

**COLONIAL**

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***Sir Alan Burns***

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The reminiscences of a man who served for over forty-two years in several colonies (Leeward Islands, Nigeria, Bahamas, British Honduras and the Gold Coast) and in the Colonial Office, and has taken part in great events. The incidents connected with the so-called "Juju Murder" in the Gold Coast, which attained much notoriety in 1947, are fully dealt with.

*continued on the flap*

# PROCEEDINGS

OF THE

## Second Meeting of Veterinary Officers in India

*Held at Calcutta from 26th February to 2nd March,  
1923*

WITH APPENDICES

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**Proceedings of the Second Meeting of Veterinary Officers, held  
at Calcutta, from the 26th February to the 2nd March, 1923.**

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**INTRODUCTORY.**

The Second Meeting of Veterinary Officers in India was held in Writer's Buildings, Calcutta, from the 26th February to the 2nd March, 1923, under the presidency of Colonel G. K. Walker, C.I.E., O.B.E., F.R.C.V.S., Principal, Punjab Veterinary College, Lahore.

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**MEMBERS.**

1. Colonel G. K. Walker, C.I.E., O.B.E., F.R.C.V.S., Principal of the Punjab Veterinary College, Lahore (President).
2. Mr. J. T. Edwards, B.Sc., M.R.C.V.S., Director, Imperial Bacteriological Laboratory, Muktesar (Secretary).
3. Mr. K. Hewlett, O.B.E., M.R.C.V.S., Principal of the Bombay Veterinary College.
4. Mr. E. S. Farbrother, M.R.C.V.S., Superintendent, Civil Veterinary Department, Bombay Presidency.
5. Mr. P. J. Kerr, M.R.C.V.S., Superintendent, Civil Veterinary Department, and Veterinary Adviser to the Government of Bengal.
6. Mr. A. D. MacGregor, M.R.C.V.S., Principal of the Bengal Veterinary College.
7. Mr. D. Quinlan, M.R.C.V.S., Director, Civil Veterinary Department, Bihar and Orissa.
8. Mr. P. B. Riley, M.R.C.V.S., Deputy Director, Civil Veterinary Department, Bihar and Orissa.
9. Mr. G. G. Howard, M.R.C.V.S., D.V.H., Civil Veterinary Department, Bihar and Orissa.
10. Mr. C. W. Wilson, M.R.C.V.S., Veterinary Adviser to the Government of the Central Provinces.
11. Major R. F. Stirling, F.R.C.V.S., Second Superintendent, Civil Veterinary Department, Central Provinces.
12. Mr. F. Ware, F.R.C.V.S., Chief Superintendent, Civil Veterinary Department, Madras Presidency.

13. Mr. Krishna Murthi Ayyar Avergal, Professor of Pathology and Bacteriology, Veterinary College, Madras.
14. Mr. W. Harris, M.R.C.V.S., Superintendent, Civil Veterinary Department, Assam.
15. Mr. T. F. Quirke, M.R.C.V.S., Chief Superintendent, Civil Veterinary Department, Punjab.
16. Mr. R. Branford, M.R.C.V.S., Superintendent, Government Cattle Farm, Hissar.
17. Mr. C. J. N. Cameron, M.R.C.V.S., D.V.H., Second Superintendent, Civil Veterinary Department, Burma.
18. Captain S. G. M. Hickey, M.R.C.V.S., Officiating Veterinary Adviser to the Government of the United Provinces.
19. Captain W. H. Priston, F. R. C. V.S., Second Superintendent, Civil Veterinary Department, United Provinces.
20. Khan Saheb Sheik Naiz Mohammed, Officiating Third Superintendent, Civil Veterinary Department, United Provinces.
21. Mr. R. T. Davis, M.R.C.V.S., Professor, Bengal Veterinary College.

#### GOVERNMENT OF INDIA DELEGATES.

The following representatives of other Imperial Services attended the conference at the request of the Government of India :—

- Mr. W. Smith, Imperial Dairy Expert, Kasauli.
- Lieutenant-Colonel F. H. G. Hutchinson, C.I.E., Public Health Commissioner with the Government of India. (Indian Medical Service.)
- Lieutenant-Colonel W. A. Pallin, C.B.E., D.S.O., F.R.C.V.S. R.A.V.C., A.D.V.S., Eastern Command. (Army Veterinary Service.)
- Mr. T. Bainbrigge Fletcher, R. N., F.L.S., F.E.S., F.Z.S. Imperial Entomologist. (Indian Agricultural Service.)

## PROGRAMME.

The agenda placed before the meeting comprised the following subjects :—

### 1. EDUCATION.

(a) Is any revision necessary of the conclusions arrived at by the Sub-Committee on Education at the First Conference held at Lahore in March 1919 and by the Meeting of Principals of Colleges at Bombay in February 1922 ?

(b) What qualifications should be required for—

- (1) The promotion of subordinate members of the department to the Provincial Service ?
- (2) The promotion of Provincial Officers to the Imperial Service ?
- (3) The direct appointment of Indians to the Imperial Service ?

(c) What forms of post-graduate training should be devised for—

- (1) Veterinary Assistants,
- (2) Provincial Officers,
- (3) Imperial Officers ?

### II. EPIZOOTIC DISEASES.

(a) Anthrax—

- (1) Prevalence among the various classes of live-stock in India.
- (2) The necessity of instituting legislation to deal with the disease; the scope and nature of such measures.

(b) Rinderpest: to review the experience already gained as to the relative advantages of the "serum simultaneous" and "serum alone" methods of inoculation in India and in other countries.

(c) Trypanosomiases —  
Surra—

- (1) Is the existing legislation for the control of surra adequate ?

- (2) The present position in respect to research and the efficacy of methods of treatment.
- (3) Information with regard to trypanosomiases, other than surra, found in India.
  - (d) Contagious abortion : information regarding its incidence among imported and indigenous stock ; proposals for control.
  - (e) Tuberculosis : prevalence of tuberculosis among live-stock in India, and the danger of infection to human beings from this source.
  - (f) Parasitology (helminthology and entomology) : necessity for instituting a survey of the incidence of the grosser parasites of live-stock in India and for the formation of central departments to control work in this connection.
  - (g) Infectious lymphangitis in cattle : causation and treatment.
  - (h) Nasal granuloma in cattle : causation.
  - (i) Rabies : measures of control.
  - (j) Diseases of sheep : nature, incidence, and control of the more important disease conditions among sheep in India.

### III. GENERAL.

- (a) Legislation : the desirability of introducing further legislative measures for the control of animal diseases.
- (b) Statistical : methods of obtaining and recording statistical information regarding the incidence of epizootic diseases in India ; suggestions for improvement.
- (c) Animal husbandry : what is the rôle of the Civil Veterinary Department in dealing with problems directly concerning the live-stock industries in India ?
- (d) Methods for facilitating and improving the supply of sera and other laboratory products, particularly in regard to the needs of remote districts.
- (e) Meat inspection : is it within the present competence of the department to deal with this problem ; what further arrangements for training personnel for the special duties entailed are required ?
- (f) Methods to be adopted to correlate technical information and render authoritative advice on professional problems.
- (g) The advisability of amalgamating certain Veterinary Services in India.

## PRESIDENT'S OPENING ADDRESS.

In his opening address at the previous meeting of Veterinary Officers in India held at Lahore in March 1919, Mr. Mackenna, Agricultural Adviser to the Government of India, who presided, referred to the Veterinary Conference at Calcutta in 1908 which was independent of the Board of Agriculture. It was resolved at the conference that a Board of Veterinary Science should be established, but the proposal did not materialize.

At the meeting of the Board of Agriculture at Poona in December 1917 it was proposed and accepted that periodical meetings of veterinary officers should be held every three years with the result that this is the second meeting of the kind to be held.

The orders of the Government of India on the resolutions of the first meeting were that sectional meetings of veterinary officers might be held in alternative years, *i.e.*, in the years in which the Board does not meet, and that one or two members of the Veterinary Service from each province would constitute a sufficient attendance.

It has been decided also that technical and professional subjects should form the chief business, administrative questions being dealt with at the meetings of the Board of Agriculture.

In consequence, it has pleased Government to permit the senior veterinary officer present to preside. It has fallen to my lot to have the honour and, incidentally, the responsibility of preparing the agenda.

I trust that I shall be able to satisfy both Government and you in the performance of my duties. The privilege of presiding is tempered by the fact that seniority has its disabilities and that time means changes.

Since our last meeting, Colonel Farmer and Mr. Shilston have died. Both officers have left many friends in the Service and in India to deplore their loss. In each case devotion to duty contributed largely to early demise.

Colonel Pease, who had to his credit many years of distinguished service in India, has retired, and we miss other senior officers in Colonel Smith, Major Oliver, and Mr. George Taylor. I beg to accord a welcome to those officers who have been deputed to attend by their respective Governments, and I trust that everyone will join in contributing to the usefulness of our discussions. We have a heavy programme before us and there are some very important matters to examine.

At this stage I do not propose to deal with any of them in detail. I have endeavoured to include in the agenda all the subjects suggested by the respective veterinary officers through their Local Governments, and I will call upon them individually to present their cases in due course.

It may be necessary to form committees to discuss the details entailed by the complexity of some of the subjects under reference, but we will come to that later.

The question of education is the first subject we have to deal with and at the present time it ranks very large. We have to bear in mind that Indians are to be educated in veterinary science up to a sufficiently high standard to enable them to fill the highest positions available. At the previous conference certain definite decisions were arrived at, and at the Meeting of Principals held in Bombay last year the details of the course of study were comprehensively worked out. I understand that the Government of India consider the scheme to be very thorough and worthy of serious consideration by Local Governments. They have already congratulated the Government of the Punjab on the adoption of a four years' course of study. Mr. Secretary Hullah's note on the subject is before you and you will perceive that he writes in pessimistic strain. The lack of adequate hospital practice alone must rule out Muktesar as a possible place for a veterinary college. Veterinary colleges can only thrive in populous centres where other educational facilities exist. Mr. Hullah thinks apparently that a four years' course of study is only required for a very limited number of men, *viz.*, those who are to receive gazetted rank, whereas it was the unanimous opinion of the members at our previous meeting that four years was the requisite minimum for all. In view of the general desire to provide a good veterinary education for Indians this view is doubtless correct, but it is clear that aspirants will be few unless prospects are improved. It is not reasonable to expect a man to spend at least four years of his life at a college where a severe course of study is required without holding out some adequate return for the necessary outlay in time and money. In short, the problem is inevitably complicated by the external financial question, and although it is not within our province to discuss finance, we shall waste our time if we ignore its consideration. We can hardly be expected to advise the creation of a cheap and inefficient agency, but the question of ways and means certainly complicates matters.

We should not fail, however, to impress certain facts in respect to veterinary education on a public which is lamentably ignorant of the true position. The empiricism practised by the latter gener-

ally, demonstrated by the unlicensed use of drugs on subjects unable to protest and unsystematic and haphazard experiments in the secrets of nature, is an indication of the general estimation held of an art which requires for its effectual practice a wide knowledge of many of the sister sciences.

Science cannot be taught without the use of expensive apparatus and equipment.

I do not wish to labour the point, but it seems to be necessary to affirm as strongly as possible that, as students of veterinary science must be taught "cause and effect," a long and expensive education is necessary, more especially in respect to preventive medicine. If, on the other hand, a band of empirics licensed to dispense drugs and to perform certain crude operations is required, the position is different. My own view is that if the latter course is to be adopted, we should draw a very strict line of demarcation between those who are educated to know the reason why and those who are mere mechanics. I am inclined to think that the middle course hitherto pursued has been only moderately successful, but I have no desire to influence your deliberations at this stage of the proceedings.

The section on epizootic diseases is of great importance as, apart from the economic factor, we are dealing with questions of very great professional interest. Anthrax has been given a prominent place, as, being communicable to human beings, it has an added importance. In this connection we are fortunate in having with us, as a visitor, Colonel Hutchinson, the Public Health Commissioner with the Government of India, who has made a special study of the economic issues.

The same remarks apply to tuberculosis, which is also to be discussed.

The need for close collaboration between the medical and veterinary services need not be emphasized.

The veterinary profession owes much to the medical profession, and it is a source of gratification to be of any assistance to the latter in dealing with its problems.

Rabies was discussed at the previous conference, but the subject has been re-submitted by Madras and we shall hear if there is anything new to learn about it.

The need for a separate organization for the study of insect parasites was discussed at the last conference and the matter is still under the consideration of the Government of India.

The general questions are very wide in their scope and it is doubtful whether we shall be able to deal with them adequately in the time



at our disposal. It will serve a useful purpose, however, if the seeds of further progress can be planted in the hope that nutrition will be provided. The subject of legislation was discussed at the previous conference, but the Government of India doubted whether with the existing staff any practical advantages would be gained by enhancing the legal powers of enforcing preventive and curative measures against cattle disease. The position has not altered materially since then.

The need of improving our means of obtaining more accurate statistical information is obvious. We are all aware that the existing systems are unsatisfactory.

The rôle of the department in respect to animal husbandry was discussed at the last conference.

Animal husbandry is a very wide subject intimately connected with complicated economic factors.

There are few problems more complex than the problem of how to effect an improvement in cattle breeding in India, and there is an increased public demand for salutary measures. Such measures, to have any chance of success, require to be discussed in a broad-minded and comprehensive spirit by men who have special knowledge of the scientific side and, in particular, considerable experience of the peculiar conditions occurring in this country.

It is certain that Government cannot provide large capital expenditure to invest in animal industries, but model farms and dairies are necessary for educational purposes.

Private enterprise on sound lines should be encouraged. I consider that each Province ought to appoint a standing advisory committee to deal with the question.

Committees should not be large and should be formed of well-informed non-officials associated with veterinary, agricultural, and dairy experts, with a revenue officer as secretary.

It might be advisable also to constitute a central committee on the same lines with the Government of India, to which references could be made and reports submitted. With the aid of the reports the central committee should be able to frame certain principles and circulate them for information and guidance from time to time. This method of dealing with the matter conforms in principle with the views of the committee which discussed Subject XII at the meeting of the Board of Agriculture at Pusa in 1916.

The Government of India concurred in the report of the committee and in reviewing the proceedings of the last Veterinary Conference stated that they were not prepared to reconsider the matter at present. The subject has been entered in the agenda

as it was included in the list of suggestions received from several Governments, but the question for the time being is one for the administration. I am not prepared to allow the matter to be discussed, therefore, unless any member of the conference has something to bring forward of strictly professional interest. You are again reminded that administrative questions are to be dealt with at the meetings of the Board of Agriculture.

The reference from Burma in respect to the storage of serum has been widened in its scope as I feel that the question will repay a full discussion.

Meat inspection was suggested by Mr. Cross, who is not present. Perhaps some other members of the conference may have some remarks to make on the subject.

The remaining subjects will be presented by their respective sponsors in due course.

I will not take up more of your time except to express the hope that the results of our deliberations will be appreciated favourably by Government. The Civil Veterinary Service in India is well known to be inordinately weak for the nature and scope of the work that is demanded of it.

The economic factor should in itself demand a liberal policy, but we have experienced many serious set-backs and there seems to be very little prospect of immediate progress.

It behoves us, however, to look upon the future as cheerfully as possible and to do our utmost individually and collectively to increase the respect that is due to the profession which we have chosen. It should be our daily duty to improve our knowledge and to do something progressive for our art.

We have to fight against ignorance and apathy, but that need not dishearten us.

The great master Pasteur fought a glorious fight. If we cannot approach him, we can emulate him.

We may take as our motto "*Decolatus sed vivus*" and give our best.

## PART I—EDUCATION.

**SUBJECT I (a).—EDUCATION. IS ANY REVISION NECESSARY OF THE CONCLUSIONS ARRIVED AT BY THE SUB-COMMITTEE ON EDUCATION AT THE FIRST CONFERENCE HELD AT LAHORE IN MARCH 1919 AND BY THE MEETING OF PRINCIPALS OF COLLEGES AT BOMBAY IN FEBRUARY 1922 ?**

The Chairman in introducing the discussion stated as follows :—  
 “ The first question has been raised particularly by Mr. Hewlett, Principal of the Bombay Veterinary College. His reference is, that in view of the financial situation rendering the establishment of a four years’ course in certain provinces impracticable, what is the best curriculum for a three years’ course ?

“ It appears that he considers a revision of the curriculum of the three years’ course is indicated, and if any Government decides to adhere to that period of study he is doubtless correct. I think you will agree, however, that in view of the proceedings at the last conference, when it was the unanimous opinion of the members that a four years’ course is necessary in order to teach the requisite subjects satisfactorily, we shall be taking a very serious step if we give our approval to any course of training of three years’ duration.

“ You have before you the proceedings of the previous conference and of the Meeting of Principals at Bombay, both of which Mr. Hewlett attended, and you have Mr. Secretary Hullah’s note also.

“ My own views on the general question have been expressed in my opening address and in my remarks at the last conference. I am strongly of opinion that if we are asked to produce an incomplete article we should name it accordingly and stamp it as such. If Mr. Hewlett gains his point that a course of three years is required we will endeavour to prepare a suitable curriculum, and I will ask you to appoint a committee for the purpose.”

Mr. Hewlett presented the following views on this sub-section (a) :—“ In my view no alteration is necessary in section (A) and (B) of the report of the sub-committee on education adopted by Lahore conference in 1919.

“ The conference of 1919 was of opinion that the recommendations made by the Public Services Commission that a course of training should be instituted in India in order to enable Indians to qualify for the Imperial branch of the department is not practicable.

“ Nothing has arisen since 1919 to make the proposal more practicable. On the contrary the financial situation, the completeness of the autonomy of the provinces, the fact that “veterinary matters” are now an entirely provincial concern and also a transferred subject render the proposal more difficult and impracticable now than in 1919.

“ The proposal put forward in the note (circulated to members of this conference) by Mr. Hullah, the late Secretary to the Government of India in the Revenue and Agriculture Department, that there should be a single college for all India and that all Local Governments should contribute to the necessary capital outlay and pay fees for the students so that no cost at all would fall on the Government of India, is contrary to the opinion of the Lahore conference and is logically unjustifiable, and that such a course would be agreed to by the local Legislative Councils is highly improbable.

“ It is probably true, as Mr. Hullah says, that the Imperial Service will in time disappear and presumably its place will be taken by a superior Provincial Service entirely under the Local Governments. The Provincial Service can never be large, probably in Bombay not more than five officers, for many years to come. The cost of training these five officers in Europe or America by means of State scholarships would be less than the contributions to the Government of India for buildings and upkeep of a central college. After the five men had been trained, the wastage would be very small indeed—perhaps one every ten years.

“ The Lahore conference was of opinion that the provincial colleges should train the men intended for the present Provincial Service, what will presumably be in future the lower grade Provincial Service, and that after training they should go through a course of post-graduate study. I consider that this view should be adhered to.

