Limited, continued to work on the Porajama section; 3,648 tons were crushed, yielding 2,462 ozs. of gold, of the average value of 13½ dwts. per ton. Chromite deposits in the Kolhan were examined under the orders of the Government of India, by Mr. L. L. Fermor, Superintendent of Geological Survey, India. The Singhbhum Chromite Company and Messrs. Luxman Rao Naidu worked the mines in the Kolhan Government Forest for chromite, and the quantity extracted amounted to 1,158 tons valued at Rs. 9,266 and 659 tons valued at Rs. 15,116 respectively. In limestone the largest interests are held by the Sutna Stone and Lime Company in the Kolhan: this mineral will take an increasingly important place as a flux in smelting metal and as a raw material in the production of cement. There was a large demand for china clay, the most important interests in which are held by Mr. Grenon both in the Kolhan and Porahat estates and by Dabu N. N. Goswami and Babu Motilal Ishwer Das in the Kolhan. In Hazaribagh the mica mines were worked under Government supervision to their fullest capacity. The joint East Indian Railway and Bengal-Nagpur Railway Colliery at Bermo and Baidkao continued to be developed. The Great Indian Peninsula Railway colliery at Khargali commenced work. Trade in timber forest produce and lac continued. *Sabai grass* provides a raw material in the production of paper; and the trade in that product benefited from the development of Indian mills to meet the shortage of paper imports from other countries.

Damage Done To Lac by Parasites.

The following is a summary of the available information on the subject of the pests that damage the lac crop. The information has been collated from the undermentioned publications of the Agricultural and Forest Departments.

(1) *Lac (Lakh) and the Lac Industries* by George Watt. (The Agricultural Ledger, 1901.—No. 9.) (2) *A note on the Lac Insect (Tachardia lacca), its Life History, Propagation and Collection*, by E. P. Stebbing. The Indian Forest Records, Vol. I., Part I, 1908. (3) *The Cultivation of Lac in the Plains of India (Tachardia lacca, Kerr)* by C. S. Misra. (Bulletin No. 28 (1912) of the Agricultural Research Institute, Pusa). (4) *The Indian Forest Memoirs on the Structure and Biology of Tachardia lacca, Kerr, with observations on certain insects predaceous or parasitic upon it* by A. D. Imms and N. C. Chatterjee. (Vol. III. part I, 1915.)

Ants of various species frequent trees carrying lac for the sake of the sugary excretion—technically known as "honey-dew"—exuded by the lac insect. They do not prey upon or feed upon the insect itself, but nip off the whitish hairs which carry air to the female within the resinous cell, doubtless merely with the object of getting them out of the way. The result is that the lac insect dies of suffocation and the whitish floss characteristic of healthy growth disappears. The cells become pitted and turn dark brown in colour. Sometimes the ants appear suddenly in numbers and if their appearance coincides with the emergence of the males, fertilisation is stopped. The ants, considering the males to be the producers of honey-dew, carry them away and prevent fertilisation. Messrs. Imms and Chatterjee hold that the ants do not appear to do any appreciable harm to the lac. They state that the ants "may in some instances seize the young larvae or the male insects and carry them off to their nests, but they primarily come in search of the honey-dew. Several writers have emphasised the injuries incurred by the presence of ants but their statements do not appear to have been based on sufficient observation."

Mr. Misra says: "Four kinds of caterpillars feed on lac. Three of these appear in numbers a few

Eublemma coccidiphaga, Hampn.

Eublemma cretacea, Hampn.

Eublemma amabilis, Moore.

Hyapatima pulverea, Mey.

days after the emergence of males in Katiki (October-November) crop from August to September. The female moth flies at dusk and lays eggs on or between the resinous cells. The caterpillar on hatching burrows into the cell until it reaches the female which it devours. Having destroyed one it moves on to another, making subterranean passages which it lines with silk and pellets of excreta. The characteristic webbing and the presence of isolated, loose, pustule-like spots on the inoculated branches are signs of the presence of the pests. If, therefore, the webbing be opened at the time with either a thorn or a sharp pointed stick, a small, whitish caterpillar with a black head will be found inside. These should be collected and destroyed. The other caterpillar also feeds on the lac insects on the trees as well as when the crop is harvested. These are small, slender, greyish insects with a black head. When full-grown they pupate within the lac encrustations and a week later a tiny, dark-grey moth comes out, copulates and lays eggs. The webbing usually met with in stick-lac stored in bulk for some time is the work of the caterpillar. The easiest and most effective way of saving the crop from these caterpillars is to fumigate it immediately after scraping. If, however, the quantity of stick-lac be small, it should be washed and the seed-lac either stored or sold and the lac-dye used as manure. If, however, the quantity of stick-lac in hand be large, and the market rates be low at the time, it should be thoroughly dried in the shade and fumigated with carbon bisulphide before storage."

According to Messrs. Imms and Chatterjee, the lac insect (*Tachardia tacca*) appears to be one of the most extensively parasitised of all known Coccidae. Of the various parasitic and predaceous insects the best known is the small Noctuid moth, *Eublemma amabilis*, Moore. Of the 31 species of parasites, hyper-parasites, and predaceous insects affecting lac which came to their notice, 6 were Lepidoptera, 8 were Coleoptera, 14 Hymenoptera, 2 Neuroptera and one or possibly two species were Rhynchota. "All the Lepidoptera and probably almost all the Coleoptera are predaceous. Such predaceous insects seize and devour the *Tachardia* bringing about the speedy death of each individual they attack. They spend their life-histories external to the body of the host. Many of the Hymenoptera on the other hand are parasites, living within the body of the host, and slowly bringing about its destruction. Others of the Hymenoptera, e.g., Braconidae, are hyper-parasites, in that they are parasites of the injurious Lepidoptera and are therefore beneficial in their action." Life-histories of the insect enemies of lac are given in the Forest monograph by Imms and Chatterjee.

It is generally believed that the most serious damage to the lac from parasites occurs during storage; but it would appear that so far, no demonstration to show the percentage of waste caused during storage has ever been undertaken.

GRASSES IN ASSAM SUITABLE FOR THE MANUFACTURE OF PAPER PULP.

The following note dealing with the question of the possibilities of obtaining paper pulp from the elephant grasses has been sent to us by Mr. R. S. Pearson, I.F.S., F. L. S., Forest Economist, Forest Research Institute and College, Dehra Dun :—

A good deal of attention has been paid during recent years to the question of the utilization of bamboos for the manufacture of paper pulp, and two publications have already been issued by the Forest Research Institute on the subject. From time to time enquiries have also been made by interested parties as to the possibility of utilizing the elephant grasses for the same purpose, and a publication dealing with the chemical side of the question has been published by Mr. Raitt, entitled "Report on the Investigation of Savannah Grasses as material for Production of Paper Pulp" [*The Indian Forest Records* Vol. V, Part III]. Such enquiries cannot be considered complete without a consideration of the closely associated questions of total available outturn, yield per acre, cost of extraction to a possible factory site, local conditions, lines of communication, labour, etc., concerning which up-to-date nothing has been published. This subject has, however, not been entirely overlooked, and in 1916 and again in 1917, a careful inspection was made of the grass areas on the Monas river in Assam, with a view of collecting data on the above points.

An extensive grass area was found to exist in the angle made by the Brahmaputra and Monas rivers, on the east bank of the former opposite Goalpara, comprising the villages of Loti bari, Amguri, Pidardhara and Nayashastra, in the Barpeta sub-division of the Kamrup Division. The grass in this area is estimated to cover some 15,800 acres, while a similar area exists on the south bank of the Brahmaputra below Goalpara.