“ With regard to section (c) of the Lahore resolution on education, I consider that a four years’ course is not a practical proposition at present and that a three years’ course should be maintained, modified to some extent and combined with post-graduate training for selected youths. I do not consider that a uniform curriculum is essential and that the difficulties in the way of a permanent examination board for the whole of India outweigh the advantages, which are very problematical.

“ The scheme put forward by the Principals’ Meeting at Bombay in February 1922 for a uniform curriculum for all colleges in India is in my opinion an excellent scheme but is idealistic in the extreme

and quite impracticable for many years to come, if ever. It is also more than doubtful if men taught up to the standard suggested would justify their existence in the districts in the place of the present Veterinary Assistants. In my view the scheme proposed in Bombay should remain in abeyance."

After some discussion with the Chairman, Mr. Hewlett made it clear that he wished to adhere fully to the decisions arrived at in sections (a) and (b) of the report of the sub-committee on veterinary education at the first conference held in Lahore in 1919 (pp. 12 and 13). In view of the financial situation existing in each province and the absence of adequate prospects for veterinary graduates he no longer adhered to the statements contained in section (c). It appeared to be beyond the means of Provincial Governments to carry out a scheme involving a four years' course of training such as was outlined in the Bombay conference, and it must be remembered that the Veterinary Services were now entirely transferred subjects and in all provinces were at present controlled directly by the Local Government. He therefore maintained that a course covering a period of three years was all that could be attained at the present time. He regarded the Bombay programme as too ideal and ambitious.

Mr. Cameron explained the conditions of service in Burma where there were two grades of personnel, namely, a lower grade, starting at Rs. 40 a month, who were trained at the schools at Burma, and a higher grade, from whom were promoted Deputy Superintendents, who had received their training at the Bengal Veterinary College. He believed that one of the existing colleges in India might be utilized as a central college for the training of Provincial Officers of the higher grade. His views in regard to the details of training which appeared to him to be indicated were distributed among the members in a circular. He did not consider it necessary to build a new college for higher training. Some of the basic training could be imparted at the universities, while training in preventive medicine could be given at Muktesar.

The Chairman maintained that it would be useless to educate, by means of post-graduate training, men for higher posts who had not received an adequate basic training. He agreed that no province could afford to educate all of the veterinary personnel required up to the highest standard. It seemed to be necessary, therefore, to institute a short course of training, probably covering only two years, for a certain number of men. The four years' course, which aimed at providing men who already possessed a groundwork of education with an intelligent grasp of their profession, was required for the higher posts. He had suggested this procedure to the Punjab

Government and he believed that in time there would be a much greater demand for the more highly educated men.

Mr. Hewlett thought that we ought to adhere to the three years' course of training, and that a sufficient number of men for the higher posts could be obtained by proper post-graduate teaching. In particular, he wished to impress upon the meeting that for certain of the higher posts, as for example, for the teaching of anatomy, it was quite unnecessary to put the selected men through a course of pathology and allied subjects.

The Chairman contended that the men who were selected for the higher posts in the Service, including the men who were to bear the responsibility of teaching, should have a wide general education and a sound knowledge of the basic sciences. The subjects which Mr. Hewlett considered to be unnecessary were of great importance in veterinary science.

Mr. Kerr recapitulated the views which he had already presented to the members in a circular. The first point to be decided was what the position of the services was likely to be in future. It had to be admitted that the services must become rapidly Indianized. At the present time there were a number of Bengalis under training in Europe with a view to appointment to the Imperial Service. It had also to be decided whether there should be direct recruitment to the Deputy Veterinary Superintendent grade, or whether men of this grade should be promoted from the lower ranks.

Mr. MacGregor stated that the training at the colleges must cater predominantly for men of the Veterinary Assistant type. Any further training must be imparted in post-graduate courses. He was emphatically of opinion that no additional subjects could be included in a scheme of three years' training, for it was his experience that in order to teach properly the subjects that were already down for study in the three years' curriculum at least four years were necessary, particularly in view of the fact that the large number of gazetted and other holidays observed at his college interfered very materially with the prosecution of study.

Mr. Cameron further dwelt upon what he considered to be a satisfactory method of post-graduate training for men who had undergone the initial training of Veterinary Inspectors and were selected for promotion to the Veterinary Deputy Superintendent grade.

Mr. Branford contended that if such men were not given a comprehensive ground-work of education to commence with, they could not be deemed capable of taking full advantage of advanced post-graduate study.

Mr. Farbrother believed that we should concentrate upon the better training of men of the Veterinary Assistant class, and he was further of opinion that men of the Veterinary Deputy Superintendent grade should be selected men from this class who had undergone further training.

Mr. Edwards subsequently dealt at length with the problem which was now directly before the meeting, namely, whether any revision of the conclusions noted in this section of the agenda was necessary. His views had already been communicated briefly to the members in his circular. He strongly maintained that the Bombay programme represented the minimum required for the inculcation of an intelligent conception of veterinary science as the science stood at the present day. He pointed to the advances made in our knowledge during recent years, since the time when shorter courses of study were adequate. It now seemed that financial conditions forbade the education of men employed in the veterinary services up to this satisfactory standard. In view of these circumstances, he submitted to the meeting that, for what might be termed routine work, such as that of serum inoculation and the diagnosis and treatment of simple clinical cases of disease, men drafted from a class intimately connected with the live-stock industries might be trained in a short time, perhaps for a period of only two years, to undertake such work satisfactorily in the field. Such men must not be regarded generally as possessing an understanding of their vocation, but would perform certain duties mechanically. He further referred to the experience of distinguished individuals who had been engaged in veterinary teaching in Europe and said that though such authorities recognized that the training imparted in some of the most important schools had obvious shortcomings, it was nevertheless such as was required in the type of man demanded by the public, namely, the general practitioner. Likewise, in India, the training of the veterinary personnel should be such as was required in the type of individual for which the Indian public was willing to pay and with whom they were satisfied. It was of no use trying to impose forcibly upon individuals recruited into the veterinary colleges an intelligent grasp of our calling by prolonging the period of study, if these men had not received beforehand a broad general training which aimed at the development of their mental capacities so as to prepare them for higher study. It seemed to him, therefore, that the fundamental proposition before them, and one which now seemed to be inevitable, was the question as to whether or not they should divide the veterinary services in the country into two separate and distinct cadres, namely, (1) a higher cadre that had undergone a training fully in accordance with the programme set forth at the

Bombay meeting, and (2) a lower cadre trained to accomplish certain tasks, menially or mechanically, representing by far the greater proportion of the service numerically, and useful in certain allotted and restricted functions. An intelligent perception of the science need not be required of these men, and a short course of study, probably not exceeding two years, might be found sufficient, whereas for the men admitted into the higher posts and who were destined to perform the incalculably important function in the economy of a well-ordered State, namely, the control of contagious animal disease, the Bombay programme represented the irreducible minimum in primary veterinary education. He further maintained that the teaching resources of the country were now so limited that it would be necessary to concentrate all their best available resources in teaching personnel and equipment at one centre in order to impart an intelligent system of training such as that outlined at Bombay.

Mr. Hewlett stated that the last speaker seemed to have overlooked the fact that some of the most distinguished members of our profession were men who had been trained when the period of study demanded was only three years, or even two years. By analogy, he maintained that men could at the present day achieve like advancement by superimposing post-graduate instruction upon the shorter, three years, course of study.

Mr. Edwards explained that the men whom Mr. Hewlett had in mind as having achieved distinction had passed through their college training when the amount of knowledge available in regard to animal disease was relatively very small, and such men had achieved distinction by continuous study after graduation.

The Chairman likewise maintained that the advances made in veterinary science during recent years had been so enormous that an expansion of the course of study was inevitable. A concentration of the best available teaching resources in one province seemed to be indicated and the other provinces should be invited to send their students to be trained up to the standard required for the higher posts at such a central college.

Mr. Quinlan and some other members objected to a course of study extending over only two years, even for the lowest grade of the service, as they believed a recommendation of this kind would be regarded as a retrograde step by Governments.

The Chairman in addressing the meeting next day at the resumed discussion of this section of the agenda stated :—

“ The discussion on this knotty point has revealed the fact that we are practically unanimous in approving whole-heartedly



the course of instruction prepared by the Principals at Bombay. I shall ask for a formal resolution to that effect. There is no doubt that it represents a genuine attempt to educate Indians up to the highest standard in veterinary science. Personally, my only fear is that four years may prove to be rather too short a time for students admitted to the colleges after passing the Matriculation standard of examination to grasp the work. My experience in the Punjab is that the Matriculation standard is not very satisfactory. We should aim at obtaining students with the Intermediate qualifications in science, and the Punjab prospectus provides for them.

“ It is clear, however, that for financial reasons this comprehensive course cannot at present be adopted at all our colleges. It has been suggested that it should be adopted at one and that is probably the only course open at present. It has to be decided later if promotion to gazetted rank should in time be limited to men who have gone through a four years' course of study as students.

“ A four years' course cannot then be generally adopted for two reasons ; first, because all the existing colleges cannot be enlarged, equipped and staffed sufficiently, and secondly, because the graduate cannot be paid highly enough to encourage students to enter for a course of training of this duration.

“ We have got to put up therefore with a large proportion of less-educated and lower paid men for the present.

“ A course of study must be devised for them, and although Local Governments will have the deciding voice in the curricula adopted at their own colleges, it will be helpful and advisable if we can suggest a suitable course, or even alternative courses, at this meeting. We may appoint a committee for the purpose and lay down general principles for its guidance. There is a division of opinion as to whether the course should remain at three years as at present or should consist of two years in future. As you know, I am in favour of the latter course, but I will try to present both points of view to you as fairly as possible.

“ The arguments in favour and against are both professional and financial. From a professional point of view we know from past experience of the three years' course that animal pathology, including bacteriology and parasitology, which are essential in a study of State veterinary medicine, cannot be taught in a three years' course to students who have no previous knowledge of the basic sciences of chemistry, physics and biology. The subject has grown enormously since the three years' course was first instituted about a quarter of a century ago. We have progressed a lot since then. In Lahore we made this discovery some years ago and a four years'

course was first instituted by Colonel Peasé, when he was Principal of the College. It was recast entirely by me as it exists at present. The Punjab University is discussing our affiliation and the grant of a degree in veterinary science. I am aware that it appears to be a retrograde step to return to a two years' course, and there is no doubt that we cannot expect to turn out scientific men in that time. But my point is that we cannot hope to do so in three years either, and I believe that in a three years' course, chemistry, botany and pathology cannot be included. The scope of veterinary study has developed so much that three years' study for men of inferior preliminary education is quite insufficient. Why then pretend to give a qualification that cannot be substantiated in its practical outcome? If we do not pretend to turn out scientific men, I think we can turn out useful assistants in 'veterinary aid' in two years, and that brings me to the financial aspects. There is no doubt that men who have done three years will not remain content with the present rate of pay, whereas two years' men should remain satisfied. If the pay of the three years' men has to be raised, it may be that the existing establishment of the veterinary services will be reduced and not increased. Further expansion and increase of expenditure should be directed, I consider, to the employment of a larger proportion of well trained men, who would be in responsible positions and be capable of carrying out investigation and giving sound professional advice. If we continue the three years' course, the men who have gone through it will expect to be considered eligible for promotion to gazetted rank, for which they will be poorly equipped by reason of their limited knowledge of the basic sciences. Our experience of post-graduate instruction at Lahore is that in the great majority of cases these men are unable to grasp pathological study owing to their ignorance of histology and general biology. Doubtless, brilliant exceptions occur, but in such cases many years of subsequent patient study are involved and they must be treated as rare individuals. I repeat that the time is rapidly approaching when the three years' men will be dissatisfied with their pay and prospects, and that, in my opinion, we should create a class of men who will do useful work in the field on what we can offer, and be content. The increased expenditure on establishment should be directed to employing a larger proportion of well educated men capable of taking responsible positions. We owe it to our profession to insist that a man who describes himself as a veterinarian should be well educated and capable of meeting members of other scientific professions on equal terms. The time will come in India, as in other countries, when a legal status will be given to qualified veterinarians. If we look ahead, therefore, we should, in order to avoid complications, create a well educated class entitled to the

use of the term 'Veterinarian,' and also, in order to meet the present financial difficulty, a class of assistants who will not be entitled to the use of the word 'Veterinary.' Personally I think the word '*salutri*' is quite suitable.

"I hope that Colonel Pallin will speak on this subject, for although at the present moment no recruits are required for the Army, some will doubtless be required in the course of time. Sir John Moore was whole-heartedly in favour of the four years' course and supported me in putting through the present course at the Punjab Veterinary College.

"If Indian veterinary officers are to be employed in the Indian Army in future, I think you will agree that a four years' course is essential for them. There may be room, however, for a number of *salutris* to assist in the larger hospitals."

Colonel Pallin stated as follows :—"I am afraid that my remarks are rather general and I trust that I may be excused if I do not adhere altogether to the point at issue. I not only take it as a great honour to have been selected to represent the Army Veterinary Service, but it is also a great pleasure to me to have an opportunity of attending this meeting and listening to the discussions on such an interesting lot of subjects as have been listed on your agenda. Unfortunately, I did not receive the intimation that I had been selected to attend your meeting until about 10 days ago. I was then on tour and consequently I have been unable to prepare very much information for the discussions. I would like, however, to give you some of my views on the subject of education.

"If a sufficient number of suitable candidates is likely to come forward and the policy of the Government of India renders it necessary that you should endeavour to educate Indians up to the standard of making it possible for them to fill the higher appointments in your service with Indians with an Indian veterinary qualification, then the scheme drawn up at your first conference in March 1919 and amplified by the Principals' Meeting held in Bombay in February 1922 does not appear to me to require any amendment. But as far as any veterinary education in India is concerned, I do not consider that the country is ripe for launching such a high standard of education. Furthermore, it is quite evident that the Government of India are not prepared to find the money for the adoption of the scheme for many years to come, and I am convinced that if the Government of India do entertain the idea of appointing gentlemen to the higher appointments in your service other than those with the membership qualification of the Royal College of Veterinary Surgeons, well then, they may as well 'wash out' the Indian Veterinary Service altogether.

“ We all know what fine rulers, statesmen, soldiers, legal advisers, etc., India can produce, but my view is that Indianization of the Government services has its limitations, and I venture to say that these limitations are more accentuated in regard to the classes from which our Indian veterinary graduates are drawn than in any other Indian community which aims at obtaining Government employment in positions at present filled by gentlemen with European education and qualifications. Only quite recently I was reading an account of a speech made by His Excellency the Governor of the United Provinces at some function at the Agricultural College, Cawnpore, at which he said, as well as I can remember, ‘ Agriculture is by far the most important industry in this country, and I do not think that any one is likely to dispute this statement.’ Consequently, in view of your close connection with agriculture and the importance of keeping live-stock free from contagious and infectious disease I fail to see why your service does not appear to receive more consideration from the Government and carry more weight with the general public. In fact, I was more than surprised to find a statement by Mr. Hullah in his criticism on your educational scheme to the following effect: ‘ The difficulty, of course, lies in the existence of the Imperial branch of the Service. That branch will, I have no doubt, soon cease to exist’ Gentlemen, with all due deference to the Indian gentlemen at present employed in your department, my considered view is that it will be a fatal mistake if the Government of India ever try to officer your service with Indians only.

“ Irrespective of ability, caste and religious principle will always make it very difficult, if not impossible, for the Indian to carry out a campaign against a contagious and infectious disease amongst animals unless he is directed and supported by British officers.

“ I am quite with you in your efforts to improve the education and training of your Veterinary Assistants. But I should be very wary about going beyond a certain point, for not only will you find yourselves gradually absorbed by gentlemen with Indian veterinary qualifications, but all the good work which has been done by your service in this country since its formation some 35 years ago will be wasted. If I may say so, what is required of you is to put your own house in order first. No officer without the diploma of the R.C.V.S. and at least one post-graduate course should be accepted for service in the Imperial branch. After they have been accepted these officers should aim at keeping themselves qualified up to the highest standard; for this purpose I maintain that searching examinations should be passed periodically before promotion is obtained to the higher appointments of your service.

“ More unity and co-ordination of your colleges and provincial offices appears to be necessary, and for this purpose I am convinced that you are certainly in need of a Director, who should occupy a corresponding position to that of the Director-General of the Indian Medical Service.

“ Judging by the correspondence which has been going on in the veterinary journals for some time the officers of the Indian Veterinary Service appear to have certain grievances in connection with their conditions of service. I am of opinion that the settlement of these grievances is very largely in your hands. You must co-ordinate and combine if you want to attain success, but, first and foremost, you must by your presence and bearing, as well as by the economical results of your professional work, make the public and Government realize that you not only justify your position but that you are worthy of more sympathetic treatment and improved terms of service.

“ This leads me up to the subject of the necessity for the re-organization of the Indian Veterinary Service. This subject is not down for discussion at this meeting, but your educational question is so absolutely interwoven with your organization that it is very difficult to review one without considering the other. At the time I was preparing my notes for this meeting, I had not had an opportunity of perusing the proceedings of your first meeting, which was held at Lahore during March 1919, but I see now that the whole history of your service and the necessity for reorganization was most ably expounded at that meeting by Colónel G. K. Walker, and I consider that we should not allow this conference to break up without passing some further resolution on this subject, at the same time drawing the attention of the Government of India to the fact that the members of this conference view with deep concern the whole future of the Indian Veterinary Service ; the utility and economical value of this Service is of such importance to the State, provided it is properly organized and efficiently staffed, and they, the members of this meeting, therefore, very much regret that the Government of India does not appear to have taken any steps seriously to consider the views put forward in resolutions Nos. 5 and 10 passed by the veterinary conference assembled at Lahore between the 24th and 26th March, 1919.”

The Chairman stated that purely administrative questions could not be discussed at the Meeting.

Continuing, Colónel Pallin said :—“ Now to revert to your education scheme, instead of entertaining the idea of trying to bring the standard of the Indian qualifications up to that of the M.R.C.V.S., or, as an alternative, having a two, three and pos-

sibly four years' curricula running side by side, I would suggest adhering to your present three years' curriculum and then from amongst the successful graduates select men for a one year's post-graduate course, of which not less than six months would be spent at Muktesar. These men would be called upon to pass a further examination at the termination of that post-graduate course, and if successful, would be granted some form of post-graduate certificate and would be noted as qualified to fill the appointment of Veterinary Inspector and for early promotion to the rank of Deputy Superintendent after having carried out the duties of Veterinary Assistant in the field for, say, not less than two years, to the satisfaction of the District Officer and Veterinary Adviser of the province."

In reply to the Chairman, Colonel Pallin stated that the reason why there had been no demand for recruits as certified Indian veterinary officers in the Army during the past two years was because there were no vacancies. He would be quite satisfied with a course of training extending over three years for these officers. He did not consider it necessary to extend the training further for holders of the Viceroy's Commissions. Further, if veterinary officers holding the King's Commission were to be appointed to the units that were in future to be officered entirely by Indian officers, these veterinary officers ought to possess the diploma of the Royal College of Veterinary Surgeons. He considered that it was impossible to discuss the question of education adequately without entering into a consideration of the constitution of the Civil Veterinary Service as it was to stand in the future. This consideration was essential although the President ruled, at the request of the Government of India, that such administrative questions were to be discussed at meetings of the Board of Agriculture.

Mr. Quinlan stated that teaching up to the highest standard as was formulated in the Bombay programme, could only be undertaken if adequate teachers were available, and this essential could only be attained by improving the conditions and salary of teachers; it appeared that such improvement was impossible in the present financial situation.

Mr. MacGregor referred to the note of dissent inserted by Sir Frank Sly in the Report of the Public Services Commission to the effect that teaching up to the highest standard for the veterinary service should be undertaken in Europe, and that it was not feasible to teach to this standard at present in India. He agreed with this view.

The Chairman proposed that, as an agreement appeared to have been reached regarding the course of study drafted by

the Principals at Bombay, the following part of a resolution be adopted :—

“(a) The system of study drafted by the Meeting of Principals at Bombay is approved as a curriculum representing the present minimum requirements for the training of Indians in India up to the highest standard of veterinary education necessary for the country, as demanded by the Public Services Commission (1912-14).”

This part of a resolution was passed unanimously.

Mr. Quirke contended that training extending over a period of three years was necessary for the education of men who were destined to fill up appointments as Veterinary Assistants and that a period of two years, which had been suggested by some members, would prove quite insufficient for the training of men who were required to undertake the duties of officers of this class in the Punjab.

Mr. Harris, from his experience in Assam, was inclined to agree with the views expressed in the note circulated by Mr. Kerr. For reasons of economy, district boards in his province were determined to reduce the veterinary staff employed by them, and he considered that the only course now open to them was to produce a cheaper article than that which would be turned out by a course of study fully covering modern requirements. The Veterinary Assistants should be qualified to diagnose the common ailments of animals and manage a veterinary hospital independently without the constant supervision at present found necessary. He favoured the splitting up of the service into two grades, namely, an upper and a lower grade. For the lower grade, two or three years' study should be undertaken, probably two years would be sufficient and the men turned out would be of the “dresser” type, if such a short course were instituted. For the higher posts a four years' course would be necessary. During the course of a prolonged and intimate experience with the men at present turned out from the colleges for work in his province, he estimated that fully 80 per cent. rapidly degenerated into mechanical dressers in the *mofussil* and only 20 per cent. developed sufficient ability to diagnose diseases in a professional manner.

Mr. Kerr was not in favour of a shorter period of study of two years even for the production of the second rate article with which they were now destined to be content. These men should be trained for three years. A sharp line of demarcation should be drawn, however, between the men who were qualified according to the

higher and the lower standard. At present there was no demand in Bengal for men educated for a period of four years in accordance with the system laid down by the Principals at the Bombay conference.

Khan Saheb Sheikh Naiz Mohammed was against a two years' course of instruction, for the men turned out in this manner would not have sufficient ability to render satisfactory information in regard to the occurrence of contagious diseases. In many districts there was only one Veterinary Assistant left in charge of the large area represented by a single district.

Mr. Cameron stated that he had had sixteen years' experience in Burma with what was termed a double cadre. For the lower cadres men were at first trained for a period of two years, but this short period was found by experience to be insufficient and it was then increased to three years. At the present time, this period appeared to be the minimum that could be satisfactorily adopted. He agreed that there should be two cadres in the services, namely, a higher one trained for a period of four years and a lower one which might be trained for three years.

Mr. Quinlan agreed with the view that it was necessary to constitute a division of cadres, into a higher cadre and a lower cadre. There would, however, be difficulty in the eastern provinces of India in adopting a scheme based on such a division in view of the poor quality of men who were now turned out of the Bengal college. The conditions might well be different in the other three colleges in India. He thought that close contact with European teachers formed a most important element in framing the character of the men who passed through any course of veterinary study in India. He considered that for the present a three years' course of study covered all that was necessary for the training of the subordinate veterinary personnel required in his province. The main obstacle towards the improvement in the type of men produced at the Bengal college was represented by the lack of ability of the teachers themselves, although occasionally some good men were forthcoming as the result of the three years' course of training. He believed that it would be certainly a retrograde step to go back to the two years' course of study. He thought it would be impossible for the two years' men to carry out the work now required of such men in the districts. Men of this type could perhaps be improved by passing through a post-graduate course of study subsequently extending over about 18 months.

Mr. Wilson was in favour of continuing the existing method of instruction at the colleges without any fundamental revision of the three years' course now in vogue.



Mr. F. Ware agreed with Mr. Wilson, but considered that it was necessary to revise the three years' course by the insertion of the subjects—pathology and bacteriology—which he considered to be of considerable practical importance. Perhaps such subjects as chemistry and botany could be omitted without much detriment. He would like to obtain the views which Colonel Walker held as the result of the experience he had already obtained in regard to the four years' course which had been instituted at the Punjab Veterinary College, and to know by how much the course there adopted differed from that formulated at Bombay.

Colonel Walker stated that before he left the Punjab College he had earnestly discussed the adequacy of the three years' course of training with Colonel Pease, who was then Principal, and they came to the conclusion that a course extending over four years was most essential. The sanction of the Punjab Government was obtained to the institution of the extended course of training for men destined for the Civil Veterinary Service. The men under preparation for the Army, however, still continued to undergo the three years' training. The only important difference between the two courses was that the men trained for the Civil Veterinary Service were taught some histology and pathology, but otherwise, the two groups of students attended, for the most part, the same classes. Since his return to the college, the whole curriculum had been revised and the men were now taught sufficient chemistry and biology to grasp the higher, applied sciences which were subsequently taught to them. He mentioned in particular that the teaching of anatomy at the college had undergone most important modifications, for, instead of wasting whole carcasses for single hurried demonstrations as was done in the past, the men were now taught to dissect and study methodically properly preserved specimens. He had had one of his officers specially trained in England with a view to teaching the subject according to modern approved methods. The most important handicap which he had encountered towards the satisfactory teaching of the students was their meagre knowledge of the English language. He had hoped that, with the admission of Matriculates only to the course, little difficulty would be encountered in this respect, but he now found that the Matriculates of the Punjab University possessed a very poor knowledge of English. Since the course was instituted two years ago, his impression was that the students undergoing instruction were obtaining a much better grasp of their profession. He disliked the three years' course, for the time did not admit of a logical and systematic exposition of the subjects which at the present time had assumed importance. He did not pretend that the proposed two years' course was adequate, but it might suffice for the *salutri* type.

In the three years' period of study, pathology, as had been suggested by Mr. Ware, could not be properly taught, as it pre-supposed a knowledge of histology and general biology. For the short period of study, it would probably be well to eliminate not only these subjects, but also chemistry and botany, and not attempt to produce thereby men with any pretence to scientific attainments. Our knowledge in regard to the nature of animal disease had increased so much during the last 15 or 20 years that a sound frame work of education in the science could not be imparted in a period of three years, and men trained for this period would not be worth, or capable of, further education in their profession. He favoured the admission of students who had passed the University Intermediate examination in chemistry and biology as soon as possible. The Matriculation standard in science was not sufficient.

Mr. Hewlett maintained that the two years' course of study had been tried in Bombay and was not found successful. He considered it necessary to continue the system of training men for at least three years.

In reply to Mr. Ware, Colonel Walker said that he had suggested to the Punjab Government that men who went through a four years' course of training should start on a salary of Rs. 100 a month. He would not be able to get recruits for the course if the graduates were made to start at the ordinary commencing salary of Veterinary Assistants, namely, Rs. 60 per month.

Mr. Ware said that he saw no objection to the prolongation of the course to four years in the Madras college.

Mr. Hewlett considered that prolongation would be too expensive at the Bombay college, where the students were not stipendiaries for the most part.

Mr. Quinlan said he could not see his way to agree with the institution of the higher course of training at the colleges on account of the lack of training facilities at present existing in the country. Teaching up to the higher standard was not possible in the existing circumstances.

After further discussion the two following parts of a resolution were passed :—

- (4) *That in view of the circumstances arising out of the existing situation of the country it is not practicable to introduce this system of education generally.*
- (5) *That less costly, shorter courses must continue.*

It was decided that the details of the shorter courses should be referred to a committee, to which the following members were appointed :

The Chairman (Colonel Walker), Messrs. Hewlett, Wilson, Cameron, Quinlan, Ware and MacGregor, with Mr. Edwards as Secretary.

Before presenting the report of the committee, subsequently, the Chairman said that arising out of the proceedings of the committee he thought that it would be advisable to amplify the first paragraph of the resolution already passed during the discussion on this section of the subject of education, as the paragraph appeared incomplete as it stood. With the proposed addition, this part of the Resolution would read thus,

- (a)
- (1) *The system of study drafted by the meeting of Principals at Bombay is approved as a curriculum representing the present minimum requirements for the training of Indians in India up to the highest standard of veterinary education necessary for the country, as demanded by the Public Services Commission (1912-14).*
  - (2) *The constitution of a Board of Veterinary Studies as recommended by them is urged very strongly, and the Board might be authorized to make minor modifications and additions to the course from time to time as required and in consideration of the needs of the several provinces. The desirability of raising the standard of preliminary education as soon as possible is worthy of early consideration.*
  - (3) *It is considered that Muktesar is unsuitable for such a course and immediate steps should be taken to institute it at one of the existing colleges and, as soon as financial considerations permit of the constitution of an efficient organization for dealing with problems connected with veterinary state medicine, at the other colleges also.*

Mr. Hewlett strongly protested against the constitution of a Board of Studies as he believed it was not consistent with the general policy of devolution and made for centralization. Otherwise, he agreed to the addition.

The Chairman pointed out to Mr. Hewlett that as a member of the Principal's Conference he had already agreed to the formation of the Board of Studies.

Mr. Hewlett said that he had since changed his mind.

The addition was agreed to by all the other members.

The report of the committee, appointed to consider the duration and scope of the shorter courses under part (c) of the resolution, was as follows :—

“ It was decided, Colonel Walker and Mr. Edwards dissenting, that the course should extend over a period of three years. The preliminary entrance examination should be, at the minimum, the sixth standard examination. Each college should further establish its own tests of general education, based upon the needs of the provinces concerned.

“ The following course of study was drawn up and agreed to unanimously :—

“ *First Year—Class A.*

“ (1) *Anatomy.* The special and comparative anatomy of the domesticated animals, including the ox, horse, sheep, and dog. The carcase of a ruminant animal should be dissected systematically at least once by each student.

“ (2) *Physiology.* General principles of physiology : the functional mechanisms of the domesticated animals in health, with an elementary study of the minute structure of the tissues and organs. Laboratory demonstrations.

“ (3) *Handling of animals : riding exercises.*

“ *Second Year—Class B.*

“ (1) *Pharmacology and Therapeutics :*

(i) Pharmacology of drugs (with *Materia Medica*, *Pharmacy*, and *Toxicology*).

(ii) *Therapeutics.* Uses and actions of the common medicinal agents used in veterinary treatment ; methods of administration.

“ (2) *A study of the common animal and vegetable parasites* affecting the domesticated animals ; the nature of the disease changes set up thereby ; elementary laboratory methods.

“ (3) *Diagnostics.* Signs and symptoms of the common ‘ internal ’ disorders of the domesticated animals.

“ *Third Year—Class C.*

“ (1) *State Veterinary Medicine :* the principles of preventive medicine, including elementary hygiene and the nature of, and methods of dealing with, the common contagious diseases of the domesticated animals ; meat and milk inspection.

“(2) *Clinical Veterinary Practice*: the nature and methods of treatment of the common non-contagious diseases of the domesticated animals: Surgical methods (including examinations for soundness, ageing, and surgical shoeing). Obstetrical methods.”

The above report was unanimously approved and accepted by the meeting.

The committee was unable to progress further with the tasks allotted to it in the time available; hence the Chairman put the following supplementary resolution covering the remainder of the terms of reference to the full meeting. It was carried unanimously (Mr. Hewlett dissenting).

“It was decided that the detailed syllabus for the course should be drawn up by a Central Board of Studies. Persons who pass through the proposed course should be entitled to the designation ‘Veterinary Assistant.’”

**SUBJECT I (b).—EDUCATION. WHAT QUALIFICATIONS SHOULD BE REQUIRED FOR :—(1) THE PROMOTION OF SUBORDINATE MEMBERS OF THE DEPARTMENT TO THE PROVINCIAL SERVICE. (2) THE PROMOTION OF PROVINCIAL OFFICERS TO THE IMPERIAL SERVICE. (3) THE DIRECT APPOINTMENT OF INDIANS TO THE IMPERIAL SERVICE.**

The Chairman said: “This reference is framed in order to determine, if possible, the policy to be adopted in promoting the members of the various grades to the higher ranks. It will be useful if separate resolutions can be passed dealing with each category on its merits. We will deal firstly with the promotion of subordinates to the Provincial Service. When Colonel Morgan was Inspector-General, I myself suggested to him the creation of the grade of Deputy Superintendent carrying with it the rank of gazetted officer. This suggestion materialized, and for many years subordinates have been selected to posts carrying gazetted rank, teaching posts in colleges included. The nomenclature differs in some provinces but the rank is the same and the limits of pay have been fixed by the Government of India. Hitherto, so far as I know, vacancies have been filled by selection only. I am inclined to think that in future some uniform system of tests should be applied. The men who undergo the four years’ course on the lines laid down at the Principals’ Conference should be eligible without further instruction, but a competitive examination might be introduced to take place among selected candidates.

“ With regard to the men already in the existing appointments who have only gone through a three years’ course, or less in some cases, I am of opinion that promotion should only be given in future to selected men who have undergone post-graduate instruction. Post-diploma courses should impart different kinds of instruction suitable to the needs of the various appointments which have to be filled. Two courses of nine months each are detailed in the prospectus of the Punjab Veterinary College. They are intended for three years’ men who have not had the advantage of having been fully trained in pathology and the other sciences. If possible, both courses should be taken by candidates selected for Deputy Superintendships before promotion. For officers selected for professional chairs special training is required, and until a higher standard is reached in our veterinary colleges it is apparent that special arrangements have got to be made for them. In the Punjab we have deputed and are deputing selected men to Europe and other colleges in India to fit them to teach up to the higher standard of veterinary education now adopted at the college. They should be able to train likely successors, but I am a great believer in change of environment during the teaching of the specialist if it can be arranged. I think, therefore, we might suggest that, in future, those men who have not undergone a four years’ course should receive post-diploma instruction in State medicine before they are promoted to the rank of Deputy Superintendent, and that before he is promoted to a professorial chair carrying gazetted rank a man should have received special extra-mural instruction in the subject which he is to teach.

“ In both cases the special study should be approved by a competent authority before promotion has effect. I do not think that promotion should be given to any man who cannot serve 10 years or more before retirement.”

Mr. Hewlett said : “ With regard to the qualifications required for promotion from the subordinate department to the Provincial Service, my view is that the matter being entirely of provincial concern had better be left to the Local Governments and their Advisers.”

Khan Saheb Sheikh Naiz Mohammed had circulated in his printed copy of observations upon this item in the agenda the following note on the requirements of subordinate members of the department selected for promotion to the Provincial Service :—

- (a) Good education, of at least Matriculation or School Leaving standard ;

- (b) Good administrative ability;
- (c) Must have gone through a post-graduate course ;
- (d) Should be up-to-date in his professional knowledge.
- (e) Must have served as a Veterinary Inspector in the Department for at least 5 years.

Mr. Cameron again referred to the experience gained in connection with the two cadres in the Veterinary Service in Burma. Provincial officers, *i.e.*, Deputy Superintendents, had all been trained at the Bengal Veterinary College and possessed Matriculation certificates of the Calcutta University, and a thorough knowledge of the English language was also demanded of them. On graduation they were admitted into the service in the category of Inspectors. It was possible that an Inspector might serve as such for as long as 9 years before he was promoted to the grade of Deputy Superintendent, and in the case of many, the capacities displayed by them did not hold out for them any likelihood of obtaining promotion at any time during their career. It was possible for a Veterinary Assistant trained at the schools at Burma to attain before the end of his service the rank of Inspector, but ordinarily he held this rank for a period of only a few years, four or five perhaps, before retirement.

Mr. Wilson stated that none of the Deputy Superintendents in the Central Provinces had matriculated. He considered that the qualifications necessary for promotion to this rank should be left in the hands of each of the provinces concerned. The framing of any rules which might be required should be arranged entirely by the particular provinces, and he considered that it was essential to send the men selected for promotion out of the provinces for post-graduate training.

Mr. Ware stated that in Madras post-graduate courses of instruction were given at the veterinary college to Assistants selected for promotion to the rank of Inspector and also for Inspectors selected for promotion to the rank of Veterinary Deputy Superintendent. He thought that the qualifications expected of men promoted in these grades should be left to the Local Governments.

Mr. Hewlett agreed with this view.

Mr. Hickey pleaded that a system of uniformity in the matter of promoting subordinate members to the Provincial Service should be adopted throughout the country. In adjacent provinces the standards in vogue might vary greatly and cause considerable discontent in the province where higher qualifications were demanded.

The Chairman said it seemed that the question at issue now resolved itself into whether the qualifications should be left entirely to the Local Governments to decide upon, or whether it was advisable to standardize them.

Mr. Branford thought that some general indications concerning the qualifications of selected men were desirable, but thought that no immutable rule should be laid down.

Mr. Davis thought that the difficulty might be surmounted by not admitting as candidates those who did not possess a Matriculation certificate.

Mr. Farbrother stated that there appeared to be required two categories of Veterinary Deputy Superintendents, namely, one destined to occupy posts in the colleges, who were expected to be specialists and therefore required post-graduate training, and secondly, one serving in the districts for whom further training was not essential. The latter category could be selected as in the past, by the experience gained with regard to their work in the field; the best men for the class of work which they were expected to undertake could not be surely discovered by an examination system.

Mr. Quirke considered that this matter had best be left to the discretion of the Local Governments.

Mr. Quinlan stated that a system analogous to that adopted in Madras was in vogue in Bihar.

Mr. Kerr considered that a post-graduate course of instruction, with the adoption of certain necessary tests, should be insisted upon as a necessary qualification.

Mr. Harris stated that in Assam there was only one Veterinary Deputy Superintendent on the staff in his province. He considered that it was desirable to lay down that a man promoted should undergo a post-graduate course of training and be examined: otherwise a delicate situation might be created by selecting men for promotion who did not appear to deserve such promotion in the minds of their colleagues on the ground merely of seniority.