The most important species of grass found in these areas are Khagra (*Saccharum spontaneum*) and Batta (*Saccharum narenga*), with patches of Nal (*Paragmites karka*) on the more swampy ground. Sample plots were taken to determine the outturn per acre, in order to obtain an approximate estimate of the annual yield. The grass was cut over a given area and weighed green and again when dry, from which it was ascertained that Khagra

yielded 7.8, Batta 3.5 and Nal 8.04 tons per acre of dry grass. It would not be possible to crop the same areas annually, and Mr. Hole, the Forest Botanist, who has for years studied these grasses to determine their mode of growth, states that Khagra and Nal can be cropped every other year and Batta every third year. By adopting this rotation we get in round figures a sustained annual yield of 4 tons for Khagra and Nal and 1 ton for Batta. Khagra is found over a greater extent of the area than the other two species, so that were an average to be struck, based on actual areas covered by these three species, this average would probably work out to over 3 tons per acre; for safety's sake it is assumed that all three species occur in equal quantities, and under such an assumption we may expect to get a sustained yield of 3 tons per acre per annum or a gross annual yield of 47,400 tons per acre of dry grass, which put at a low yield of 33 per cent of pulp, gives over 10,000 tons of pulp per annum.

The cost of extracting a ton of air dried grass to a possible factory site at Jogipura, a small tahsil town in the Bijni Estate, just below the junction of the Monas and Brahmaputra rivers, worked out as follows:—

Khagra (*Saccharum spontaneum*) per ton Rs. 7-8

Batta (*Saccharum narenga*) per ton Rs. 6-2-0.

Nal (*Phragmites harka*) per ton Rs. 8-8-0.

Hand samples of the above grasses were sent to England to be tested on a laboratory scale, while several tons were sent to an Indian paper mill to be made into paper. The results were satisfactory and proved that a very fair quality of paper can be produced from these grasses at a relatively low price. Small samples of such paper can be obtained by persons interested in these grasses from the Forest Economist, Forest Research Institute, Dehra Dui, who can also supply further details regarding the above described area.

It may be remarked that the Monas area was dealt with first by reason of its relative proximity to markets and sources of labour, and it may be superfluous to add that there are other very extensive and doubtless suitable areas in the Brahmaputra Valley and throughout Burma which have not yet been examined.

Dr. W. H. Brown, Ph.D., of the Bureau of Forestry, Philippines, has recently published a pamphlet on "Philippines Forest Products as sources of Paper Pulp," in which he deals with Khagra (*Saccharum spontaneum*) grass. He states that Mr. Richmond found that the pulp bleached to a good white colour with only 2.3 per cent loss in weight, by the use of 57 per cent of bleaching powder, calculated on the original weight of the material digested. These results confirm those obtained in India.

EDUCATION.

Teaching Profession.

We take the following from the *Times Educational Supplement*:—

Mr. Fisher, President of the Board of Education, speaking at a meeting of the Women's Citizens' Association at Ealing, said that it was an anomaly, and a great waste of money, that the population of the country should be divided into two sections—one, an aristocratic section, which received a full education through the period of adolescence, and the other a democratic section whose education was curtailed at the age of 14. In the Education Act, 1918, provision had been made to continue the education of the whole population of this country. They realized that the force of economic pressure was such that children could not be kept out of the Labour market after the age of 14. They felt, too, that it would be of no value for a child to continue its education after a long day's work. Accordingly, they provided that children leaving an elementary school at the age of 14 should have a short period of day teaching in the employers' time every week.

We are out to educate citizens in all the tasks of citizenship, said Mr. Fisher, and we cannot afford to see human beings bound down by the tyrannous and mechanical machine of industry. We do not intend to interfere with their earning power or propose that their wages should be diminished, but we do intend to take out of their industrial time a few hours for education. Referring to the deplorable state of the physique of children, Mr. Fisher said that industry was becoming more mechanical and monotonous. It produced one-sided physical development which must be corrected by physical exercises. He believed that the Act of 1918, which provided for some form of physical exercise for all young people engaged in industrial toil, would enormously improve the physique of the population.

The whole secret of education, Mr. Fisher continued, depends upon the teacher. We have to work through human instruments, and no nation is well advised to allow its teaching profession to become discontented or unattractive to talent and devotion. The teaching profession is a disinterested profession, and there must always be a missionary spirit in the profession. I do not want it to be a highly-paid but I want it to be adequately paid. There is no calling which makes such a constant and continuous demand upon high spirits as the calling of the teacher. A good teacher should flood a classroom with his vitality. Only the day before, Mr. Fisher said, a measure became operative which would have the effect of ensuring adequate pensions for teachers, and, in addition, he had been the means of securing from the Treasury very large additional sums, both for elementary and secondary education, which would enable local authorities to make better provision for their teaching staffs.

14 POINTS ON HOLIDAYS.

In defence to the fashion of the time, Mr. H. A. L. Fisher, President of the Board of Education, placed the following fourteen points on holidays before the Educational Associations Conference :—

1. Plan your holidays carefully, but be ready to abandon your plans on the slightest provocation.
2. Never go north when you can go south.
3. A change of work is in itself a holiday.
4. Never drive when you can walk, and never walk when you can ride.
5. Take short cuts if you will, but remember that there is seldom time for them.
6. A good holiday is like eternity: there is no reckoning of time.
7. One of the best fruits of a holiday is new friendship.
8. Stay where you are happy.
9. Soak yourself in the atmosphere of a new place before you study the details.
10. The best holiday is that which contains the largest amount of new experience.
11. Holidays come up for judgment before the next term's work.
12. In the choice of holiday books act on the principle that one of the main uses of leisure is to feed the imagination.
13. The principal experts in the art of taking holidays are painters, naturalists, travellers and historians; the worst person to consult is a golfer.
14. On occasions a very good holiday can be taken at home—if you change the hour of breakfast.

Wide, vivacious, desultory reading of all kinds of books, continued Mr. Fisher, was the finest way of quickening the imagination, and was the best way of keeping alive. Quantity was almost as valuable as quality.

To keep books behind glass or on ill-lighted bookshelves was the summit of inhumanity; he had seen some school libraries that contained a ton of tedium for every ounce of entertainment.

SANITATION AND PUBLIC HEALTH.

Railways and Public Health.

The following resolution of the Government of India on the subject of the influence of railway construction on public health has been issued :—

I am directed to address you on the subject of the influence of railway construction on public health, especially the questions involved in large aggregations of labour, the effect of borrow pits and the interference of embankments with the natural drainage of the country. These subjects have been engaging the attention of the Government of India for some time. Copies of a note by Lieutenant-Colonel Clemesha, the Sanitary Commissioner, with the Government of India, dated 27th September, 1916, and of a circular of the Railway Board, No. 430—W.—16, dated the 5th December 1916, are enclosed for information.