Mr. Hickey agreed with this view and pointed out that discontent might arise among Inspectors if selection based upon the opinions of a superior officer with regard to past work were the means of promotion.

Mr. Kerr admitted that certain members might display evidence of suitability on account of the administrative ability they had displayed in the course of their career, but notwithstanding this it was in his opinion preferable to standardize the system of promotion.



After some further discussion it was resolved unanimously :—

on I (b)

- (1) *That the promotion of subordinate members of the department to the Provincial Service should be left in the hands of Local Governments and their Advisers, but it is desirable to impart to the men selected for promotion a suitable form of post-graduate instruction followed by a test, the nature of which should be decided upon by the Local Government and its Advisers.*

SUBJECT I (b) (2).—THE PROMOTION OF PROVINCIAL OFFICERS TO THE IMPERIAL SERVICE.

The Chairman : “ I am not in the confidence of the Government of India in this matter and I confess that I find the present position very bewildering. After thinking over the recommendations of the Public Services Commission for a number of years, the Government of India in 1920 affirmed that the standard of teaching at the provincial colleges was low and that ‘ it was idle to contemplate the possibility of obtaining students with attainments sufficient to enable them to benefit by post-graduate courses in a central college.’ It was stated that what was wanted first of all was the raising of the standard of teaching at the provincial colleges. Pending that desideratum, however, they recommended, (a) the promotion of officers who had served in the Provincial Branch and had subsequently been through a course of post-graduate training in Europe ; (b) the grant of State scholarships to enable young men to proceed to Europe with the object of gaining the diploma of the R. C. V. S.

“ At present we are concerned only with the first suggestion. It is a strange one, as it had already been stated that it was idle to contemplate the possibility of obtaining students with attainments sufficient to enable them to benefit from post-graduate training. It was stated, however, that they would not be appointed to the Imperial Service unless they obtained the same qualifications as candidates recruited in England. At this stage, in discussing the rate of Indianization of the Service, the Government of India were strongly opposed to any lowering of the standard of efficiency and qualifications demanded from veterinary officers, and stated that they had no intention of countenancing any relaxation of that standard. In June 1921 the Government of India discovered that it takes four or five years to obtain the diploma of the R. C. V. S. and that the Royal College would be unlikely to grant a diploma unless the full course was taken.

“ They considered that there would probably be only a few Provincial Officers who possessed the requisite education and ability to reap the full benefit of such a course.

“ They suggested in lieu a course of two years in England for these ill-educated men and stated that they were advised that special study of the kind would be of ‘ greater value ’ than a study of the subjects required for the diploma of R. C. V. S. After two years’ study it was proposed to promote these men to the Imperial Service in spite of the fact that they would not have the qualifications that they had considered necessary a year previously. This scheme was sent to Local Governments for opinion and in due course reached me.

“ I said that I considered the proposal to be retrograde and that it appeared that the admitted backwardness of veterinary education in India was being put forward as a plea for lowering the standard of the Imperial Service. I pointed out the revised course of four years’ study at the Punjab Veterinary College approximated closely to that of the R. C. V. S. and that the instruction provided in the basic sciences would enable students to take advantage of post-graduate training on the lines suggested by the Government of India.

“ I stated that Provincial officers holding chairs in subjects for which they had special qualifications and aptitude and in which they had gained distinction were in a different category and should be regarded as special cases. I added that if, in pursuing a policy of expediency, it was decided to send members of the Provincial Service for training, equal facilities should be given to men employed in the Punjab in spite of the fact that I did not agree with the proposed course. It would obviously be hard on men of equal ability in one province to be denied advantages given to men in other provinces.

“ It seems to me that in making selections for the Imperial grade without expert advice the Government of India are in a very difficult position. Provinces do not demand equal standards of attainments in their Provincial Services, and their recommendations are influenced accordingly. A selection Board of Imperial Officers is certainly indicated.”

“ The Government of India apparently had some support for their scheme for training selected men in England as it was sent to the Secretary of State for approval.

“ He referred it to Sir Stewart Stockman and Professor Edwards, who doubted its practicability and suggested that the desired training should be given in India.

“ On Professor Edwards’ arrival in India he was consulted. He drew up a very enthusiastic scheme extolling the advantages of Muktesar for the purpose. This scheme was presented to the Principals at the Bombay conference, who were unable to discuss it at the time in the detailed manner considered necessary.

“ It was suggested that it should be circulated for opinion as it appeared to be open to considerable criticism and amendment. The opinions of the Superintendents were obviously necessary. The Principals had already suggested that selected students who had taken the proposed *degrée* in veterinary science, *i.e.*, after the four years’ course of study, might be regarded as candidates for appointment to the Imperial Service, after undergoing a further course of post-graduate instruction in India. The Government of India, however, ignored these suggestions and decided, without taking further advice, to adopt Mr. Edwards’ proposals and to start the course from the 1st July, 1922, by way of trial. The letter propounding this was dated 16th June and was received by the Principal, Punjab Veterinary College, on the 18th July.

“ It is understood that some provinces have nominated candidates and they are undergoing instruction. They have a flying start, therefore, of any possible candidates from Punjab. As a matter of fact the Punjab Government were not asked to send any men.

“ I am unable to accept the course as drawn up by Mr. Edwards. It is merely an outline and lacks detailed information. Mr. Edwards suggested that prior to admission candidates should be interviewed and submitted to certain tests by an examining board. As far as I know this very obvious and necessary safeguard has not been adopted.

“ It was also suggested that only men who had at least 10 or more years service to put in should be deputed, which appears to be sound. I understand, however, that this suggestion has also not been put into effect. What sort of test, if any, is to be applied at the end of the course remains to be seen.

“ Recently, a Provincial Service officer in Madras has been promoted to the Imperial grade without having done this course.

“ I will sum up the situation. In 1920 the Government of India drew up a scheme for training Provincial officers for promotion to the Imperial Service. In 1921 they revised the scheme, but it was not approved by the Secretary of State. In 1922 they instituted another. In 1923 they promoted an officer without any of special training which they had previously announced necessary. I repeat that I am bewildered by the comparative rapidity of the changes brought about and the obscurity of the situation.

“What are the qualifications required for the promotion of Provincial officers to the Imperial Service and who is to be responsible for their promotion?”

“Are Provincial men who have been promoted to fill a certain proportion of the Imperial posts or is promotion to be given as a reward? I am opposed to making the Imperial Service a sort of selection grade and such a course would be obviously extravagant.

“If this is going to happen the sooner the Provincial and Imperial grades are amalgamated the better. The scheme would probably be economical as the pay would be revised on a uniform scale between the two services, non-domiciled officers receiving adequate overseas allowances.

“In the meantime if the Government of India are determined to promote a certain number of Provincial officers to the Imperial Service, I think we should recommend very strongly that some standard of qualification should be laid down. It should comprise special post-graduate instruction successfully completed in (a) particular subjects (Professors) or (b) State medicine (District Officers). A detailed syllabus of minimum requirements should be prepared by a committee of veterinary officers. I consider also that only men of outstanding character and ability should be selected and that a Selection Board of as permanent a constitution as possible should approve of every candidate before promotion.”

Mr. Hewlett submitted the following note:—“In my view the promotion of Provincial officers (present service) to the Imperial Service had better be left in abeyance until it has been decided of what class of men the Imperial Service is to consist. In the future if a superior Provincial Service is created to take the place of the present Imperial Service, the question will become one of local concern and should be left to the Local Government to decide.”

Khan Saheb Sheikh Naiz Mohammed, in his circulated printed notes, stated: “Some posts of the Imperial cadre should be reserved for Provincial officers as is done in the Civil Service, Educational Service, Medical and Police, etc., the promotion to be made by selection (seniority, of course, must be given special consideration in selecting such officers) from among such officers as have special qualifications in the veterinary profession, by undergoing a post-graduate course in special subjects such as bacteriology, parasitology, breeding of animals, etc. The officer must be able to express his views thoroughly in good English. A list of all Provincial officers should be kept at the Government of India offices. Arrangements for temporary vacancies can be made locally by the province in which these vacancies occur.”

Mr. Hewlett further stated that he understood that the men at present selected for training with a view to entering the Imperial Service would be employed in the provinces from which they came. In this manner they would represent merely a selected grade of Provincial officers drawing Imperial Service pay. He considered that the promotion of officers to the Imperial Service by this method had better be left in abeyance for the present, and that the Imperial Service, properly so called, should be restricted to British officers, as hitherto, recruited in England. The training of Provincial officers with a view to replacing Imperial Service officers had also better be left in abeyance for the time being. The men now under training, he thought, should be admitted into the Imperial Service grade, but when a superior Provincial Service grade was created, they might be made to enter that category of the Service. The men under training should be promoted if there were appointment available when they emerged from training. He had recently advocated the promotion of Provincial officers who had done remarkably good work during their careers, but this method of promotion should be rare and exceptional. Indeed, he was not prepared to recommend men for promotion for some time to come.

The Chairman said he believed that the Punjab Government would have stern objections towards making the Imperial Service a selection grade for Provincial officers.

Mr. Howard explained the predicament in which some members of the Imperial Service now undergoing their period of probation found themselves. It appeared not unlikely that they would be turned out of their appointments when the promoted Provincial officers had completed their training.

Mr. Krishna Murthi, in making answer to the remarks made in the President's discourse, stated that since the year he had got qualified in 1909, he had taken great pains to submit himself virtually to continuous post-graduate instruction under eminent masters and that on account of the efforts which he had made in this direction and the services which he had rendered, he had been selected for appointment in the manner stated to the Imperial Service.

Mr. Kerr was in a dilemma as to the object of recruiting for the Imperial Service in this manner.

Mr. Hewlett explained that in the Report of the Public Services Commission it had been stated that a certain proportion of Provincial Service officers must be promoted to the Imperial Service after undergoing further training, and that the Government of India had taken steps officially in accordance with this recommendation.

Mr. Wilson explained that he had deputed one of his officers to the Muktesar course with a view to having him trained more especially in laboratory technique. He subsequently discovered that the officer was being trained in the general duties expected to be performed by men of Imperial Service rank.

Mr. Hewlett believed that it was clearly laid down that the promoted men must be subsequently employed in their own provinces.

Mr. Quinlan agreed with the observations made by the Chairman regarding the high-handed manner in which the Imperial veterinary officers in charge of provinces had been treated in the matter of the training of the men now undergoing instruction with a view to promotion.

Mr. Howard maintained that only men possessing the diploma of the Royal College of Veterinary Surgeons should be eligible for the Imperial Service.

Mr. Quirke likewise stated that the M. R. C. V. S. qualification of its equivalent should be insisted upon. He pointed out that there would arise difficulties of a commercial nature if men were admitted not possessing these qualifications, as certificates in regard to animal disease were not accepted by certain corporations or individuals unless they were signed by a holder of that particular diploma.

Mr. Cameron also stated that this objection was a real one, for it often occurred that there was difficulty in granting a certificate in regard to the export of hides from Burma when no M. R. C. V. S. was available. The Government of Australia, for example, would not accept a certificate in respect of exported hides unless it was signed by a M. R. C. V. S.

Mr. Riley also raised the question regarding the possibility of hardships for Imperial Service officers now under probation, when the men now under training became promoted.

The Chairman then proposed the terms of a Resolution :—

- (2) *That in view of the Government policy providing for the* Resolution  
*promotion of a proportion of Provincial Officers to the Imperial Service, it is considered that promotion to the Imperial Service should be restricted to those Provincial officers who have at least 10 years' further service to the credit of Government, whose selection is approved by a Standing Committee of Imperial officers, and undertake to submit themselves to a course of special work to be prescribed by this Committee and pass successfully the tests laid down for the course.*

Mr. Hewlett opposed the institution of tests on the admission of officers for training upon the advice of a Selection Board.

Mr. Quinlan submitted that the question of safeguards might be left to the experience of Mr. Edwards, who had undertaken the training of these officers at Muktesar.

Mr. Edwards explained the main aspects of his experience gained in training the officers selected for promotion during the past year at Muktesar. He insisted that it was necessary to examine men of the type selected for promotion carefully beforehand in order to ascertain whether they could carry a superstructure of post-graduate training involving an intelligent appreciation of modern knowledge regarding animal disease. It was his experience that logical discussion on broad issues with ill-educated men merely conveyed to them the impression that they were being imparted a theoretical teaching, and such men were not capable of grappling with the difficult propositions encountered by practical workers in disease investigation. There appeared to be an all-round clamour among officers occupying posts in the Indian Services, who had ceased their training in Europe at a comparatively very early age, that all that was necessary to attain full competence and efficiency in their pursuit was to attend a so-called post-graduate course of training; whereas, in reality, competence could only be acquired by hard work and study and long apprenticeship under a skilled master of the calling. It seemed that the self-styled "practical" man in the veterinary profession in every country was a man who never read, or studied, and was too much obsessed with his innate abilities to seek improvement from the experience of others. He had found great difficulty in impressing upon the students whom he had under training the need of submitting themselves to repeated testing in order to gauge their progress; he could not undertake to train men satisfactorily unless they were prepared to submit themselves unconditionally to what he considered to be essential tests. It had been represented to him by students that in post-graduate courses elsewhere no system of tests was instituted. He had had to point out to them that the ordinary post-graduate courses were attended by men who generally paid for their instruction themselves and attended the courses at considerable personal sacrifices in order to improve their knowledge concerning matters in which they were deeply interested. The men he had had for training were at first under the impression, in common with many other individuals, that training in practical work merely involved recognition of type specimens at the class-room bench, and failed to realize that scientific investigation involved tedious and prolonged examination of material which did not invariably conform with the type specimens.

selected usually and purposely for the ready teaching of class students. He pointed out also the difficulty he had had to convey to students the necessity of unremitting attention to their work if they wanted to acquire competence in the methods in disease investigation. He had found that they had become the slaves of office procedure, with its restricted hours and numerous so-called gazetted holidays. The resolution as drafted by Colonel Walker seemed to be an indispensable safeguard for ensuring that men deputed for training would make the effort which was expected of them during their attendance at such courses.

He further wished to impress on the meeting that he had strongly advocated the training of veterinary graduates who were selected to occupy the highest posts in the service in India at Muktesar, because the institution now presented facilities which were probably unrivalled in the world for the teaching of problems in animal preventive medicine, particularly those peculiar to India. The resources of the institution could best be developed if research and teaching were prosecuted at it concurrently. Moreover, the wealth of material for study and the strength of the staff available for imparting instruction in the side of their profession of importance to the State, namely, what might be termed animal preventive medicine, epizootiology, or State veterinary medicine, far surpassed those available in any veterinary institution at Home, where, moreover, the susceptibilities of the Indian student would not be specially considered. With patient training he had found the students become more amenable, and they certainly possessed ability, so that he was confident of the ultimate success of the training. The course at present was merely a trial course, and he had submitted his report on the first session of the two years of study to the Government of India. The needs of the men deputed for training would always be carefully watched, and the instruction given would be modified as necessity arose to fit them for the duties which they would subsequently fulfil.

The resolution drafted by the Chairman was then passed un-animously.

**SUBJECT I (b) (3).—THE DIRECT APPOINTMENT OF INDIANS TO THE IMPERIAL SERVICE.**

The Chairman said: "With regard to the direct appointment of Indians to the Imperial Service, I presume that the same qualifications as those required by the Secretary of State for British officers will be considered necessary. Hitherto, the Secretary of State has selected only British officers who possess the diploma of



the Royal College of Veterinary Surgeons, and have passed through a post-graduate course of training or have some special qualification. I do not know if similar qualifications have been demanded from Indians recruited for the Imperial Service. In future, recruitment will be almost confined to Indians. I think all we can say is that we hope it will be possible to maintain a high standard in the recruits and enlist Indians of high character and good education. I consider that Indians selected for scholarships abroad should be selected by a competent board in India, and that after completion of their training they should be examined before appointment by a competent board in London. The minimum qualification for recruitment should be that of the Membership diploma of the R. C. V. S. for the present. Later, when the University degree in veterinary science has been instituted in India according to the recommendations of the Principals' Conference, the course proposed in their report might be adopted."

Mr. Hewlett submitted the following note: "In my view the direct appointment of Indians to the Imperial Service should be made by the Secretary of State from youths sent to Europe to study as State scholars and from youths studying in Europe at their own expense. Later, no doubt this method will have to cease if the recruitment of Indians to the Imperial Service ceases and the superior Provincial Service takes its place. In that case the appointment of our officers will rest with the Local Governments, who, probably, would wish to select the youths and send them to Europe or America to study as State scholars."

Further he stated that, in his opinion, Indians appointed direct to the Imperial Service should possess the diploma of the Royal College of Veterinary Surgeons and should be given a post-graduate course of training in this country on appointment.

Mr. Edwards stated that he believed that the Government of India would be in a position to provide technical facilities for the training of appointed men for one year in this country on arrival to take up their posts.

Mr. Quinlan maintained that it should be impressed upon the men who had gone to the United Kingdom in order to qualify themselves for the diploma of the Royal College of Veterinary Surgeons that it was necessary during their course of training to observe the conditions of cattle practice with reputable practitioners in the large dairying districts in England. The feeling among Indian students trained at the Indian colleges was that their own professors were noticeably defective in their practical knowledge of cattle practice. He considered this knowledge essential on account of the predominant position of the ox as a domesticated animal in India.

Mr. Edwards explained that the difficulties which had forbidden insistence upon a form of apprenticeship during the college curriculum for British students would be much accentuated in the case of Indian students undergoing training in England. They would probably meet with little sympathy even if they exhibited a marked inclination to better their practical experience in regard to cattle practice while they were undergoing training in England. He believed that facilities existed which were admirably suited for their training in this respect in this country and he mentioned particularly the herd of dairy cattle at Pusa maintained under the supervision of the Imperial Agriculturist, and the well known breeding herd of draught cattle at Hissar. His own students under training had recently been sent to Pusa in order to study the improved conditions of maintaining dairy cattle there adopted, and he contemplated deputing them to other centres. It was much more likely that the susceptibilities of students would be studied at these institutions on their return from training in England.

Khan Saheb Sheikh Naiz Mahammed in his note on the subject stated: The candidates (Indians) for direct appointment to the Imperial Service should be subject to the same rules and regulations as are at present in force for the Service.