2. The Sanitary Commissioner lays special emphasis on the necessity of the control of congregated labour on railway construction and other large public works and in his opinion outbreaks of malaria and the general unhealthiness of large tracts of country are directly due to the deficient sanitary arrangements made during the aggregation of labour and the unsatisfactory conditions under which labour is housed and controlled. He suggests that greater co-ordination in respect of sanitary arrangements is necessary between the Sanitary Department and those responsible for the construction of railways and other works. To secure this object he has, in paragraph 11 of his note, outlined the constitution and functions of a committee. His suggestion for the appointment of a committee when railway and other large public works are taken in hand has the approval of the Government of India. The constitution of the Committee has been criticised by several Railway Administrations as being too elaborate. This, however, is a matter of detail, and the Government of India would leave to the local Governments, when they receive intimation that railway operations or other large public works are imminent, to settle in each case in consultation with the authorities concerned the constitution and the functions of the committee. The Railway Administrations have also accepted the proposals put forward by the Sanitary Commissioner that adequate arrangements for medical supervision of labour and for ensuring proper sanitary conditions should be made during construction; and the Government of India trust that similar steps will be

taken in the case of public works under the control of the Public Works and other departments of Government. It would, no doubt, be desirable to formulate proposals and to obtain the necessary sanction before the work began. In the case of large works, controlled and managed by private agencies, steps should be taken to ensure that the necessity for proper arrangements for the medical and sanitary supervision of labour is not overlooked.

3. It will be observed that the Sanitary Commissioner is of opinion that the results of borrow pits and the blocking of drainage on the health of local inhabitants have been exaggerated. He thinks, however, that in some areas borrow pits are undoubtedly the cause of a good deal of malaria and that in certain cases railway lines have caused serious obstruction to drainage; and he considers that in the neighbourhood of towns and railway stations borrow pits are objectionable. The Railway Administrations have generally agreed that borrow pits are objectionable. The Railway Administrations have generally agreed that borrow pits should not be dug within the boundaries of considerable towns and railway stations and that, when practicable, railway excavations should be made so as to drain off promptly and not result in stagnation near inhabited areas. The Railway Administrations have also accepted the suggestion made in the circular letter of the Railway Board that railways and local bodies should share the cost of filling up existing borrow pits and of draining all excavations in equal proportions, though reservations have been made by certain railways that they should not be required to carry out drainage or reclamation when for sufficient reasons this is not practicable.

4. The municipalities cannot legally be called upon to bear half or any portion of the cost of filling up or drainage the existing borrow pits and excavations dug by railways and the provisions of the Railway Act do not deprive municipalities of their statutory powers to require railways to fill up or drain excavations prejudicial to health. It is also desirable that when a scheme is proposed in this direction the Sanitary Commissioner of the Province should be consulted as to its necessity in order that no unnecessary expenditure may be incurred. I am to point out that expenditure on any scheme for drainage and reclamation incurred by the railway would be useless if the municipality proceeded against the railway alone without taking similar action with regard to other places injurious to health and that, as pointed out by the Sanitary Commissioner, the filling up of borrow pits would not in all cases assist in the prevention of malaria. The Government of India trust to the local bodies to exercise their legal powers in such a way as not to call upon the railways to incur

expenditure which would not serve a useful purpose.

5. It has been suggested that in some provinces railway companies should be encouraged to dig deep tanks instead of borrow pits in inhabited areas. In this connexion attention is invited to the remarks made in page 11 of Major Fry's first report on Malaria in Bengal to the effect that in certain areas deep tanks and borrow pits which contained sufficient water all the year round to enable the fish population to survive and which were free from weeds were rarely important as breeding places for mosquitos. This statement, is, of course, not applicable to all parts of India. But when it is applicable and where such deep tanks and borrow pits supply a local need, it is believed that the local bodies will be willing to contribute a fair share of the extra cost involved. I am to commend the possibilities of this suggestion to the notice of the local Governments.

6. I am further to observe that it is generally agreed that the water logging in certain areas is due to the interruptions of the natural flow of water by embankments, canals, etc., which are insufficiently provided with waterways and that by such water-logging both the health of the people and, in certain large tracts of country, the productivity of the soil are prejudicially affected. Every endeavour should be made to see that natural drainage is not impeded and that, where it is already impeded, such impediments should be removed. This is one of the points which the Sanitary Commissioner in paragraph 11 (f) of his note has indicated as requiring attention when a new line is under consideration, but equally when the question is one of the removal of existing impediments to drainage the best results will be secured by consultation and discussion between the various interests concerned.

ENCLOSURE.

Letter—from the secretary, Railway Board.

To—the Agents, Assam-Bengal, Barsi Light, Bengal and North-Western, Bengal-Nagpur, Great Indian Peninsula, Guzerat, Madras and Southern Mahratta, North Western, Oudh and Rohilkhand, Roilkhand and Kumaon and South Indian Railways, Agent and Chief Engineer, His Highness the Nizam's Guaranteed State Railway (through the Hon'ble the Resident at Hyderabad,) Manager, Jodhpur-Bikaner Railways.

Dated—the 3th December, 1916.

No.—430-W.

I am directed to inform you that the question of the influence of railway construction on malaria and the measures to be adopted for the prevention of the spread of the disease have been under the consideration of the Government of India.

2. The Sanitary Commissioner with the Government of India, who was consulted in the matter, has recorded his views in a note on the subject, and I am to enclose a copy of his note for your consideration. It will be seen from this note that the Sanitary Commissioner holds:—

- (a) that in some, but not in all, areas borrow pits cause malaria;
- (b) that blocking of drains as a cause of malaria has been exaggerated; and
- (c) that malaria is due mainly to the congregation of labour employed on railway construction or other large works.

3. To meet the danger referred to in (c) above, the Sanitary Commissioner considers that greater co-ordination is necessary between the Sanitary Department and those responsible for the construction of railways or other works, and he outlines in paragraph 11 of his note the best method by which co-operation between these authorities could be secured with respect to sanitary arrangements on such large works.

4. As regards (a) and (b) in paragraph 2, it has been suggested that, within the municipal boundaries of any town of over ten thousand inhabitants, no new borrow pits should be dug by railways, and that the existing borrow pits, if any, should be drained or reclaimed as occasion offers in consultation with the municipal authorities; half the cost of any scheme of drainage or reclamation that might be agreed upon being borne by the railway and the balance by the local body concerned.

5. I am now to ask that the Railway Board may be favoured, as soon as possible, with your views on the following points:—

- (1) whether railways are prepared to accept some general principle of the kind put forward in paragraph 4;
- (2) whether you agree that railway excavations should, where possible, be made in such a way as to drain promptly and completely into the nearest watercourse, and not result in stagnation of water in the neighbourhood of inhabited areas;
- (3) whether the Sanitary Commissioner's proposals on the subject of medical supervision of labour employed on construction as to the sanitary arrangements of works are such that they can be accepted.

6. The whole matter is clearly one of great importance and the Railway Board will be glad to have your views on it.

SERIAL NO. 11.

Note on the influence of railway construction on malaria.

The subject of the influence of railway construction on the health of a district is a very large and extremely important one, and it will be necessary to make a few preliminary remarks of a general nature.

2. The issues that arise from the question of borrow pits and obstruction to drainage are but portions of a very much larger problem with which we are faced, and I am strongly of opinion that the best course will be to deal now with the whole subject rather than taking it, up piecemeal. How large and important the influence of Railway construction on the health of a country may be, is extremely well set forth in an important article* by Bentley and Christophers. This article is of such importance that, in my opinion, copies of it should have been put into the hands of all large employers of labour at the time of its publication. I recommend it to the most earnest attention of the Members of the Railway Board.