The Chairman subsequently addressed the members on the necessity of adopting safeguards for maintaining a high standard of general education, basic scientific training, and modern professional knowledge in entrants to the Imperial Service. Although the membership diploma of the R. C. V. S. had been hitherto recognised as the essential qualification for entrance to this branch of the Service, the Secretary of State had demanded additional attainments in candidates for vacant posts in view of the fact that the work upon which they were subsequently engaged was of a highly responsible nature and required considerably more knowledge regarding the larger issues in controlling animal disease than was usually obtainable from the teaching imparted in the four years' curriculum laid down for membership graduation by the R. C. V. S.,—a curriculum which, moreover, was planned with the object of providing primarily for the requirements in training of the great majority of veterinary graduates in the United Kingdom, namely, veterinary clinicians, or practitioners. In order to cater for the comparatively few students who had the necessary ability and desired to undergo a more thorough training in veterinary science, which would provide them with a sufficiently sound groundwork of knowledge to fit them later to deal with the peculiar problems in animal disease of interest to the State, some of the British veterinary colleges had taken steps to become recognized schools of the local universities.

and university Matriculates who passed successfully through the prescribed courses of study at the schools were granted degrees in Science (Veterinary Science) by the universities concerned. The prescribed courses could be taken concurrently with the course for the membership diploma of the R. C. V. S., but it was recognized that ordinarily an additional year would have to be spent in study by those who took both courses. As the courses of training prescribed by the British universities were calculated to impart the soundest primary veterinary knowledge that was desired in candidates for the Imperial Veterinary Service, he strongly commended to the members that they should embody in the resolution drafted under this section an expression which would convey to the Secretary of State the view that in the selection of candidates, who necessarily possessed the diploma of the R. C. V. S., preference should be given to those who possessed a university degree in veterinary science of a British university. If the system of study formulated by the Principals' Conference at Bombay were adopted eventually, it would be imperative to impress upon the Secretary of State that the standard represented above, by the degrees granted by the British universities, was the standard considered to be necessary for entrants to the Imperial Service.

The Resolution passed by the members was as follows :—

- 12 I (b) (3) *That candidates selected for direct appointment to the Imperial Service should possess the diploma of the Royal College of Veterinary Surgeons ; preference should be given to those who possess a university degree in veterinary science of a British university, and have taken steps, moreover, to observe the methods of cattle practice during their course of study ; on their arrival in India they should first undergo a course of post-graduate training at Muktesar and instruction in animal husbandry and dairying at the institutions concerned with these pursuits in India.*

**SUBJECT I (c).--EDUCATION. WHAT FORMS OF POST-GRADUATE TRAINING SHOULD BE DEvised FOR:--(1) VETERINARY ASSISTANTS, (2) PROVINCIAL OFFICERS, (3) IMPERIAL OFFICERS.**

The Chairman said :—" We have now to discuss what forms of post-graduate training should be devised for the different grades. I have already said that I consider post-graduate training is indicated for Veterinary Assistants who have only done a 'three years' course of study before promotion to the Provincial grade. Each

veterinary college might undertake such a course of training, and if you agree we will appoint a committee to define the courses required in order to obtain some uniformity. The system of post-graduate instruction that should be laid down for Provincial officers selected for promotion to the Imperial Service forms a large problem, but I think the same committee should be able to deal with it. We have Mr. Edwards' scheme to go on and it should be helpful. Imperial officers should take up post-graduate courses under the leave study rules and we may make some suggestions for such courses."

Mr. Hewlett:—"With regard to post-graduate training, the ordinary Veterinary Assistant does not require any such special training. He should be kept up to the expected standard of efficiency by his own officers, who should examine such men for promotion from time to time. The post-graduate training of men selected for the Provincial Service should consist of special courses in Europe or America. Imperial officers desiring to go through a post-graduate study should, I consider, do so in Europe at the recognised schools."

Khan Saheb Sheikh Naiz Mohammed stated the following requirements:—

- (1) *Veterinary Assistant.* (a) Elementary bacteriology, so that the assistant may be able to prepare slides and morbid materials to be despatched for further bacteriological examination and he should know the use of microscope, with a few of the very common staining methods;
- (b) Elementary entomology, a short course on biting flies and ticks;
- (c) Parasitology, common worm parasites and their eradication.
- (2) *Provincial Officers.* A further course of another 6 months in all the above subjects and also training in practical animal breeding on certain farms.
- (3) *Imperial Officers.* (a) A practical course on the contagious diseases usually prevailing in India;
- (b) Training with some senior officers in practical field work in India;
- (c) Practical training on animal breeding, connected with the indigenous breeds of India, on some important farms.
- (d) A short course at Muktesar.

Mr. MacGregor stated that the course of training for Veterinary Assistants could probably be undertaken at the colleges, as all that seemed to be required was to resuscitate the enthusiasm of men who had lost touch with their colleagues on account of their isolation in the *Mofussil*.

Mr. Hewlett thought that a course of training should be instituted for the best type of Veterinary Assistant at the commencement of his career, if he displayed any enthusiasm in this direction, and he suggested that a course might be given to such men for five or six months at Muktesar.

Mr. Cameron considered that it would be better before dealing with the question of post-graduate training to settle upon the details of a three years' course of study, and that the discussion under this heading might be postponed until the decisions of the committee appointed were available.


After some discussion it was resolved to refer the details under the whole of Section C to the consideration of the committee appointed.

As the Committee was unable, however, to complete the labours allotted to it, the Chairman subsequently proposed the following resolutions to the meeting, as they appeared to him to embody the views of the members. The resolutions, which were carried unanimously, were as follows:—

tion I (c)

- (1) *Post-graduate courses for Veterinary Assistants should be instituted at all the existing colleges: the syllabus for these courses should be approved by the Board of Studies.*
- (2) *The institution of post-graduate courses of study at Muktesar and elsewhere for Provincial officers is approved by this conference, and the curricula for these courses should be examined by the Board of Studies.*
- (3) *Imperial officers should be given facilities for taking post-graduate courses at Muktesar and abroad.*

## PART II.—EPIZOOTIC DISEASES.

SUBJECT II (a).—ANTHRAX. (1) PREVALENCE AMONG LIVE-STOCK IN INDIA; (2) THE NECESSITY OF INSTITUTING LEGISLATION TO DEAL WITH THE DISEASE; SCOPE AND NATURE OF SUCH MEASURES. 

The Chairman said : “ As you are well aware anthrax was one of the first diseases to be recognized as being due to a specific organism. At one time a number of other diseases including hæmorrhagic septicæmia were classified as anthrax in India, and it was not until 1904 that I was instrumental in obtaining a separate heading in our statistical tables for hæmorrhagic septicæmia. We all know that the mortality in cattle from hæmorrhagic septicæmia far exceeds that from anthrax, and most of us will probably agree that anthrax does not cause græve mortality in animals in India as compared with several other epizootic diseases. We know that some Indian cattle appear to possess a considerable degree of immunity also. We must admit that it exists in most parts of the country, however, and for that reason it is a real and potential danger particularly from the industrial point of view. It will be interesting to learn the experience of members of the conference in respect to the prevalence of the disease in the various parts of the country represented by them.

“ Granted that measures are necessary for the protection of workers, as recommended by the Advisory Committee, convened by the Third International Labour Conference, the question is what can be done in India.

“ Colonel Hutchinson was a member of the Committee which sat in London last December and we shall be very glad to hear what suggestions he has to make.”

Mr. Edwards, as sponsor of this section, summarized from the Government of India files the efforts which had recently been made by the Government of India to introduce legislation to combat anthrax infection in India. In 1920 the Karachi Chamber of Commerce had become much exercised on account of representations made to them by the Karachi Wool Association with regard to the reported presence of anthrax in sheep in Sind and the possibility that the Home authorities were contemplating measures which would have for their ultimate effect the prohibition of importation of Indian hair, wools and hides. The advice of the Superintendents, Civil Veterinary Department, of the Bombay Presidency and of Sind, Baluchistan, and Rajputana was sought by the Govern-

ment of the Bombay Presidency, who referred the matter to the Commerce Department of the Government of India. It was then referred to the Revenue and Agriculture Department and after examination of the conditions existing in India, the Secretary drafted a Bill on the lines of the Glanders and Farcy Act for dealing with the disease. The Bill was next forwarded to him (the speaker) for technical opinion, and advice was submitted upon the peculiar problems connected with the institution of proper measures of anthrax control based upon the general experience of other countries in this respect. In particular, the essential differences in the nature of measures designed with the object of eradicating the two diseases, glanders and anthrax, were pointed out, for in the former the living, usually chronically, affected animal was the point of attack, whereas in the latter disease the carcass of the dead animal was mainly to be considered. It was explained that from the general experience in regard to anthrax it would undoubtedly be found that the disease had a much wider prevalence in India than was evident from the statistics furnished in the reports of the Civil Veterinary Department if a proper system of reporting deaths from this disease were adopted. He related the experiences which had been published in connection with the spread and prevalence of the disease in Argentina and in South Africa, in particular, where it had rapidly assumed the position of the most important infectious disease of cattle in the country. He understood that the conditions which had made for the widespread and even epizootic prevalence of the disease in these countries obtained to a marked degree in numerous localities in India, and in view of this circumstance he had recommended the insertion of a clause which would enable Local Governments to enforce vaccination in the scene of considerable outbreaks. Unfortunately, the matter of legislation was now in abeyance, at the instigation of the Honourable Member of the above department. Again, the speaker read extracts from a lecture upon the subject of anthrax control given recently by Major-General Sir John Moore, late Director of the Army Veterinary Services in India, at a Meeting of the Royal Society of Medicine in London. It would appear from this address that the lecturer considered there was no excuse for delay in the institution of legislative measures for the control of the disease in India. While he (Sir John Moore) served at the headquarters of the Government of India he had submitted a comprehensive draft of such a measure for dealing with anthrax, together also with detailed drafts of measures for controlling other infectious diseases of animals, to the Government of India. Having in mind the probable outcome of the deliberations of the Special Anthrax Committee of the International Labour Organization of

the League of Nations, the evidence already available with regard to the incidence of anthrax in India, together with the economic situation that would arise from the adoption by importing countries of prohibitory measures in regard to Indian exports of wool, hair, and hides, it appeared that the time was fully ripe for the introduction of legislation to deal with this disease. Legislation of this kind would have for its immediate effect the testing of the machinery represented by the Indian Civil Veterinary Department; the strengthening of this machinery to cope with this disease, although it would undoubtedly prove economically beneficial in itself, would prove to be of incalculable benefit in controlling concurrently the manifold epizootics of great domestic economic concern. He believed that a comprehensive measure in the form of a Diseases of Animals Act would be the best form of primary legislation, whereunder certain infectious diseases, of which anthrax formed a concrete example, could be scheduled as necessity arose. Orders could be formulated by Provincial Governments then for the application of measures concerning the particular disease. In order to secure uniformity in action throughout the country it would be well for a technical conference to draw up a set of model regulations in regard to each disease for the guidance of Provincial Governments.

Lieutenant-Colonel Hutchinson said that he was peculiarly interested in this disease on account of the fact that it was transmissible from animals to men, and it went to prove that the problem of disease was one and indivisible whether affecting men, animals or plants. The incidence of anthrax infection in man was undoubtedly rare, but the rarity of the infection was no argument against the adoption of stringent measures of control. He stated this in particular as in hydrophobia, for example, costly measures of control were in vogue. Four Pasteur institutes were maintained for the purpose of preventive treatment in India, whereas in regard to cholera, which occurred in infinitely greater distribution, resources for combating the infection were much smaller although it might be safely said that if the amount of money spent for the control of hydrophobia were spent on cholera, much greater benefit would accrue to the country at large. Another point of importance was that any measures which were instituted for controlling anthrax would likewise be of great benefit in providing organization for the control of other diseases. Human anthrax in India was very rare, so far as he could gather. From the very few cases that were on record directly due to infection from animals it would appear that the majority discovered were through infection from shaving brushes. The rarity of the disease in India, however, was not by any means universal. In some other countries the disease was



comparatively common. He gave some statistical summaries and such statistics could be divided up as follows:—(1) Human infection due to dealing with wool, including goat hair; (2) due to handling hides and skins, bone-meal, hairs, hoofs, and other hairs such as horse hair and pig bristles. In regard to (1) the quantity of wool supposed to be infected represented only a small percentage of the total wool production. The wool production of the world amounted to 2,500 million pounds and on examination it was estimated that only about 120 million pounds, or about 5 per cent., was infected. But it had to be remembered that 50 per cent. of this infected wool was derived from India. This did not mean to imply that the wool was actually produced in India, as some of it reached India from trans-frontier provinces and was exported from India, and was designated in the market as Indian wool. The percentage of infection among people who dealt with this infected wool was very considerable. About 90 per cent. of the total wool reached Liverpool. The major portion was used in England, chiefly at Bradford, but a small portion was sent to France and to the United States of America. During the last ten years there had been 405 cases of human anthrax in England. In the United States of America the disease from handling wool appeared to be rare, while in France 108 cases had been detected in the same period. Infection of East Indian goat hair was found in 33 per cent. of samples examined; of East Indian Kashmere in 19 per cent., and of East Indian wool in 11.6 per cent.

The incidence of anthrax in England led to trouble with labour and the Government were forced to take action. The result was the Anthrax Order of 1919 which practically prohibited the importation of East Indian wool unless it had been disinfected. A committee was appointed to investigate the problem of disinfection and a very efficient process had been discovered. This process, however, added a cost of 2½*d.* per pound to raw wool. The additional cost affected the manufacturers in England so seriously that they could not undertake to carry out the process unless other countries also adopted the same measure. The question of compulsory universal disinfection was therefore placed before the International Labour Office of the League of Nations, and it was suggested that the importation of suspected or scheduled wool into all countries should be prohibited unless disinfection was adopted. When it comes to be considered that the adoption of such a measure in India is confronted by almost insurmountable difficulties, particularly in view of the fact that wool traverses almost the whole range of the Himalayas through 15 or 16 channels, the problem of disinfection of all wool entering the country becomes impossible. At the International Labour Conference in 1921 a

resolution was passed that the International Labour Office should appoint a committee of experts to advise on the question of the prevention of anthrax in all its aspects. It was also pointed out that wool exported from India lost in the process of disinfection 55 per cent. of its weight and this loss meant gross adulteration or a very dirty wool. A great deal of the wool exported from India is skin wool, *i.e.*, wool taken from a dead animal, and thereby the danger from anthrax is greatly enhanced. It ought to be possible to prevent the exportation of skin wool. The danger of infection from hides and skin was far more serious, and human anthrax from handling hides and skin was practically worldwide. India is not the only country involved in the export of infected hides and skins but takes a prominent position. The importance of this source of infection lay not only in the direct danger of infection from the hides and skins but also indirectly on account of the contamination of other objects from this source. In the United States of America and Germany a large number of epidemics have been recorded, due to the flooding of pasturage by streams into which effluent from tanneries had been admitted. There were also instances on record of infection being left behind in the ships used for transporting these commodities, and grain and hay carried subsequently in the vessels had caused epidemics among horses.

Infected bone-meal also gave rise to anthrax. One case had been recently recorded in London, caused by the importation of bone-meal from India. Soil infection also must be considered. Infection from horse hairs was not a serious one as far as India was concerned. The offending countries in this respect were Russia and Siberia.

Lieutenant-Colonel Hutchinson then related that he had attended the committee referred to, which met in December last, and it considered firstly the problem of wool disinfection.

He considered that this question would again undoubtedly form a part of the agenda of the International Labour Conference that would meet in 1923 or 1924.

He gave an estimate of the large sums of money that would need to be expended in completing the processes for the disinfection of wool alone in India. Roughly about 120 million pounds of wool would have to be dealt with yearly. The actual plant needed for the disinfection would involve an initial expenditure amounting to about half a million pounds and the recurring annual expenditure would amount to from a quarter to half a million pounds sterling. With regard to wool and hair the committee recommended that all wool and hair liable to infection should be disinfected by an approved method before use industrially.

As regards horse hair and pig bristles a resolution was passed to the effect that all such material must be disinfected before use in industry.

The question of hides and skins was not taken up in detail, for no process of disinfection is known at present which can be depended on not to injure the hide for industrial purposes. Further research was recommended. The question of eradication of animal anthrax was referred to the International Agricultural Institute at Rome.

It would appear from the above resolutions that India is now faced with either the adoption of the compulsory disinfection of all wool before it is used industrially, or the eradication of the disease among animals by preventive measures. Disinfection must be regarded as a confession of failure, and such failure was due to the inadequacy of knowledge or to a lack of facilities for applying such knowledge. In regard to anthrax prevention, knowledge is sufficient for a policy of eradication, if sufficient money was available for this purpose. It seemed therefore that the Indian Veterinary Department had an unrivalled opportunity for pressing for a reorganization sufficient to meet the necessity for preventing disease. On the one hand Government is confronted with the possibility of an unproductive expenditure on disinfection of about half a million pounds sterling annually to save a few cases of human anthrax. On the other hand, much smaller expenditure on the prevention of the disease in animals would accomplish the elimination of human anthrax and at the same time improve the condition of stock in this country. The measures indicated were: early notification of cases among animals, the efficient disposal of carcasses, the limitation of movement of infected herds, and perhaps preventive inoculation.

The policy of preventive inoculation against the disease must be seriously considered. South Africa, as had been mentioned by the previous speaker, was faced with this very serious problem, and the Government of the Union has now sanctioned a campaign which at first would cost £200,000 per annum. In regard to hides and skins, there was no process of disinfection at present generally accepted as efficient. More research was needed in order to evolve a satisfactory method, and it seemed that the facilities for such research in India were unrivalled.

In the neighbourhood of Bòmbay, for example, the industry was concentrated in one area and the conditions were thus splendid for observing the efficacy of disinfection. He recounted briefly the process for the disinfection of infected wool as carried out at Liverpool. The fundamental difficulty connected with this lay

in the fact that the resistant spore was embedded in a dense blood clot. Throughout the process there was no handling of the wool. The dust involved in opening bales was aspirated into the furnace. The wool passed automatically through two tanks containing an alkaline soap solution at a temperature of 112°F. The wool was pressed through rollers between each tank. After thorough scouring in the alkaline soap solution the wool was passed through two disinfecting tanks containing 2.5 per cent. of formaldehyde at 102°F. The wool was pressed through rollers between each tank. The wool was next dried in a current of air at a temperature of 160°F. The wool after drying was fit for use. The whole process occupied one hour.

In the case of hides and skins many processes had been recommended, but there was no process that the trade would accept until by research it was shown possible to evolve a process which effectively disinfected the hides and did not injure the skins. A satisfactory process now appeared to have been evolved by a practical tanner, by which the hides were subjected to the action of a solution of perchloride of mercury and formaldehyde. More research work upon the process was, however, needed before it could be applied to the trade.

In the case of bone-meal the material was ground up and subjected to the action of super-heated steam.