3. It is unnecessary for me to repeat the general lines of argument of the paper, but it will be observed that, in several places, reference is made to the deficient arrangements for prevention of disease made by railway and other employers of labour, resulting in ill-health to large tracts of country. I do not think that it can be denied:—

- (1) That owing to deficient sanitary arrangements, or other causes, during the aggregation of labour for construction work, epidemics of malaria and other diseases have occurred, and very large tracts of country have been rendered extremely unhealthy.
- (2) That railway and other authorities, not infrequently, incur unnecessary expenditure by not taking expert advice and making adequate sanitary arrangements for the protection of their working staff in unhealthy districts. An unnecessarily large amount of sickness and death amongst their employees thereby results and wholesale desertion of the labour force may occur.
- (3) That alterations in the natural condition of a locality occasioned by the construction of borrow pits and the blocking of drainage with embankments sometimes occasions the ill-health of the rural population.

*Transactions of the Bombay Medical Congress, 1909.

These may appear, at first sight, to be very dogmatic assertions, but the careful survey of the facts of the case will carry conviction as to their general accuracy. There can be no doubt whatever that in certain cases, the advent of a railway has resulted in a marked deterioration in the health of the community which it serves, and it is only by careful research and application of modern methods of sanitation that such untoward happenings can be avoided in the future. Probably the most important factor in such cases is the one mentioned in Bentley and Christophers' paper, namely, that railway officers, up to the present, have not recognized the danger incidental to any aggregation of labour in tropical countries.

4. Before discussing this matter further, it will be well to give certain concrete examples illustrative of my main contentions.

(1) As pointed out by Christophers and Bentley, it is now fairly certain that the extraordinary epidemic of malaria which occurred in Lower Bengal which was known as the Burdwan fever epidemic was due to the construction and opening of the railway between Calcutta and Burdwan. There probably were other factors concerned, such as the river bunds along the banks of the Damodar, but in the light of the most modern research on malaria probably the deciding factor in the case was the aggregation of labour and the expansion of trade caused by the opening of the line. The results of this epidemic are still with us. In parts of Murshidabad, Nadia, Jessore and Burdwan malaria is still hyper-endemic, and it seems almost impossible to break the vicious circle when one recognises that the natural conditions are all favourable to malaria.

(2) The case of Ennur is another example of the result of the deterioration of health of a settlement on account of railway enterprise. Not very long ago, before the railway was constructed, Ennur was one of the health-resorts of Madras. Since the construction of the railway bridge over the back water the place has been practically uninhabitable on account of the prevalence of malaria. All the bungalows are now unoccupied. The railway staff at Ennur was allowed to live some miles further up the line on account of the great prevalence of the disease. Prior to the starting of the railway construction works there were a few healthy fishermen in the neighbourhood and a large salt factory. Anopheles of a deadly character must have even then been present but there was no 'reservoir of parasites.' The advent of coolie labour for the construction of the bridge supplied this deficiency in the malaria cycle, and the anopheles did the rest. The

place is still very malarious in spite of endeavours on the part of Government of Madras to lessen the number of parasite-bearers by wholesale treatment with quinine.

It may be objected that the above two instances are very ancient and occurred prior to the proper understanding of the malaria problem, and that the explanation given is open to certain criticisms. It is desirable therefore to give some more modern instances.

(3) Amongst these is the epidemic of malaria in the Rajshahi division which occurred between the years of 1905 and 1909 at the time of the construction of the railway line between Godagarighat and Katihar. This epidemic was carefully investigated by a Sanitary Officer, namely, Major Mt. Combie Young, who demonstrated that there was a distinct correlation between construction of the railway and the amount of malaria in the districts concerned. The report is available for anyone who wishes to see it. Major Young also pointed out that the mortality amongst the coolies engaged on the work was very high.

(4) An instance of the serious results of lack of knowledge of the guiding principles of malaria came to my notice in 1914 in the arrangements for the construction of the line from Kishanganj to Siliguri. The bungalows for the Chief Construction Engineer, the Assistant Engineer, and the workshop were situated on what appeared to be a very suitable site on the banks of a small river. As a result of this, during the following malaria season the Chief Engineer and his wife, the Assistant Engineer and his wife, and every member of the workshop staff were down with malaria. The provincial preventive staff consisted of myself and two expert malaria officers, who were never consulted in the selection of this site; any of us would have been able to warn the officer responsible for the work that in the Terai, the banks of streams were absolutely deadly at certain times of the year. At this date also the only medical staff that was considered necessary for a line some 70 miles in length through probably the most malarious country in the whole of India was one hospital assistant. The amount of sickness and desertion on the part of coolie labour was very high indeed and the Railway Board are probably better acquainted than I am with the large cost of the work due to delays and enhanced rates to contractors caused by lack of proper medical arrangements.

(5) The final example of defective sanitary arrangements in connection with construction work to which I desire to draw attention is that of the Kidderpur Bracebridge Hall dock extension. I do not know whether this combined railway and dock extension scheme comes directly under the cognizance

of the Railway Board or not, but the necessity for proper organization of labour forces is extremely well exemplified in this particular case.

At present a comparatively small labour force is employed because the work is largely confined to the construction of dock gates and river frontage works, for which highly paid and skilled labour is necessary. When the ordinary excavation work of the main dock is commenced a large force of coolies will be required. I have made a careful survey of the whole locality and of the conditions of housing the small labour force which is at present employed, and I may say that the conditions under which these coolies live are extremely bad and require to be changed. The malaria survey of the district shows that there are mosquito breeding places in any number. Anopheles mosquitoes also abound. The existing labour force is small, is very well paid, has been located on these sites for a considerable period, and does not contain a large percentage of parasite-carriers. That is the reason why malaria is not at present rife in the neighbourhood, but the advent of 8 to 10 thousand coolies from other parts of India, bringing with them a fair percentage of malaria parasite-bearers, is just the one factor necessary to start a violent epidemic as it did in Bombay in 1908. It is unnecessary for me to go here into details as to what should be done to prevent this evil. The point is that close co-ordination between the Engineering authorities undertaking the work and the Sanitary Department is necessary, if disaster is to be avoided.

5. I think the above instances will be taken as sufficient to prove my point. They could be multiplied almost indefinitely by hunting up the records of Civil Surgeons and Sanitary officer's reports. Allusion has been made to the epidemic of malaria in Bombay city in 1908. The Railway Board may not be in any way responsible for this, but it is an example of the careless aggregation of labour which brought in its train very dire results. Finally the old idea that cutting the earth and turning up the soil was the cause of malaria is now adequately explained by modern workers as due entirely to the unsatisfactory conditions under which the coolies were housed and looked after. It may be objected that quite a large proportion of the instances given above occurred in Bengal, which is notoriously a malarious country and, therefore, more liable to serious accidents of this nature. I am prepared to admit the force of this contention, but the main reason why Bengal instances are largely chosen is that they are best known to me. I have no doubt in my own mind that conditions are more favourable for serious and widespread epidemics in that Province and in Assam than

in most parts of India, but at the same time similar smaller and less important accidents are not unusual throughout the whole of India, and in touring about one frequently hears of them.

6. I do not propose to deal at length with the subject of cholera on railway construction works because malarial epidemics undoubtedly present the greater difficulties and any organization which is prepared to cope with these will certainly be competent to remove most, if not all, of the dangers of spreading cholera. That cholera is frequently visited on railway construction must be admitted; one has only to meet construction engineers from any parts of India to hear stories of epidemics amongst railway coolies which never find their way into any Government report or against which preventive measures are never undertaken until they have occurred. Very likely there has been an improvement in this direction in recent years, but more is necessary.

7. After so much adverse criticisms of defective methods, it is pleasant to be able to speak most highly of the excellent sanitary arrangements that were made for the construction of the Lower Ganges Bridge. There a skilled and energetic medical officer was appointed, he was given a large preventive staff; he was made a sort of Civil Surgeon of the districts adjoining his work and every possible care was taken of everybody on the work. The Medical Officer in charge worked in co-operation with the Sanitary Commissioner of the Province and received additional help from him in the matter of a Deputy Sanitary Commissioner to advise him on anti-malarial work, and financial assistance was also forthcoming from the local Government. The results of these sound arrangements are better known to the Railway Board than they are to me. The work of construction was completed well in advance of the promised time and, I believe I am correct in saying, with a considerable saving on the budget estimate. But these excellent arrangements should be the rule and not the exception.

8. Before closing I wish to say a few words on the relative importance of each of these three main criticisms given in the early part of this note. A careful perusal of Christophers and Bentley's paper will show the stress they lay on the importance of the aggregation of labour. In all probability this is by far the most important factor in the spread of disease; a great deal of the agitation in the lay press against blocking of drainage and manufacturing of borrow pits is wrong; in point of fact, the results they complain about should in reality be brought under this first head. Of course, the dangers resulting from the careless aggregation of labour vary enormously in different parts of this country, but

practically in no part of the country can the present unsatisfactory arrangements of collecting thousands of coolies together without adequate sanitary precautions or skilled advice be allowed to continue. The results of carelessness under this head are so far-reaching that no amount of trouble and expense must be spared in order to prevent accidents. It is impossible to estimate either the financial loss or the amount of suffering to a large number of innocent individuals that results from a widespread epidemic of malaria. As already pointed out, we are probably still suffering in Bengal from the direct results of an epidemic which was primarily started by the construction of the line between Calcutta and Burdwan in the fifties.

9. As regards the second allegation, it will probably be admitted by all in a position to judge that there is nothing so expensive as ill-health among the labour forces on the construction of a line; it is impossible to estimate the financial loss to Government of say two or three good construction engineers being invalidated home on account of a preventable disease. In how many instances are estimates exceeded and difficulties multiplied tenfold due to sickness amongst the labour? Therefore, from a business point of view, everything should be done to maintain the whole of the employes, from the Chief Engineer down to the lowest paid coolie on the line in a good and efficient state of health.

10. With regard to the results caused by borrow pits and blocking of drainage, I consider that it is impossible to make any general statement; what is true in one place is hopelessly incorrect for another. The blockage of drainage is, in many parts of the country, a very serious affair, but I am inclined to believe that the amount of obstruction that is caused by railway lines that have been constructed, say three years previously, greatly exaggerated. Of course, it is a sort of parrot cry that the advent of railways always obstructs local drainage. As a matter of fact investigation of many of the lines shows that this is not the case, and the damage to health which is connected with the railways is probably, as already pointed out, due to the first cause and not to the obstruction of the drainage itself. Instances have, however, been brought to my notice where serious obstruction has occurred, and, I regret to say, where it has taken years to get the matter remedied. Very much the same remarks apply to borrow pits. In some parts of the country, borrow pits are most objectionable and are undoubtedly the cause of a good deal of malaria, particularly in such places as round the city of Delhi and Amritsar, in the Doab in the United Provinces, and in other places where flooding and stagnation of water appear to be powerful

factors. They are, I consider, a powerful factor in the spread of the disease along the line from Chitragong to Chandpur. On the other hand, there can be little doubt that in many places the borrow pits can have little influence on the health of the local inhabitants. I am inclined to think that, in a marshy country like Bengal, their influence on the general health is greatly exaggerated, and that careful investigation would prove this. As in all malaria problems, it is impossible to lay down hard and fast rules, and the only way of solving the problem is to have a careful inquiry made by a skilled officer in places where there may be any reasonable doubt. In the neighbourhood of towns, and close vicinity of railway stations, it is safe to say that borrow pits are objectionable and undesirable. More than this I do not want to say at present.

11. Within the last decade, the science of epidemiology and preventive medicine have made enormous strides. Much of the work that has been done is naturally not known to Railway and Irrigation authorities and other large employers of labour, but the time has now come when co-ordination between these and the Sanitary Department is pre-eminently desirable. I consider that the best way of attaining this object will be as follows:—

(1) As soon as the Railway Board have decided to construct any portion of a line and have decided on the route to be followed, information shall be given by the Railway Administration to the local Government concerned who will arrange to convene a committee consisting of—

- (i) Sanitary Commissioner of the Province,
- (ii) Chief Medical Officer of the Railway Company,
- (iii) Chief Engineer of the Railway, who is to carry out the construction work,
- (iv) Chief Engineer, Irrigation Department of the Province,
- (v) Commissioner of the division through which the railway travels or Collector of the district and the Civil Surgeon as may be thought desirable, and
- (vi) The Malaria Research Officer of the Province.

(2) This committee will meet, make study of the route along which the line is to be constructed and will carefully investigate the following points: (they will record their opinion and will report to the Railway Board, and if necessary, to the local Government)—

- (a) The general health conditions of the country through which the line travels particularly as regards malaria.

- (b) The medical staff that will be required in order to supervise the medical and preventive arrangements for the construction of the line.
- (c) To locate the places where hospital accommodation shall be provided.
- (d) As far as is practicable to suggest to the railway company where labour camps should be arranged and what localities to avoid.
- (e) To advise railway company as to the best sources of water-supply for the labour forces.
- (f) The Chief Engineer, Irrigation Department, in consultation with the railway engineers will deal with the subject of the interference with natural drainage that might be caused by the railway embankments.
- (g) The committee will also with the help of the Malaria Research officer study the subject of the influence of borrow pits on malaria of the district and will make such suggestions as circumstances demand.
- (h) Some members of the committee preferably the Malarial Research officer and the Sanitary Commissioner will periodically inspect the line to see that the health conditions of the labour force are satisfactory and to make any recommendations that circumstances demand.
- (i) To advise what villages in the neighbourhood are likely to be centres of spread of disease and to provide for the regular inspection and improvement of these.
- (j) In case of any difficulty the Sanitary Commissioner of the Government of India may be called upon to meet the committee and to decide any point.

12. The main point of these suggestions is to obtain all possible assistance from local Governments in helping the railway construction engineers with the soundest advice on the health conditions they will have to meet during their construction operations. Thus the Sanitary Commissioner, Civil Surgeons of districts and Deputy Sanitary Commissioners, will all be more or less at the disposal of the railway department and to assist the medical staff appointed to look after the actual work. I foresee that in actual practice arrangements will be made very similar to those that obtained at the Lower Ganges Bridge. In this instance the Chief Medical Officer was made particularly a Civil Surgeon of a small area; neighbouring villages were put under his

control; villages which were likely to act as disseminating centres for cholera and in which the labour resided were provided with a water-supply and were regularly visited by his sanitary staff; when the Medical Officer in charge was in difficulty on the subject of malaria a Deputy Sanitary Commissioner was lent in order to investigate any problem. In the event of any matter coming up from the local committee to which the Railway Board were not disposed to agree or which they considered to be unreasonable, they can always appeal to the Sanitary Commissioner with the Government of India, who will be prepared to investigate and advise. Railway Engineers may consider that the powers allotted to this committee are excessive and likely to interfere with the construction work; they must, however, be prepared for a certain amount of scientific control in matters appertaining to the health of districts. Judging by past results this has now become a necessity. Of course, the price of construction per mile may show some increase in the estimates, but the improved health of the staff will more than balance this, and we hope to do away entirely with the criticism which we are certainly open to at present, namely, that many square miles of territory are ruined from a health point of view owing to carelessness at the time of construction of railways. After all we are only asking for the application of the same principles that were necessary in the instances of the Panama Canal. In this rather extreme example the Panama Canal would never have been built at all had it not been for the thoroughly-organized service and preventive medicine. Visitors to the Canal Zone and critics of our administration in India frequently make the remark "why can't the Government of India do something of the same nature in this country." The time has come when we must act more or less on the lines of the American Government when they undertook to construct the Panama Canal through a very unhealthy part of the country. I think that the above suggestions will meet the case of India, at any rate, to commence with. We shall get experience as time goes on and modifications and additions to the above suggestions will certainly be necessary, but, I consider, that the above are a very fair beginning and will result in much good to the community at large.