Mr. Cameron indicated the difficulties which had to be faced in Burma and the steps which had to be taken in order to attempt to solve the problem of anthrax control. In Burma contagious diseases were dealt with by the Burma Village Rules that had to be applied by the village communities, and under these rules a death register was maintained in Lower Burma by the village headman and every animal that died had to be reported to him and a rough diagnosis given. The reporting agency had to be so primitive because the Veterinary Assistants often had charge over an area covering about 500 square miles and could not attend to individual deaths. Where a disease was reported as contagious, it was the duty of the village headman to report it to the Sub-divisional Officer, who then reported it by telegraph to the Veterinary Adviser. As anthrax assumed sporadic form most frequently it could not be expected that village headmen were able to diagnose the condition. The Sub-divisional Officer was unable to diagnose and the Veterinary Assistant likewise was not competent to diagnose it. Moreover, an animal might die at a distance of 200 miles from the railway. The result was that the hides of such animals were taken off by the owners of the animals and sold. Under the Village Rules it should be stated that if a case was suspected to be anthrax the carcass

must be buried intact and slashed after it had been put into the grave in order to prevent the subsequent digging up of the carcase. In his opinion if all animals that die suddenly were buried merely on suspicion of anthrax, their owners would be subjected to hardship. On the other hand there were difficulties with regard to the disposal of the carcase. It was stated in the Rules that if the carcase could not be buried it must be burnt and it often happened in the rains that water covered the ground to a depth of 3 feet or so, so that carcases could not be buried and in such conditions it was usually impossible to burn the animals.

Mr. MacGregor stated that he remembered that while he went through his post-graduate course, anthrax organisms disappeared within a few days from the bodies of guinea-pigs that had succumbed after experimental infection with anthrax. He wondered whether it would be possible to dispose of an animal effectively by blocking up the natural orifices and protecting it against wild animals so that the organism might in this manner disappear from the carcase.

Mr. Cameron further stated that the Contagious Diseases Act in England as amended by the Act of 1894 might well be taken as the model of an Act to deal with animal diseases in India, and he thought that Local Governments might be allowed to make their own orders under it. In Burma the export trade in hides was large and the owner of an animal was liable to a fine of Rs. 5 only if it was discovered that the hide had been removed from an animal that had succumbed to a contagious disease. He considered that a fine of this magnitude was far too low. It was his experience that when a large epizootic occurred in any locality, the number of hides that came from this locality was very large. The deaths in such an outbreak might be due to rinderpest, or anthrax, or other contagious disease, and as the fine was so small and the chances of detection almost infinitely small it was worth the owner's while to run the risk of being fined Rs. 5 only considering that he might easily sell half a dozen hides without detection. The hide firms always insisted that they had disinfected the hides and they were free from anthrax, but no fine would divulge the method of disinfection nor could they adduce proof that the hides in question were free from disease.

Lieutenant-Colonel Hutchinson stated that in view of the resolution passed by the committee he had previously dealt with, a certificate would only be taken and recognized as effective in the case of wool, if the process of disinfection adopted had been approved by a special committee to be appointed under International Agreement.

Mr. Ware stated that the difficulties which Mr. Cameron had enumerated as applying to Burma seemed to be often very formidable in Madras. For example, no mortality rate had been returned in goats in that province, although the goat population seemed to be innumerable. The mortality from anthrax recorded among other animals in Madras seemed to be larger than the total mortality from this disease in all the other provinces put together.

Mr. Cameron further said that he had not observed any anthrax in goats in Burma. He had explained the system of reporting, but when sudden deaths occurred among goats they were attributed by the owners of the animals to sun-stroke, snake bite, or some other condition.

Mr. Farbrother stated that he had experience of the outbreak of anthrax referred to by Mr. Edwards which had actuated the Government of India to take action in regard to legislation. He could not discover anthrax organisms in that suspected outbreak. In Bombay, anthrax was practically never reported except in cattle.

Lieutenant-Colonel Hutchinson mentioned, however, that the incidence of sheep anthrax in Sind was of such importance that it had attracted most peculiar attention.

Mr. Farbrother said that during his experience in Sind he had confirmed the presence of anthrax in all classes of animals except goats. Further, he pointed out the difficulty of controlling anthrax on account of the existence of the Native States all around the borders of Sind.

Mr. Hewlett stated that in Bombay the disease had come to his notice in horses, cattle and dogs.

Mr. Kerr from his experience in Bengal said that the disease appeared to be comparatively rare, but no dependence could be placed on the reports received as the owners were not perturbed over deaths involving only two or three animals. In fact, the poor type of animal kept in this province succumbed so frequently from exhaustion or overwork that a sporadic case of anthrax would stand no chance of being reported. One of the main difficulties about reporting was that owners did not place much value on their cattle and if they died the owners were prepared to cut their losses quickly and report the death as due to a series of conditions covered by one generic vernacular name, and hence the veterinary authorities could not be enlightened in any manner with regard to the true incidence of anthrax.

Mr. Krishna Murthi stated that in the city of Madras a number of outbreaks had been known to occur and were all reported. A system of reporting had been adopted. In the case of hides

intended for export, samples amounting to six hides from each consignment were chosen by the exporting firm at random and were sent to the laboratory for bacteriological examination. The system of examination was guinea-pig inoculation, as this was deemed to be the only reliable method. No cases had been encountered during the past five years while this method had been adopted. The examination was undertaken with a view to giving a certificate. The hides had to be certified to have been collected from districts that were free from anthrax. The speaker detailed the method of bacteriological examination.

Mr. MacGregor inquired what steps were recommended by the International Committee for the sterilization of bone-meal and whether it should be sterilized as bone-meal or raw bones.

Lieutenant-Colonel Hutchinson stated that there were several methods that could be adopted. For bones which were used for glue the latter were boiled for 15 minutes in water at 120°C., four hours in water at 180°F. or steeped for a minimum of 24 hours in milk of lime or in concentrated hydrochloric acid for 48 hours.

Mr. MacGregor wondered whether the digestion at 50 pound pressure was necessary as this had been insisted upon in the case of bone-meal exported from Bengal to New Zealand. A process involving 25 pounds pressure for two hours was also recommended.

Mr. Branford asked Colonel Hutchinson if there was any evidence of wool sorter's disease in India.

Lieutenant-Colonel Hutchinson stated that no evidence had hitherto been obtained of this disease. The only evidence available was in regard to three cases that had occurred in jails. He considered that the system of reporting deaths among human subjects in India was not so inefficient as is generally supposed. The reporting authority was the village officer and he reported the death according to the most prominent symptom. A Registration Manual containing simple instructions in regard to the symptoms was issued to each officer giving just the prominent symptoms of the familiar diseases. In order to demonstrate the reliability of this method it was stated that in regard to measles, for example, which was a very common disease, when he had examined the statistics obtained from the registers of the village officers, the age incidence of mortality from this affection corresponded exactly to the age incidence reported in civilized countries. This was a very striking point.

Mr. Branford considered that the evidence which had been adduced in the course of the discussion in regard to the necessity of training the personnel to control this disease had made a very

strong case for the institution of a four years' course of training, for the Veterinary Assistants could not be depended upon to diagnose the disease.

Mr. Quinlan stated that in Bihar the position was much the same as in other provinces. The village chowkidar was the reporting agency and it was difficult to get from him information quickly enough. The whole question resolved itself into one of providing an adequate staff. It must be pointed out to the Government very clearly the absolute necessity of providing an efficient veterinary staff, otherwise it would not be possible to carry out the recommendations of the International Committee. It ought to be laid down as the considered opinion of the meeting that this aspect should be put before the Government of India in the strongest terms and should be explained before the International Board of Agriculture and the Geneva Convention. This problem must be adequately solved first of all if we were to be considered in a position to carry out the instructions of industrial countries.

Mr. Wilson stated that in the Central Provinces no knowledge with regard to anthrax could be obtained unless the disease occurred among animals in some of the Government institutions. Elsewhere the occurrence of deaths was not reported promptly enough. On Government farms outbreaks had been dealt with most effectively by serum inoculations. No regulations could be enforced in the province without adequate staff.

Mr. Hickey stated that in the United Provinces single cases were not reported, for it often happened that the Veterinary Assistant might arrive at the scene of the outbreak 10 days after the death had occurred. Anthrax was only diagnosed when blood films were sent to him for examination from the local authorities.

Mr. Harris stated that in Assam the disease occurred sporadically but uniformly throughout the province; and, on some tea gardens, a few coolies had been infected by handling carcasses. The local authorities had used Muktesar serum successfully for the treatment of these men. There was no reporting agency in Assam and the knowledge he had obtained with regard to the disease was derived from the reports of the Veterinary Assistants themselves. He mentioned that in his province there was no agency which would be capable of carrying out any legislative measures. A large part of the country was water-logged and measures for the proper disposal of carcasses would be difficult to undertake.

Mr. Branford emphasized the importance of studying sheep diseases. Hitherto sheep had not been considered important enough, but he had found that when there had been outbreaks



of anthrax among cattle at Hissar the disease had likewise affected the sheep at the same time.

Colonel Pallin said that he had received no report of anthrax among military animals during the past year while he had been A. D. V. S. to the Eastern Command. Twenty years ago, however, while he was stationed at Meerut he had experience of an outbreak of anthrax among the artillery horses.

During the previous year the disease had also occurred among these horses and he took pains to trace the origin of the outbreak, and after taking the usual precautions he fixed on some stacks of hay which the artillery horses used to have in those days, and which were procured from the same place and made up of grass brought in by the grass cutters. It was concluded that the butts of these stacks were the source of infection. The stacks were burnt to the ground and no further trouble was caused. In 1902, about the same time, his attention was called to the sudden deaths of horses in the Viceroy's bodyguard at Dehra Dun. When he got to the stables he discovered that five horses there were already dead and five more were on the point of dying. Thus ten animals out of 110 became affected. The source of infection was traced to the green grass brought in by the grass cutters which was found to have been cut from the banks of a river into which carcases were usually thrown. On his recommendation no further supplies of grass were brought in from this area, and no further cases of disease occurred. A considerable amount of disease was caused and spread by throwing carcases into the beds of rivers.

Lieutenant-Colonel Hutchinson further emphasized that the country was at present faced either with heavy expenditure in setting up methods of disinfection, which would be quite unproductive or with what would also admittedly be a heavy expenditure upon controlling disease in live-stock, which nevertheless would connote an improvement in live-stock, so that this expenditure would be productive. Unless steps were taken to eradicate the disease the export trade might suffer.

In reply to Mr. Hewlett he stated that compulsory legislation might be advocated by the International Labour Conference to meet in 1924 and admitted that eradication could not immediately follow the enforcement of legislation.

Mr. Kerr raised the question as to the susceptibility of goats to anthrax. He was under the impression that they were more resistant than the other domestic animals.

Mr. Edwards said that, in his experience recently at Muktesar, he found that certain strains of anthrax proved to be extremely

virulent upon experimentation with goats, whereas other strains which had been kept in the laboratory for some time proved of very low virulence for all classes of animals. There was some evidence available pointing to the existence of strains of relatively low virulence among infected animals in the field.

Mr. Ware stated that fairly recently a shipment of goats amounting to 500 head that had been sent from Madras to Colombo suffered a 50 per cent. mortality from anthrax on arrival at Colombo.

Lieutenant-Colonel Hutchinson stated that 510 goats were found to have succumbed to anthrax at one of the slaughter houses at Colombo.

Mr. Smith stated that he had experience in buying sheep and goats for Government for export to Mesopotamia during the war. A large number of the sheep and goats had succumbed to anthrax.

The Chairman stated the discussion had now resolved itself into a consideration of the subject under three heads: (1) the prevalence of the disease; (2) the necessity for research; (3) the institution of preventive measures. With regard to the first of these heads, it had been brought out in the discussion that the disease was extremely virulent and it was fully realized that a large quantity of anthrax-infected material went out of India. A large number of the diseases scheduled in the returns under the heading of hæmorrhagic septicæmia was undoubtedly anthrax. When "hæmorrhagic septicæmia" received a separate column in the returns, some deaths were probably included which were in reality anthrax. He still favoured the view that indigenous animals in this country were probably possessed of a large degree of immunity and became infected with the latent form of disease. Secondly, on account of this relative immunity, the mortality did not correspond with the enormously high proportion of infected material represented in the figures for the export returns. Wool and hides were most likely infected from a small proportion that had died from the disease. He thus contended that much further research into this question was necessary. Thirdly, with regard to legislation, it would be necessary to discuss this question later on under subject III (a). A resolution would probably be drafted to cover the peculiar requirements of this disease. However, as had been pointed out by Mr. Edwards, the problem of anthrax afforded a concrete example which indicated the necessity for the application of such measures. In India the state of the country with regard to legislation for the control of animal disease was almost as bad as it could be. Obviously the first necessity in connection with the control of the disease was to institute compulsory notification, but this problem was difficult. In some provinces there was

maintained a register of deaths. At least such was his experience in Bombay and in the Punjab. At the present time it was unlikely that we could proceed very far in regard to notification. In anthrax there were no prominent symptoms, and the symptoms presented by cases of infection due to acute hæmorrhagic septicæmia were to a layman almost exactly similar. Sir John Moore had thought that notification could be enforced and likewise that compulsory segregation could be effected by orders from the Deputy Commissioner or by means of the police agency. However, there seemed to be insuperable difficulties in the way of enforcing segregation measures in general. The first and essential necessity was, however, that there must be available a sufficiently highly trained veterinary staff.

Mr. Kerr also maintained that, in order to carry out effectively any veterinary police measures, an additional veterinary staff was imperative. Legislative measures should, however, be uniform in their application, but this was not possible with the Provincial Services, particularly when the control of the subordinate veterinary personnel in the Provincial Service was in the hands of District Boards, with a Chairman who held office for a comparatively short period and had no permanent or predominant interest in this kind of work.

A resolution, the terms of which were drafted by a sub-committee consisting of Lieutenant-Colonel Hutchinson, Messrs. Branford and Smith and Major Stirling, with Mr. Edwards as Secretary, was subsequently unanimously passed by the meeting :—

- (1) *The evidence available shows that anthrax is a serious disease of live-stock in India and is much more prevalent than the official records would indicate.*
- (2) *The Conference, having considered in detail the incidence of anthrax among animals in India and men handling animal products in other countries and the economic issues resulting therefrom, resolved :—*
  - (i) *that as the spread of infection is not limited by geographical and provincial boundaries, measures directed against the dissemination of the disease both in India and to and from India from other countries should be considered a central subject ;*
  - (ii) *that disinfection of animal products, while throwing a great financial burden on industry, will accomplish nothing towards the eradication of the disease in animals and thereby improving the condition of stock in India ;*

- (iii) *that the only sure way of dealing with the situation, and at the same time of lasting economic benefit to the country, is by making a persistent effort to prevent the spread of infection among animals, and thereby to secure the control and ultimate eradication of the disease.*

*The success of any measure designed with these objects will depend upon*

- (i) efforts to improve the agency for notification,*
- (ii) an increase in numbers of the veterinary personnel of all grades consistent with the work which has to be done,*
- (iii) improved facilities for the education of the veterinary personnel recruited in India in the problems connected with the control of epizootic diseases,*
- (iv) legislation (see resolution under Subject III a).*

**SUBJECT II (b).—RINDERPEST. TO REVIEW THE EXPERIENCE ALREADY GAINED AS TO THE RELATIVE ADVANTAGES OF THE "SERUM SIMULTANEOUS" AND "SERUM ALONE" METHODS OF INOCULATION IN INDIA AND OTHER COUNTRIES.**

The Chairman stated that at the first meeting held at Lahore in 1919 there was a strong feeling among the members that the simultaneous method might be adopted more generally, and a resolution which he read was passed to that effect. Since then Messrs. Pool and Doyle had published a Memoir in which they indicated the very fleeting immunity conferred by "serum alone" and they commended the advantages of the simultaneous method. He believed it would be a great advantage if this method of inoculation could be performed generally on young animals, under a year old, before they became very valuable.

Mr. Quirke said that he had put forward this question in order to find out what was the experience obtained in the districts with regard to the simultaneous method. He considered that it was undoubtedly the better method if it was practicable in the districts. They were always ready to progress in this direction in his province if they were sure of the means. In the Punjab it would be possible to introduce the method at first on the Government farms but he was not clear as to the efficacy or safety of the method at present.

Mr. Hewlett stated that in his considered opinion the widespread use of "serum alone" in combating the disease was fore-

doomed to wastage in time and money on account of the fleeting immunity conferred by this method and its uselessness when applied to animals already infected. This wastage was particularly accentuated on account of the conditions which obtained in the districts where outbreaks occurred. The veterinary staff had no means of enforcing inoculation and preventing the movement of animals in the scene of an outbreak or to ensure the mixing of the inoculated animals with infected cattle in order to give them opportunities of direct infection and thereby secure active immunity. Having all these facts in mind he thought that the present method of inoculating serum alone was not really doing much good. He considered that this question should be earnestly discussed by the officers from the provinces.

Mr. Quinlan stated that in Bihar the only place in which the simultaneous method had hitherto been adopted was at the Government cattle farm where about 150 cattle had been inoculated by this method and no deaths had occurred therefrom among them. It would be, however, in the present conditions quite impossible to apply the methods to the cattle in districts where the population was largely Hindu, unless great changes took place in the attitude of the people towards inoculation. Where the owners of animals were Mohammedan in religion, the method would be more easy of application, as they would not resent the taking of blood for the virus inoculation to such a degree. As regards the so-called "serum alone" method, it was admitted that it had limitations and so far as his own experience went, he was emphatic that the owners believed that it did a considerable amount of good and that large numbers of cattle were saved. In fact, villagers now came forward and asked for their cattle to be inoculated as a preventive measure, when they feared an impending outbreak. These villagers who sought for inoculation were mainly Mohammedan and members of co-operative societies, where these societies were in existence.

Mr. Branford stated that the problem which confronted them in the districts was twofold: first of all, what form of inoculation to adopt in the face of an outbreak, and, secondly, what form of inoculation to adopt as a preventive measure. In the Punjab the disease seemed to be spread largely by the movement of animals to and from fairs and it was not impossible to prevent the spread in these circumstances. In the neighbourhood of Hissar there had only been three outbreaks of rinderpest in the course of 12 years and he had successfully treated his cattle with "serum alone" as a preventive measure on these occasions. He believed that in the face of an outbreak the simultaneous method would be more effective, but he thought that there was great risk of

setting up a focus of infection in carrying out the simultaneous inoculation if the virus was introduced into a locality where the disease did not already exist. When rinderpest had occurred at Hissar, the cattle were not removed on account of the danger of infection to the neighbouring cattle.

Khan Saheb Sheikh Naiz Mohammed stated that he believed that the system of double inoculation could be gradually adopted in the United Provinces and a start might be made with cattle belonging to Government institutions and District Boards.

Colonel Pallin stated: "During 1920 the Government of India decided to adopt the serum simultaneous method of inoculation against rinderpest as a general measure for all Government bullocks and Government dairy farm cattle. Having only returned to this country last February after an absence of several years I am not quite *au fait* with the results obtained throughout India during the first two years during which the Army Veterinary Service has adopted the serum simultaneous method of inoculation against rinderpest for Government animals, but I am informed that on the whole the results obtained were very satisfactory. However, in view of the fact that it is stated that the mortality following on the serum simultaneous method of inoculation against rinderpest should not be more than 0.8 per cent., [Pool and Doyle] I am greatly concerned at the high rate of mortality which has occurred amongst the Government dairy farm cattle during the present cold weather, particularly at Allahabad and Sitapore, which farms came under my veterinary administration. At the former place 39 Government dairy farm young stock and five imported bulls belonging to an American Mission were inoculated during November last with the following results:—

Class of animal	Inoculated	Died	Percentage of mortality
Imported bulls . . . . .	5	5	100
Young stock, more than half imported blood	15	10	66
Young stock, half and less than half .	8	<i>nil</i>	<i>nil</i>
Young stock, buffaloes . . . . .	16	<i>nil</i>	<i>nil</i>
TOTAL .	44	15	34

While at the latter place, *i.e.*, Sitapore, 50 young stock varying from 10 to 15 months were inoculated during the first week in January last with the following results :—

Class of animal	Inoculated	Died	Percentage of mortality
Young stock, $\frac{1}{2}$ to $\frac{3}{4}$ imported blood . . . . .	33	5	15.1
„ „ cross-bred . . . . .	8	nil	nil
„ „ buffaloes . . . . .	9	nil	nil
TOTAL . . . . .	50	5	10

“ Now in view of the fact that these two sets of inoculations were carried out by officers in whom I have every confidence, it must be admitted that the results are far from satisfactory and as I am further informed that serious casualties occurred following on serum simultaneous inoculations at the Government dairy farm at Karnal, we are naturally becoming greatly alarmed.

“ In the case of the casualties at Allahabad, the Veterinary Officer, Major P. V. Beatty, R.A.V.C., states that most of the animals, which died, did so after showing typical rinderpest symptoms. Blood smears from two of the cases were examined and although one animal showed symptoms of red-water previous to death the results of the microscopical examination of the blood are reported to have been negative.

“ In the case of Sitapore, where the inoculations were carried out by Captain T. F. Arnold, R.A.V.C., (who in view of the recent unsatisfactory results at Allahabad was specially warned by me to be most careful with these inoculations), 10 of the half-bred animals were unfortunately in poor condition, but he reports that they appeared to be strong enough to be inoculated. He further stated that most of the animals inoculated showed a temperature reaction after 24 to 36 hours and some of the cattle and all the buffaloes gave a clinical reaction on the third day; the clinical reaction was a mucopurulent catarrh of the eyes and in one case

only diarrhoea. The following note is given regarding the animals which died :—

No.	Breed	Date of death	Cause of death
528	‡	2 <sup>nd</sup> 3 <sup>rd</sup> night . .	Probably shock or toxoemia, this animal was one of the 10 in poor condition.
78	‡	4th mid day . .	Piroplasms found but no temperature reaction, probably toxoemia.
510	‡	5th morning . .	Piroplasms found on 4th and 100 C. C. 3 per cent. trypanblue giving intravenously.
527	‡	4th morning . .	Probably toxoemia. Blood examined but no piroplasms found.
520	‡	5th evening . .	Only off feed day preceding death.

“ In forwarding the veterinary officer’s report on these inoculations to the Director of Veterinary Services in India I made the following comment :—‘ As will be seen, five animals out of 50 died, *i.e.*, 10 per cent. Whether these animals died from toxoemia, piroplasmosis or rinderpest there appears to be little doubt that had they not been inoculated they would not have died.’

“ As it is stated in para 10 of Bulletin No. 120 of 1921 from the Agricultural Research Institute, Pusa, that the total mortality after the serum simultaneous method of inoculation against rinderpest has been under 0·8 per cent. it appears to me that if the high percentage of casualties which have occurred during recent inoculations at Allahabad, Karnal and Sitapore is accepted as being due to latent piroplasmosis aggravated by the serum inoculations, some wholesale prophylactic measures such as dippings should be taken to deal with piroplasmosis amongst cattle in this country before the serum simultaneous method of inoculation against rinderpest is continued.

“ Gentlemen, I can assure you that as the serum simultaneous method of inoculation is the only form of inoculation which is guaranteed to give a lasting immunity, we are most anxious to make this form of inoculation a success. Veterinary officers have been sent to the Imperial Bacteriological Laboratory, Muktesar, for special instruction in the *modus operandi*; the instructions laid down for the inoculation have been carefully complied with and special serum was obtained for these inoculations; but in the face of such casualties as we have recently had I cannot agree to continuing this method of inoculation until the causes of the high percentage of the fatalities are made quite clear and until we are



in a position to ensure better results. Whether the fault lies with the serum or not I am not prepared to say, but at the request of Mr. Edwards all the serum remaining over from these inoculations has been returned to him for examination and he will no doubt inform you what are the results of this enquiry."

Mr. Hewlett stated that he was under the impression that for a number of years the inoculation at the military dairies had been in charge of a Veterinary Deputy Superintendent (Mr. V. R. Phadke, G.B.V.C.), deputed from Muktesar for the work and that although several thousand cattle had been inoculated, the mortality was extremely small.

Mr. Smith stated that Mr. Phadke from Muktesar had inoculated in his group of military dairies about 2,500 head of cattle and that the mortality was not 1 per cent. The mortality among Ayrshire cattle was extremely small. He complimented this officer for the large amount of time he spent and trouble he took with the cattle during the process of inoculation and his constant solicitude for any evidence of piroplasmiasis. He mentioned a very bad outbreak which he had experienced at Mhow. About 120 animals were put into the rinderpest camp and treated with serum and not one of those animals became subsequently infected with the disease.

Mr. Ware stated that he had begun this method of simultaneous inoculation in Madras in 1918, and since that year over 400 animals had been inoculated. Those inoculated included one Ayrshire bull. During this season he had inoculated in one camp over 100 cattle, at the Agricultural Farm, Coimbatore. The inoculated cattle subsequently suffered from severe reactions although he had taken all reasonable precautions with regard to the inoculations. None of the inoculated animals, however, died. Out of the 400 animals which had now been inoculated only one small calf had died. In the inoculated animals, however, piroplasmiasis made its appearance very often. In the districts he had hitherto inoculated only about 25 animals in one camp. He experienced very great difficulty in securing the necessary degree of isolation for the animals while they were under process of immunization.

Mr. Branford did not consider that there was much danger of the disease spreading during the process of immunization if simple measures were taken to prevent the spread.

Mr. Ware stated that he had recommended a certain budget allotment in Madras for the purpose of adopting this method of inoculation. It seemed that in future it would be difficult in his province to resort to the "serum alone" method on the same.

large scale as it had hitherto been employed on account of the fact that the Government had now decided to charge a fee for it, and it was probable that in future the numbers of animals that would be inoculated by the simultaneous method would be increased and that the numbers done by the "serum alone" method would be reduced.

Mr. Riley stated that he had carried out the double inoculation on two occasions after having studied the method at Muktesar. In his experience the process gave rise to considerable anxiety when the inoculated animals contained imported blood. While he was in charge of the inoculation of the Pusa herd he was fortunate in having every facility for the task and the work was carried out successfully, with no deaths subsequently. He was very careful to examine the blood of the inoculated animals for piroplasmiasis when they exhibited a rise of temperature and also to have them properly housed at night time. At the agricultural farm attached to the Asylum at Ranchi he had likewise obtained very great facilities for carrying out the work, but the inoculation was performed late in the year in April. The animals were country bred animals and their temperatures subsequently ran up extraordinarily high, to 107° or 108° F., but there were no deaths. He lost three "controls" (virus producers) out of four. He considered that work of this kind could not be carried out in the field in Bihar unless some method could be evolved to eliminate the use of "controls". He obtained fresh virulent blood for the work from Bareilly. The use of "controls" in distant centres made it impossible to undertake the work.

Mr. Farbrother stated that he had no personal experience of the inoculation, but one of his Veterinary Deputy Superintendents, Mr. Vacha, had performed the work in the Bombay Presidency at a certain place quite recently where 66 cattle had to be inoculated. He was entirely successful with the work, but what struck him (the speaker) was the period of time which was required, namely, about three weeks, to carry out the work. The method was, therefore, impracticable in the districts. In any event it would hardly be possible to recommend legislation for the adoption of the method on a larger scale.

Mr. Ware raised the question as to the best method of providing virus for the districts.

Mr. Quinlan asked Col. Pallin about the conditions under which the animals in the Sitapur and Allahabad outbreaks were housed, because in his experience animals affected with even a mild form of rinderpest were liable to succumb if proper attention was not paid to the housing.

Col. Pallin stated that special *chuppers* were built for these animals as they were showing signs of weakness and the weather was cold.

Mr. Quinlan was particularly emphatic that it was very necessary to pay attention to the housing of animals during the rinderpest reaction.

Col. Pallin stated that it would be of great assistance to him to have the indications for carrying out the method redrafted as had been promised by Mr. Edwards.

Mr. Smith wished to lay particular emphasis on the feeding of animals while they were under the process of immunization. He had found it necessary to place them on laxative diet consisting of bran mash and treacle and to omit hard food such as grain, etc.

Mr. Davis asked Mr. Edwards what the method was in use at present in Upper East Africa where he believed transport difficulties were much greater.

Mr. Branford believed that the department was not yet strong enough to undertake the work of serum simultaneous inoculation in the districts.

Mr. Hewlett again emphasized that the serum simultaneous method should be used in large dairies and in other concerns of this kind, but he held out no hope of successfully dealing with rinderpest by the use of serum alone in the manner it was now generally adopted.

Mr. Edwards stated that the exceptionally heavy mortality which had occurred at certain military dairies during the present season had caused him a great deal of anxiety, and searching tests were being carried out at the laboratory in order to investigate the origin of these accidents. In the outbreak first reported—from the Karnal military dairy—the officer in charge had communicated to him detailed reports of the animals under inoculation, and the evidence seemed to show that some condition other than rinderpest was accountable for the mortality; the animals which succumbed developed symptoms very early—within a day or two—of the inoculation and deaths commenced within three days. The typical symptoms of rinderpest—buccal lesions and diarrhoea—were generally absent, and hæmoglobinuria was a prominent symptom. The officer in charge was convinced that acute piroplasmiasis was the cause of the deaths. No piroplasms, however, had been detected in a few smears which he (the speaker) had received for examination. He was not prepared yet to express any definite opinion upon the cause of these deaths, but in many of the dairies he believed that the records indicated that a condition developed which could not be

definitely asserted to be rinderpest. In the Allahabad outbreak, however, undoubted symptoms of rinderpest did develop in many of the cases which succumbed later during the course of observations, but in many of the fatalities occurring elsewhere the records pointed to the development of a condition with acute blood destruction. He had already retested a sample of serum returned from the Allahabad dairy and found it to be protective at the dosage stipulated at issue, but there had been quite an appreciable falling off in potency since the time of the original test. He had been much exercised about the manufacture of potent serum since he had taken over charge of the laboratory, particularly as he had lost a short time after his arrival the collaboration of Mr. Pool, who had evinced during his tenure of office at the laboratory such extraordinary solicitude in this matter that his competence was probably unrivalled. He had thus, soon after Mr. Pool's departure, taken in hand the personal supervision of the manufacture and testing of all rinderpest serum and made provision, as he thought, for the issue of anti-rinderpest serum from the laboratory of sufficiently high potency so that it could all be used safely for the "serum simultaneous" inoculation. The occurrence of excessive mortality in the military dairies this season had therefore come as a considerable surprise, and he was sparing no pains to obtain information upon it which would enable him to take steps to obviate these accidents in future. The results of his investigations would be fully reported upon later. In order to test the safety of the method with the use of the materials produced at the laboratory he had deputed one of his colleagues (Mr. Bennett) to carry out under his directions the immunization of the valuable Pusa herd of cattle, comprising Montgomery and cross-bred Ayrshire-Montgomery cattle, and the results, upon 80 animals, which he had only just learnt, had been completely successful.

*A priori*, there would appear to be no reason to fear any accident following upon the simultaneous inoculation provided an adequately large dose of a sufficiently highly potent anti-rinderpest serum were injected into the animal at the same time as the small dose of virulent rinderpest blood. There was a great deal of recorded evidence forthcoming from other countries pointing to the relative safety and extraordinary efficacy of the method when applied to a considerable cattle population; he had in mind particularly the results achieved in Egypt, in East Africa, and towards the conclusion of the war in the zone bordering the southern limits of the territory formerly known as German East Africa where the application of the method effectually prevented the southward extension of rinderpest into Southern Africa. In the Italian colony of Eritrea the wholesale inoculation of all the cattle population every two years by this method had been recommended. Moreover, the evidence showed

that the simultaneous method conferred an immunity which was in all probability life-long, whereas inoculation with serum alone as had recently been clearly demonstrated by Messrs. Pool and Doyle gave the animal an immunity which could be depended upon to give it a sure protection for a period of only nine days. Having in mind the durability of the protection conferred by the simultaneous method and its recorded comparative safety elsewhere where it had been tested on very large numbers of cattle there could be no doubt that this was the method of choice for combating rinderpest in India, and if the method were systematically adopted throughout the country there seemed to be no reason why the disease should not soon become extinct. The difficulties which stood in the way of its universal application, notably the prejudices and apprehensions of owners, had been pointed out by previous speakers.

In spite of the knowledge available with regard to efficacy of the method it was, however, well known that its adoption was not always free from danger. In the first place, there was danger of setting up fatal rinderpest unless the serum injected simultaneously was of certainly dependable potency. The manufacture of a serum of the required potency did not appear to be an easy task, for the experience of his laboratory had recently been that in spite of repeated massive hyperimmunization the serum obtained from the serum producers gradually fell off in potency after the early bleedings, so that great care had to be taken not to issue serum for the simultaneous method obtained from later bleedings. However, with a highly potent serum, it had often been found possible to mask completely the reaction following upon the injection of a rinderpest blood of high virulence, and the inoculated animal was found subsequently to be immune. He had found also that the practice of utilizing buffaloes for serum production and hill bulls as virus producers, although it had been found an economical procedure for the manufacture of serum for preventive purposes, had a drawback in that the serum of the buffalo became markedly hæmolytic for the blood of the ox after repeated hyperimmunization.\* For the simultaneous inoculation of cattle, where large doses of serum had often to be injected into animals of high susceptibility, he believed that special care should be taken to issue only sera specially prepared and tested as to a high degree of potency from cattle (hill bulls), or sera from the first bleeding, exclusively, of buffaloes.

The risk due to intercurrent piroplasmosis was well known, and the appearance of so-called "redwater," due to *Babesia bigemina*

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\* Researches carried out at the laboratory subsequently indicated that this view of the origin of the accidents was justified. J. T. E., November 1923.

or other piroplasms, might be twofold in origin : first, the virulent blood itself might contain infective piroplasms, in which case symptoms of redwater would occur after an incubation period of seven to nine days, while on the other hand, the inoculated animal might suffer an attack of acute piroplasmosis due to the resuscitation in virulence, owing to the depressant effect of the rinderpest infection, of piroplasms lying dormant in the animal's system and kept in a latent state subsequent to a former, natural piroplasm infection,—in which event the symptoms might appear at any time, early or late, during the course of the reaction. The very common small piroplasms *Theileria mutans*, that frequently appeared in the blood of inoculated cattle, did not seem to exert an invariably distinctly prejudicial effect.

He had again been perturbed concerning the possibility of mutation in the virus, for it was well known that in other diseases due to filterable viruses—horse-sickness, in particular, swine fever, and, according to recent reports of French investigators, the foot and mouth disease virus—various strains existed which differed greatly in their behaviour towards a protective serum prepared against a single strain. He was conducting experiments bearing upon this point, but had hitherto obtained no evidence of such mutation.

As had been said before, the information of other countries appeared to show that with few precautions the mortality rate due to any of these factors was a very small one when large numbers of cattle were inoculated, and in other countries the prolonged observation of inoculated cattle which was generally undertaken in India was not usually made. He had already performed the simultaneous inoculation quite successfully upon a number of young calves kindly sent to him for this purpose by Colonel Matson, Controller, Military Dairy Farms, and upon calves specially reared at the laboratory. He proposed to test the durability of the immunity conferred upon these calves at various intervals ; tests hitherto conducted showed that it remained solid for a year, and there was no reason to believe that it would not last many years. A great advantage of immunizing young calves in this manner was, as was well known, their relatively high resistance towards the severe effects of an accidentally transmitted redwater infection.

Although the " serum simultaneous " method was the method of choice where it could be applied, the " serum alone " method had its indications for adoption and he saw no reason why this method should not be pursued to the utmost possible extent pending the development of circumstances favourable for the general application of the former method. In the first place, anti-rinderpest serum;

properly prepared and tested, was one of most reliable products judged by its efficacy known to prophylaxis. The protection conferred by it was certain and immediate, and in the scene of an outbreak it was the method that should always be applied to cattle exposed to infection. If cattle protected in this manner were immediately allowed free intercourse with infected animals there was a chance that they might contract infection, and develop a durable immunity of the kind conferred by the simultaneous inoculation; but experience had shown that it was well not to put much dependence on this eventuality, and that it was better to repeat the serum inoculation at intervals of nine or ten days while the outbreak persisted. The judicious use of serum alone upon all exposed cattle in this matter would undoubtedly bring about the limitation and extinction of outbreaks, as was accomplished by Mr. Smith in the military dairies. The serum issued from the Muktesar laboratory was all rigorously tested as to its efficacy for this purpose, and workers in the field had to see to it that the serum used by them was not such as had deteriorated by prolonged or improper storage and was administered in the dosages indicated by the susceptibility of the inoculated animals.

Further, he stated that as rinderpest was the most important single disease of live stock in India he had marshalled the resources of the Muktesar laboratory for the investigation of the disease, for its etiology was still obscure beyond the fact that it was usually held to be due to a filterable virus and he described the progress of the work done.

A small committee was then formed consisting of Messrs. Harris, Quinlan and Cameron with Mr. Edwards as Secretary to draft the terms of a resolution embodying the views of the meeting. The resolution, passed unanimously by the meeting, was as follows:—

ion II (b)

- (1) *That the process of active immunization against rinderpest by the so-called serum simultaneous method should be prosecuted with the utmost vigour, whenever possible, as it represents the only means at present known of conferring a satisfactory permanent immunity upon susceptible animals.*
- (2) *That in the districts, however, the time is not yet opportune for the wholesale performance of this method of immunization, as the occasional accidents which follow upon its adoption might hinder, in view of the prejudices of the smaller owners, the eventual universal adoption of the method.*

- (3) *That investigations upon the nature of the rinderpest virus and upon the factors involved in the safe conferrence of a satisfactory immunity should be regarded as research projects of primary importance.*
- (4) *That meanwhile, until the time arrives for the wholesale adoption of a process of active immunization, the "serum alone" method of immunization, though it confers but a passive, fleeting immunity, should be regarded when properly applied as the system best suited for general adoption in the face of outbreaks in India.*

SUBJECT II (c).—TRYPANOSOMIASES : SURRA. (1) IS THE EXISTING LEGISLATION FOR THE CONTROL OF SURRA ADEQUATE? (2) THE PRESENT POSITION IN RESPECT TO RESEARCH AND THE EFFICACY OF METHODS OF TREATMENT. (3) INFORMATION WITH REGARD TO TRYPANOSOMIASES, OTHER THAN SURRA, FOUND IN INDIA.