SANITATION AND PUBLIC HEALTH.

Conference of Medical Experts.

A Conference of medical experts was held at Simla, on 23rd May at the Imperial Secretariat building. The Hon. Sir Sankaran Nair in opening the Conference said:—

I have invited you to come to Simla and to discuss together one of the most important subjects—perhaps the most important which can claim the attention of the professional expert and of the administrator of to-day. It is a matter of pride to us that India has made substantial contributions to medical knowledge. The Indian Medical Service has done splendid work and the names of some of our investigators have become household words. I hope to see this branch of medical activity go on increasing in scope and efficiency, and that India will continue to earn the gratitude of the world for the discoveries which her medical services make in the causes and remedies of diseases but I also want to see India herself benefit more freely from the application of the knowledge which she has produced. When I say this, I am sure you will all agree with me that we can claim the most revolutionary and certain discoveries in regards to malaria which carries off its hundreds of thousands in our midst every year. We can claim the theory of plague infection and yet for twenty-two years this scourge has infected our country. We are carrying on valuable research on the subjects of hookworm, leprosy and other diseases, yet our labour force is disabled by hookworm and the leper is too often found among our villages. Our rural tracts are insanitary, our cities are frequently maddened of unsatisfactory housing. These are matters which for long have been occupying my mind. Similar problems have recently come to the front in other countries also. Even in England, where sanitary conditions are so infinitely more advanced than they are in India, we have seen the introduction of a bill for creating a Ministry of health. The president of the local Government board in introducing it spoke of the loss of 700,000 of the English race in the battles of the great war and the monthly influenza mortality last year was as high as the average monthly mortality during the war. India has no doubt lost so heavily by reason of the war, but we have malaria, plague, cholera and other diseases ever with us and we have just had an influenza epidemic which, in some two

months carried off six million lives. In Egypt too elaborate proposals have recently been put forward for a ministry of health, with a wide ramification of workers in the provinces, some of whom will be in charge of public health work, others of clinical work, the health of school children, etc. When other countries are thus organizing, it is impossible for India to stand still and merely look on. We are constantly being criticised here for our delatoriness in dealing boldly with the problem, which confront us in the city, chawl or in the jungle ridden village. Such critics are apt to overlook what has been done in the matter of discovery, the gigantic scale of our difficulties and the Poverty of the Country but they have much truth in them and we cannot fold our hands while millions perish and national vitality is lowered. The weakness of our organization was brought into high relief by the epidemic of last year. Grievously as countries suffered from it, and great as the mortality must have been, even had India been normally equipped with facilities for medical aid, the appalling death roll had added a new and powerful argument, if indeed fresh argument were needed for drastic action. The time has come when we must take a bold step forward. The first thing is to obtain money. It has been said that public health is purchasable and that, within limits, a community has to determine its own death-rate. Here we have a population ignorant of sanitary affairs and too poor to afford the medical amenities which are found in western countries. I am convinced that public bodies and private individuals will not be blind to the dictates of humanity or the ultimate prosperity of the country, but the Government must lead the way. We have this year secured a sum of five lakhs as the nucleus of a public health fund. This is separate from the sum which we annually disburse for medical research. It is to be used in the application of medical science in a practical and work-a-day form among the people. You have been called together, as a body of experts, to advise the Government as to the best means of doing this. The agenda before you will show you some of the questions connected with this problem. First, we shall have to consider the central organization, its composition and its functions. You will have to consider relations of preventive action of clinical work and of medical research, and to what extent it is desirable to combine guidance in these activities in a single body. You will also have to consider the distinction between the administrative and advisory functions of such a body. I observe that the English public health ministry will not control the medical research organization, but you will perhaps think that the reasons which have led to this feature of the Bill are non-existent in India,

You will no doubt be influenced by the recommendations of the conference of the sanitary and bacteriological experts which I summoned at Delhi last December, and you will remember that a committee has just concluded its deliberations on the medical services in India. Secondly, you will no doubt advise upon the relations of the body with similar bodies which may be set up in the provinces. I need hardly remind you that the bulk of sanitary work is a provincial subject and that as provincial autonomy grows, this is likely to be even more so. It will not be difficult for you to define those international or inter-provincial questions in which a central body may legitimately exercise control, and to distinguish them from the great mass of purely provincial work in which the action of a central body must be limited to advice and assistance in times of stress. Thirdly, and to this I attach the greatest importance, I ask for your advice as to how best we may give practical assistance and encouragement to the provincial authorities in the struggle against disease. You have noticed, no doubt, that the commission on public health in Egypt claim that work of their epidemic department bears a favourable comparison with what has been achieved in India. My idea is a Mobile Corps of Workers lent in normal times to the provinces to supplement the provincial staffs, but ultimately subject to the orders of the Government of India acting on the advice of its public health board and liable to concentration in any area afflicted by a peculiarly virulent epidemic. The arrowing accounts which have reached us of the condition of things in certain tracts during the epidemic of last October and November show how essential it is to have such a body of workers. In connection with this, you will consider the training which such workers should undergo and the qualifications they should possess. Another point is the equipment they will require, whether of travelling laboratories and their *modus operandi*. Finally, there are subsidiary matters such as the medical inspection of schools, the popularization of sanitary knowledge and so forth, on which I hope you will touch. You will see in this rapid sketch of the organization which we have in view that I have spoken of a body of practical sanitary

workers. The claims of research were considered when this money was secured, but it has been decided to expend the money on organizing sanitary work and supplementing our sanitary staff. The agenda before you, however, will introduce the question of a research institute as I regard this as of the highest importance, but though closely related to the sanitary work, it forms a separate subject and can be discussed here only in its bearings upon the questions which we have immediately in hand. Such an institute will provide the knowledge which the sanitarian will utilize and may play an important part in training. We already have our central research institute, our research laboratories and our schools of tropical medicine. These are bound to increase in number and efficiency, but it is impossible to regard India merely as a Fertile Field for Research.

We must apply in an increasing measure, to her people the results of the researches for which so many of those who have worked here are so justly distinguished. The things must proceed *pari passu*. They will react wholesomely upon each other and, I believe, that the sanitary organizations which will now be introduced are certain to supply research with a wealth of data and opportunity which would otherwise be impossible. I need hardly, in conclusion, impress upon you the magnitude of the problem which confronts us. I speak to a body of experts, who know far more accurately than I do myself, the extent of the miseries, the pain and the economic loss which disease annually inflicts upon the Indian population. I feel assured that you, as distinguished members of the most human of professions, will assist the Government with advice in the task of rescuing the population, from the danger which constantly assails it.

STATISTICS.

Imports of Paper into Madras.

The following statement shows the imports into Madras in the years ending 31st March, 1914 and 1917 :—

PACKING PAPER.

	1914.		1917.	
	Cwt.	Rs.	Cwt.	Rs.
Total, of which from ...	12,493	122,671	5,221	117,417
United Kingdom ...	4,703	52,439	4,187	95,195
Russia ...	373	3,061	18	150
Germany ...	6,322	56,516	84	814
Netherlands ...	527	5,305	107	3,639
Switzerland ...	353	2,780	24	640
Norway ...	...	...	688	13,596

PRINTING PAPER.

Total, of which from ...	64,197	902,266	47,071	1,584,488
United Kingdom ...	42,720	654,667	26,219	952,329
Sweden ...	2,630	26,948	2,172	55,339
Norway ...	2,134	22,249	10,983	299,556
Germany ...	10,621	122,398	37	980
Austria-Hungary ...	4,760	60,220	...	...
Japan ...	...	...	1,526	41,461

WRITING PAPER AND ENVELOPES.

Total, of which from ...	...	772,275	...	1,361,430
United Kingdom ...	...	649,571	...	1,243,076
Norway ...	...	1,120	...	18,848
Germany ...	...	36,687	...	1,870
Netherlands ...	...	10,938	...	1,380
Belgium ...	...	25,922	...	1,630
Austria-Hungary ...	...	40,382	...	...
Japan ...	...	87	...	64,096
U. S. A. ...	...	4,147	...	27,711

OTHER KINDS OF PAPER (including Paper Manufactures).

Total, of which from ...	57,007	474,657	17,638	669,495
United Kingdom ...	50,637	358,436	7,441	379,342
Sweden ...	530	7,415	8,442	204,699
Germany ...	3,376	61,754	1	30
Belgium ...	1,057	23,112	138	7,062
China ...	504	12,557	136	8,972
Japan ...	...	...	261	7,989
U. S. A. ...	71	2,437	169	6,627
Norway ...	18	300	470	13,920
France ...	4	140	159	29,660
Netherlands ...	396	4,948	135	7,120

(15 Rupees = £1.)

MYSORE ECONOMIC CONFERENCE. PROGRESS IN THE DISTRICTS.

Shimoga.

AGRICULTURE.

Cattle Show at Shimoga.—The report on the Cattle Show held at Shimoga on the 11th April was read and the Committee thought it necessary to hold a cattle show at Shimoga annually and resolved to refer the matter to the Agricultural Sub-Committee to work out a scheme to make the future shows quite successful.

EDUCATION.

A School Building.—The construction of the school building at Gangenahalli has been completed.

Contribution to the Mysore University.—Mr. Chinnikatti Eswarappa contributed Rs. 500 to the funds of the Mysore University, at the time of the Taluk Conference held at Honnali on the 15th March, 1919.

A Grant-in-aid School.—A grant-in-aid school was started at Chordi.

Opening of a Commercial Class.—The memo from the District Economic Superintendent, recommending the opening of a commercial class at Nyamati was read and the members resolved to recommend the matter to the Inspector-General of Education.

GENERAL.

A Modern Hindu Hotel.—The application from Mr. T. S. Vaidyanatha Iyer, submitted through the Economic Superintendent, in regard to opening a Modern Hindu Hotel at Shimoga, was read and it was resolved that a recommendation be made (i) to sanction a house rent of Rs. 50 per mensem, (ii) to advance a loan of Rs. 2,000 at 4 per cent interest, should the applicant furnish sufficient security, the loan amount being made repayable in five years.

Shows and Exhibitions.

CHUNCHANKATTE.

During the *Jatra* held at Chunchankatte in the Yedatore Taluk, a Cattle Show was held on the 16th January, 1919, in the compound of the travellers' bungalow. There were 17,941 heads of cattle at the Show, and a Committee of eight gentlemen with the Sub-Division Officer as President, and the Amildar as Vice-President was appointed to select the cattle deserving of prizes. The right to collect tolls on shops and cattle were sold out and a sum of Rs. 3,930 was realised. The Deputy Commissioner, the Sub-Division Officer, the Civil Veterinary Superintendent, and the District Economic Superintendent, besides the representatives of other Departments were present during the busy portion

of the *Jatra* and ran the Show. The Deputy Commissioner presided and gave away gold and silver medals and money prizes of the aggregate value of Rs. 220. Certificates were also issued and photoes of prize winning cattle were taken on the occasion. The estimated cost of cattle sold was about Rs. 1,50,000, the best pair costing as much as Rs. 1,500. The total receipts were Rs. 4,475-10-10 and the expenditure amounted to Rs. 662-10-6.

In connection with the *Jatra* and Cattle Show, the Taluk Progress Committee arranged for the first time for a small taluk exhibition and demonstration in a pendal specially put up for the purpose. A weaving demonstration by the proprietor of the weaving school at Manchenahalli was also arranged for. Lectures were also arranged for and the Deputy Commissioner kindly presided over them. The Proprietor of the Sirahatti Dramatic Company kindly placed the pendal at the disposal of the Committee for delivering lectures, and he was also generous enough to place part of the income, Rs. 125, of a Drama at the disposal of the Taluk Progress Committee. The District Economic Superintendent conveyed the thanks of the Committee in an appropriate speech and a medal was awarded to the Proprietor on behalf of the company as a sort of recognition of his services.

MUDAKATORE.

In connection with the *Jatra* of Sri Mallikarjuna Swami at Mudakatore a Cattle Show was held in February last. There were 8,545 heads of cattle at the Show, the important varieties represented being (1) *Madeswara*, (2) *Bettalapur*, (3) *Amrut-mahal*, (4) *Hallikar*, and (5) *Naludana*. A committee of eight gentlemen selected cattle deserving of prizes. Money prizes ranging from Rs. 5 to Rs. 10 and certificates were kindly distributed by Mr. T. Chokkanna, Deputy Commissioner, to the owners of deserving cattle. Out of the grant of Rs. 100 made from District Funds a sum of Rs. 68-8-0 was spent for prizes, etc., the balance with a sum of Rs. 131 realized by the sale of manure collected on the grounds, was credited to District Funds.

MADDUR.

On the occasion of Sri Narasimhaswami *Jatra* at Maddur, Mandya Taluk, a Cattle Show was held on the 22nd, 23rd, and 24th April, 1919. There were about 4,000 heads of cattle at the Show, and a committee of seven gentlemen inspected all the cattle and selected those deserving of prizes. The District Board sanctioned Rs. 50 for awarding prizes and there was a voluntary contribution of Rs. 2 by the Amildar. Four medals and four money prizes were awarded to the owners of deserving cattle. A special prize of Rs. 2 was given to a cow as the same was produced after the distribution was over.

QUERIES.

Hints to Correspondents.

Write on one side of the paper only. (2) Write each query on a separate sheet of paper. This will facilitate answering questions as in many cases they may have to be referred to experts. Put your name and address down on every such sheet. No attention will be paid to unsigned queries. (3) Drawings for illustrations should be on separate sheets of paper. They must be made in black ink only on white paper—not in pencil or colour—and twice the size they are intended to appear, especially reference letters and figures. (4) Put titles to queries, and, when answering queries, put the number as well as the titles of the queries to which the replies refer. (5) No charge is made for inserting letters, queries, or replies. (6) Letters or queries asking for addresses of manufacturers or correspondents, or where tools or other articles can be purchased, or replies giving such information, cannot be inserted except as advertisement. No question is answered through the post. (7) Letters sent by correspondents under cover to the Editor, are not forwarded and the names of correspondents are not given to inquirers. (8) As the space devoted to queries and replies is limited, they should be drawn up as briefly as possible. (9) To facilitate reference, correspondents, when referring to any letters previously inserted, should mention the number of the letter, as well as the page on which it appears. (10) All communications should be addressed to the Editor, *Mysore Economic Journal*, "Ringwood," Bangalore.

In reply to a question by Mr. Lambert in the House of Commons on Tuesday the Chancellor of the Exchequer made the following statement as to the cost of the war to the United Kingdom from August 4, 1914 to March 31, 1919:—"It would perhaps have been possible to answer the right hon. member's question with more confidence had he indicated in his question the assumptions on which he wish the calculations to be based. As it is, I give the answer with all reserve. After making the allowance usually taken for normal peace expenditure on the one hand and for debts due from the Dominions and Allies on the other hand, and after taking account of other Vote of Credit assets, the net cost of the war to the Exchequer of the United Kingdom up to March 31st last, on the basis of the Exchequer issues during the five years ending March 31st last, may be estimated in round figures at £6,700,000,000. These figures are, of course, exclusive of liabilities in respect of the war, accruing after March 31st last, and of losses to private citizens, localities, and trades in so far as these losses have not been made good out of the Exchequer." Mr. Chamberlain afterwards explained that in making this calculation he took credit for half the amount of the loans made by the United Kingdom to Dominions and Allies.

BOOKS IN BRIEF.

City of Toronto Report of Housing Commission.—Housing Commission, Treasurers Department, City Hall, Toronto.

This is an instructive Report from many points of view. How far can municipalities undertake housing operations? That is a point that has arisen already for solution in this country. The Toronto Commission do not favour undue liability on the part of municipalities. The following passage may be usefully quoted from their Report:—

"Moreover, house building is highly specialized form of activity, demands constant expert supervision, and does not lie within the compass of municipal duty. Private enterprise must, as in the past, be depended upon to a large extent to meet the increasing demand for housing accommodation. Nothing else can restore confidence, credit and stability in house property as a sound security for investment. Consequently, builders and investors should not be discouraged by the municipality engaging directly in house construction, and thereby entering into competition, with them. The City's chief contribution to housing lies in planning, in improved transportation facilities, in strict enforcement of building and sanitary laws, in rendering financial guarantees to responsible and bona fide housing companies, such as are herein-after mentioned, and in offering to sell or lease, its own vacant land on reasonable terms."

The whole report is well worth careful study by those interested in the housing question in India.

Imperial Institute Map of the Chief Sources of Metals in the British Empire.—Imperial Institute office, London; S. W. 5 sh. 6d. (post free). Mounted on linen and folded.

This is a useful map with diagrams of production for 1915 of the chief sources of metals in the British Empire. It has been prepared at the Imperial Institute with the advice of the Mineral Resources Committee. It shows the chief British countries of occurrence and production of metallic ores and the relation of their outputs to those of other countries in the world. We may add that copies of the map can be obtained from the Imperial Institute.

Statistical Abstract of the Baroda State from 1907-8 to 1916-17.—Price Annas 5. Baroda Printing Works, Baroda.

This is a handy volume issued by the Baroda State Department of Commerce and Industry. In preparing this Edition many mistakes found in the statements sent in by the Departments, since the publication of the Revised Statistical Abstract for 1916-17, have been

corrected. We are glad to note that Indian States are increasingly interesting themselves in issuing Abstracts of this kind. It is a sure sign of progress, for on correct statistics depends in the last resort all ideas of reform and improvement. We note with pleasure that the Baroda State is alive to the necessity of improving its system of collecting Statistics. That is a step in the right direction. In an Appendix to the volume we find a table showing the population, revenue, and expenditure for twenty years—1897-8 to 1916-17.

INFLUENZA.

Some Simple Instructions.

During the last year people in all parts of the world fell sick with a fever called influenza. After the fever had gone away many felt weak and suffered from small ailments. In the summer the fever was not dangerous, but it came back in the autumn and killed many people. It probably will come back again and all persons must be ready to guard against it. It is not possible to promise that proper measures will prevent all people taking it, but if people follow the advice now given, it will help greatly.

There is no law to make people careful to follow advice but for their own sake they should take the advice now given.

Influenza fever usually begins with sneezing and coughing and other people should keep away from a person in this condition; and a person who has fever and coughing and sneezing should not go near other people.

Keep well and try not to go near people suffering from this fever and if you have the fever try and keep away from other people.

Take food at regular times, get plenty of sleep, take exercise. Do not get cold and do not drink spirits. People will then be able to stand the fever better. Sneezing and coughing will give the fever to other people. Always cover the nose and mouth when sneezing or coughing.

Always work and sleep with windows open, wash out the inside of the nose and gargle the throat with one teaspoon of salt in a pint of water.

Do not go into room full of people and keep away from crowds.

Anybody with fever or sneezing should go at once to hospital or go home to bed, keep warm and send for a doctor if possible. Try and have a bed in an empty room or if not screen the bed off from the rest of the room. For the nose discharge, if handkerchiefs are used they should be boiled, if cloths or paper they should be burnt.

Do not return to work until quite cured. It is a danger to other people and if work is started too soon, other sickness may come. Do not go to meetings or tamashas until the fever has been gone for seven days. Let the sun enter any room where a person has been ill with this fever.

Do not visit persons suffering from influenza. Remember that the disease passes from person to person almost always by close company and that open air and ventilation are the best preventives.

RECENT PUBLICATIONS.

Papers on Current Finance. By H. S. Foxwell. 8½ x 5½. xvii + 280 pp. Macmillan. 10 s. n.

Railway Re-organization. "By A Railway Officer." 8½ x 5½. xii + 108 pp. Spon. 6s. 6d. n.

Instincts in Industry. A Study of Working Class Psychology. By Ordway Tead. 7½ x 5½. xvii. + 222 pp. Constable. 6 s. n.

The Financial History of Great Britain, 1914-18. By Frank L. Mc Vey, President, University of Kentucky. 10 x 7, v. + 101 pp.

On Payment of the National Debt. With "Proforma Assessments." By William Leighton Jordan. 8½ x 5½. 8 pp. Simpkin Marshall. 9d.

Economic Phenomena Before and After War. A statistical theory of modern wars. By Slavko Secrov. 8½ x 5½. viii. + 226 pp. Routledge. 10s. 6d. n.

The Control of Public Finance and Officials. By Richard Higgs. 8½ x 5½. xii. + 234 pp. Dover: Dover Printing and Publishing Co. 10s. 6d. n.

Effects of the War upon Insurance with Special Reference to the Substitution of Insurance for Pensions. By William F. Gephart, Professor of Economics, Washington University, St. Louis, under the Carnegie Endowment for International Peace. vii. + 302 pp.

War Administration of the Railways in the United States and Great Britain. By Frank Haigh Dixon, Professor of Economics, Dartmouth College, Chief Statistician, Bureau of Railway Economics, and Julius H. Parmelu. 9½ x 6½. xiii. + 155 pp. New York and London; Oxford University Press. 4s. 6d. n. each.

The State in Peace and War. By John Watson, Professor of Moral Philosophy in Queen's University, Kingston, Canada. 8 x 5½. xii. + 296 pp. Glasgow: Mac Lehos. 7s. 6d. n.

The State. Elements of Historical and Practical Politics. By Woodrow Wilson. Special edition revised to December, 1918, by Edward Elliott. 8½ x 5½. v. + 554 pp. Harparr. 10s. 6d. n.



THE RED, MAURITIUS CANE—A HARDY VARIETY (S. ARCOT.)