The Chairman called upon Mr. Ware who stated that much information was required upon the problem of surra and he had suggested that this subject might be discussed in order to find a means of obtaining more information upon the many aspects of the problem which were at present recognized to need solution. He asked for the appointment of a whole-time protozoologist to study the question and he hoped that a resolution would be drafted to this effect. If this worker did not find sufficient work in the investigation of the trypanosomiasis, he would certainly find much occupation in studying the parasites of other protozoan diseases of incalculable importance in the live stock economy of the country.

Mr. Fletcher, Imperial Entomologist, stated that he had no further information to impart upon the problems connected with surra. He had summarized the information available on the aspects of the subjects which concerned him, in the printed review which he had circulated. At the Fourth Standing Committee on Surra, at which he was present, it had been decided largely at his instigation to constitute a small body of investigators, comprising a veterinary pathologist, an entomologist, and a protozoologist, in order to study the whole problem of surra in India. As he had pointed out in his review of the published information upon the transmission of surra, there was hardly a single point connected with this aspect of the problem that had been put forward as throwing light on the problem, which was not disputed by other workers.



properly prepared and tested, was one of most reliable products judged by its efficacy known to prophylaxis. The protection conferred by it was certain and immediate, and in the scene of an outbreak it was the method that should always be applied to cattle exposed to infection. If cattle protected in this manner were immediately allowed free intercourse with infected animals there was a chance that they might contract infection, and develop a durable immunity of the kind conferred by the simultaneous inoculation ; but experience had shown that it was well not to put much dependence on this eventuality, and that it was better to repeat the serum inoculation at intervals of nine or ten days while the outbreak persisted. The judicious use of serum alone upon all exposed cattle in this matter would undoubtedly bring about the limitation and extinction of outbreaks, as was accomplished by Mr. Smith in the military dairies. The serum issued from the Muktesar laboratory was all rigorously tested as to its efficacy for this purpose, and workers in the field had to see to it that the serum used by them was not such as had deteriorated by prolonged or improper storage and was administered in the dosages indicated by the susceptibility of the inoculated animals.

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The review dealt with the position up to the time it was published, June 1921, and it was submitted to the Government in order to explain the position.

Government had apparently rejected the proposals submitted by the committee on the score of expense. He had regarded the action proposed by the committee as vital, for there was no comparison between the present economic loss from deaths among animals due to surra and the relatively very small expenditure that would have to be laid out in the proposed investigations. Mr. Edwards in his note had suggested that efforts should now be concentrated upon treatment. He (Mr. Fletcher) pointed out that if one were to take the analogous examples of malaria, it was admitted that the eradication of this disease could only be effected by attacking the actual means of transmission, for no advance could be made in this direction by the administration of an efficacious remedy, namely, quinine. To put off investigation on the plea that a remedy might be found was in his opinion a weak argument. In malaria it was agreed that efforts should be concentrated on the eradication of the mosquito as the means of controlling the disease. He moreover thought that as a general policy it was most unwise to assist the Government in finding a means of escape from the considered opinion of a technical body such as had been constituted in the manner of the Surra Committee. It was likely that this would form a precedent and that Government would regard scientific committees as vacillating and untrustworthy.

In reply to the Chairman, who asked if he was conversant with the recent work of Mr. Cross on the tick transmission of surra, Mr. Fletcher replied that he was acquainted with this work, but notwithstanding the claims put forward he considered that it did not in any way point to less research in this connection being required.

Mr. Cameron stated that in Burma the disease was more prevalent than was represented in the map drawn up to show its distribution, and he considered that it was necessary to check a large amount of evidence still in order to get a correct appreciation of the situation. In the affected districts there were prevalent many kinds of Tabanid flies, and surra was well known to affect "belts" of country. The agency by means of which it was transmitted was quite unknown, but several species of flies might be suspected. In discussing the question as to whether existing legislation was sufficient to deal with the disease or not he mentioned that it almost invariably happened that the "Veterinary Practitioner" appointed to take the action laid down under the Glanders and Farcy Act was not within a reasonable distance of the scene of the outbreak to seize the affected animal. The Government of Burma had recently

declared that men who had acted in the appointment of Veterinary Deputy Superintendents for two or three years could be regarded as "Veterinary Practitioners" within the meaning of the Act, in addition to the members of R. C. V. S. But even so, the area for which each of these officers was responsible was so considerable that he could not reach the declared case of infection in time. Even if the Veterinary Practitioner was within reach, he could not find any means of having the animals shot, for in a country where all the inhabitants were Buddhists, including the Veterinary Assistants, it was extremely difficult to get the law enforced. The result was that it was not uncommon for an animal found to be affected to be turned out into the jungle rather than shot on account of these religious prejudices and thus it became a reservoir of infection. The legislation should be modified so that the animal could be seized by the police and kept in segregation until it could be declared free from infection. If an animal was certified to be infected after a microscopic examination, it should be destroyed by the police. In the course of the discussion it was pointed out that the rules which each province was entitled to draw up under the Act should be made uniform in this respect in each province. He had found no other trypanosomes in bovines other than what he believed to be those of surra. He thought that Mr. Fletcher's recommendation that a small whole-time committee should be appointed to work upon surra was a sound one.

Mr. Edwards elaborated the points submitted to the meeting in his note. He explained the position which had arisen subsequent to the Fourth Meeting of the Standing Committee on Surra, in 1921, and he reiterated his belief that the problem of surra should not be attacked alone, but efforts should be made to prosecute its study as part of the much larger problem of the whole group of diseases among live-stock in India caused by protozoan parasites, concerning which our knowledge was lamentably defective as compared with that existent in other countries upon diseases of this kind and in view of the economic issues entailed. It might very likely transpire that the Government of India would be sorely disappointed with the economic benefits that would accrue from the labours of a specially appointed body of investigators working for a certain term of years, although from a philosophical standpoint the information they would be able to furnish would undoubtedly be of great value. He said this particularly as he had in mind the analogy of the formidable African trypanosomiases of man and the domesticated animals. In spite of the fact that a great deal of very precise knowledge was now available regarding the parasite, the vectors, and the pathology of these conditions, no practical results on a large scale had yet been

derived from this knowledge ; for, those who were reckoned to be authorities in this field of study could not make up their minds whether it was best to attack the problem by clearing the forests which harboured the vector or by stamping out the game believed to act as reservoirs of the trypanosomes ; in any event, both propositions appeared to be economically quite impracticable. Hence, short of avoiding the areas in which these diseases were known to occur nothing seemed to have been done except to exploit the possibilities of therapeutic treatment. He considered that the results hitherto recorded in connection with the therapeutic treatment of this group of diseases to be distinctly encouraging. He had in mind the information recently published concerning the efficacy of the German preparation " Bayer 205 " in the treatment of human sleeping sickness, and the prospects opened up by the successes claimed appeared to be so considerable that it had been put forward that the German Government would hold out the disclosure of the method of preparation of this compound as the basis of negotiations for the return of her African tropical possessions. He also mentioned the successes claimed by Dr. Pearce, of the Rockefeller Institute, with cases of human sleeping sickness in the Belgian Congo ; this worker had kindly placed at his disposal a quantity of the preparation (tryparsamide) which he employed for the experimental treatment of surra, but the results hitherto obtained seemed to indicate that this disease in horses was not easily amenable to treatment. The results following treatment with tartar emetic in certain trypanosomiasis, such as the surra of camels investigated by Cross and the trypanosomiasis of cattle in South Central Africa due to *Trypanosoma congolense*, were well known. [At the Muktesar laboratory he had obtained remarkably good results in the treatment of bovines affected with trypanosomiasis, caused by a trypanosoma indistinguishable from that of surra, by intravenous injections of tartar emetic.] Spirochætal affections, which might be regarded as nearly related, had proved often to be most susceptible to chemotherapeutic treatment. A large amount of information was now scattered in the literature upon the chemotherapeutic treatment of this class of disease, and it seemed that a co-ordinated effort should now be made to ascertain the efficacy of the various classes of drugs, believed to act as remedies, upon a large scale upon naturally infected cases in the field. In the case of the domesticated animals susceptible to surra any system of treatment ultimately recommended must be efficacious, cheap, and easily applicable. He therefore proposed to seek the co-operation of the Veterinary Service in the field to the largest possible extent for the observation of the effects of certain remedies which suggested

themselves. Work of this kind undoubtedly took considerable time, but as it would cost Government very little or nothing there was no excuse for keeping back this kind of investigation on the plea of financial stringency. With regard to the larger problem of the whole group of protozoan diseases, he stated that the opportunities for valuable research in this field were immense. For the past year at Muktesar systematic examinations had been made upon cattle more particularly for protozoan parasites, and they had come across a large number of cases of bovine coccidiosis, four cases of infection set up by parasites identical in appearance and distribution in the body with that of the formidable East Coast Fever of cattle in Africa (*Theileria parva*), and innumerable examples of infection in cattle with small piroplasms of the type *Theileria mutans*. During his stay at Muktesar Mr. Sheather had discovered a parasite in cattle very similar to that of malaria in man, and a number of cases had been found since. Very little seemed to be known with regard to the nature and distribution of the "red-water" parasites of cattle in India, and he was particularly interested in this matter on account of the dangers involved in the active immunization of cattle against rinderpest. In all questions connected with insect transmission of these diseases he would look to the Imperial Entomologist for assistance, for any work directly dealing with insects was of too specialised a nature to be readily taken up by the veterinary pathologist. Again, he thought the time was ripe for the permanent appointment of a specially trained and experienced protozoologist for work and advice upon all questions dealing with protozoan parasites of veterinary interest. He thought the proto-zoologist would best be placed on the staff of the Muktesar laboratory, where he would be incorporated in a team for the investigation of surra and the other trypanosomiasis and all the important classes of diseases due to protozoan parasites of economic interest in the live-stock industry of the country.

Mr. MacGregor thought that surra was a disease which could not be much affected by therapeutic treatment and he could not agree to the analogy between it and certain of the diseases mentioned by Mr. Edwards.

Mr. Hewlett said that he would be pleased to carry out the treatment suggested in the lazaretto in Bombay. He had previously tried the treatment and had found no difficulty in carrying it out. The only difficulty was the expense of maintaining the animals, for he had no money available for their upkeep, but he could probably manage to keep three or four horses at one time. He considered that the existing legislation was not adequate but was quite justified. With regard to information upon the presence of trypanosomiasis

in other animals, it had been discovered at the college that in Bombay about 2 per cent. of the cattle harboured trypanosomes in their blood. The percentage in buffaloes was higher, about 10 per cent. He could not declare what species of trypanosomes were represented in these estimates, but his colleague Mr. Sowerby was of opinion that they were *Trypanosoma evansi*. Outbreaks of trypanosomiasis in buffaloes in Bombay sometimes led to fatal termination in the affected animals and upon death their blood was found to be teeming with trypanosomes.

Mr. Branford stated that he had tried Cross's treatment for surra upon one affected camel and the animal was completely cured.

Mr. Wilson stated that the present legislation placed him in a paradoxical position, for if a case of surra was confirmed in an equine animal this animal had to be destroyed, whereas in the neighbourhood it might be quite easy to discover similar trypanosomes in the blood of cattle, but these animals could not be slaughtered. Affected cattle yielded readily to treatment. Without doubt, this anomalous position would be severely criticised in future.

The Chairman believed that all present were agreed that the existing state of legislation was not satisfactory. He entertained grave doubts as to the efficacy of existing methods of treatment. In his own hands the treatment recommended by Holmes had not given satisfactory results and recently at the Punjab Veterinary College the method of treatment recommended by Cross had been tried on a number of infected camels with no success, due possibly to the animals being old and in very poor condition. He believed that chemical treatment would not cure animals unless it was combined with good food and favourable climatic conditions. Purity in the drugs employed appeared to be essential also. The urgent necessity for further research was clear, and it was regrettable that the recommendations of the Fourth Standing Committee on Surra had not been adopted.

After some further discussion a committee comprising Messrs. Ware, Fletcher, and Farbrother with Mr. Edwards as Secretary was appointed to draft resolutions in conformity with the opinions expressed by the meeting. This committee drafted the following resolution, which was passed unanimously by the Meeting.

tion II (c)

- (1) *Investigations into the nature and mode of transmission of the animal trypanosomiasis in India should be prosecuted forthwith. Likewise, the whole problem of the important protozoan diseases of the domesticated animals of the country should be approached concurrently. For this purpose it will be necessary to strengthen the technical resources at present available in the*

country for research into different aspects of the above projects, comprising the entomological, protozoological, and pathological aspects, by centralization of the facilities available in each of these pursuits, and the delegation, on request, of workers to assist those engaged directly in the elucidation of the disease problems. An experienced protozoologist should be appointed to the staff of the Imperial Bacteriological Laboratory for research into these problems. Entomological assistance should be derived from the staff of the Imperial Entomologist. These workers would find unlimited scope for their activities, in addition, in the investigation of the economically highly important diseases of live-stock caused by protozoan parasites, other than those of surra.

- (2) Efforts to obtain a cheap, effective and easily applied remedy for the cure of surra, in particular, and other protozoan diseases should be prosecuted on a large scale in the laboratory and in the field, and the co-ordinated services of the whole veterinary profession in India are required for this purpose.
- (3) In view of our present inadequate knowledge of the trypanosomiasis of animals in India, and the likelihood that the pathogenic trypanosomes find a reservoir frequently in relatively resistant host species, the present legislative measures dealing with surra should be reconsidered in the light of better information that may be procured on further research directed with the object of elucidating these peculiar conditions.

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SUBJECT II (d).—CONTAGIOUS ABORTION. INFORMATION REGARDING ITS INCIDENCE AMONG IMPORTED AND INDIGENOUS STOCK; PROPOSALS FOR CONTROL.

Mr. Edwards explained the text of his note already circulated among the members. Tests at the Muktesar laboratory had indicated that in the Punjab and elsewhere the common form of equine contagious abortion was very prevalent and tests upon one herd of military dairy cattle had shown a high incidence of infection with the common form of contagious bovine abortion. Contagious abortion and tuberculosis were the most serious menaces to live-stock in Western countries, and of these two conditions probably contagious abortion ranked first as a cause of direct economic loss to the stock breeder. In India, the import-



ance of this disease was probably masked by the much greater attention paid to the serious epizootic diseases of the country, notably rinderpest. In the case of tuberculosis, it seemed that the incidence of infection in India was very low, and among indigenous cattle it would probably be found that the prevalence of contagious abortion was likewise low as compared with that obtaining in more civilized countries on account of the conditions which obtained there due to the efforts made to improve the breeds of cattle and horses. With the resulting greater movement of animals, dependent largely upon the much better transport facilities, animals infected or acting as carriers of infection spread the disease readily over great distances. Inasmuch as with the improvement of live-stock breeding in India, the same factors would most likely also prevail, it was probable that these diseases of both cattle and mares would before long assume very considerable importance. It seemed, therefore, that steps should be taken soon to ascertain the prevalence of the infection in the various parts of the country and the relative susceptibility of indigenous and imported cattle. Effective measures of control for both equine and bovine abortion depended upon early diagnosis of the condition, so that as soon as it was found affecting a herd or stud, segregation measures could be promptly instituted. In bovine abortion vaccination was resorted to in some countries on a fairly large scale, but inasmuch as vaccination implied the inoculation of animals with the living causal organisms, and hence might keep alive indefinitely the disease in carriers, it should not be a method to be lightly undertaken, particularly if the disease could be eradicated by simple preventive measures. It appeared, therefore, that it might be found that in cattle, particularly, both tuberculosis and contagious abortion were conditions that could be checked at the present time in this country on account of their low incidence. We might be able, in this manner, to avert the evil which is prevalent among Western herds in this respect, with the early institution of proper measures of control.

Mr. Branford explained his views concerning the experience gained on the Hissar farm. He was not inclined to believe that contagious abortion in cattle was a new disease in this country. On the Hissar farm, at any rate, it appeared to have been in existence for many years. He had published records showing the number of cases of abortion which had occurred in the herd over a period of ten years and it seemed that the number of cases which occurred each year was relatively small. He was inclined to believe that contagious abortion assumed importance not on account of the spread of civilized methods of improving breeds of live-stock but on account of the aggregation of large numbers of cattle in certain localities.

Mr. Wilson stated that in the course of his experience with certain herds in the Central Provinces a few cases of abortion had occurred and these were strictly confined to half-bred cattle. No cases appeared to occur among indigenous cattle.

Mr. Hickey stated that in his experience no contagious abortion existed on the Government agricultural farms in the United Provinces.

Mr. MacGregor stated that investigations carried out at the slaughter houses in Calcutta and tests on jail cattle undertaken in order to determine the true prevalence of tuberculosis had revealed a much greater incidence than was generally suspected. Indeed, he encountered quite a number of cases of tuberculous mastitis. If systematic investigation were similarly performed with a view to ascertaining the prevalence of contagious abortion, it would most probably be found that the disease was fairly common. He asked Mr. Edwards, if it was not true that the disease tended to extinguish itself if it was allowed to run its course in the infected locality.

Colonel Pallin recounted the history of the outbreak in the Lucknow military dairy, which he presumed was the outbreak referred to by Mr. Edwards. On account of the abnormal number of abortions which had occurred in the dairy during the past year, the officer in charge had approached the Muktesar laboratory, and the animals were systematically tested. He gave figures showing the percentage of animals of various classes infected.

The following is a summary of results of the agglutination test for contagious abortion carried out on the animals belonging to the Government dairy farm, Lucknow, during October and November 1922 :—

	Positive	Negative	Doubtful	Total
Cows . . . . .	92	56	10	158
Buffaloes . . . . .	17	42	7	66
Bulls . . . . .	nil	3	2	5
Heifers . . . . .	1	nil	nil	1
Total . . . . .	110	101	19	230

i.e., 47.7 " positive " out of the whole herd.

On the result of this test he put up a recommendation to the D. V. S. in India that they should take steps to ascertain the extent

to which each Government dairy farm was infected and steps are now being taken to call for information regarding the incidence of contagious abortion in India, on the receipt of which the question of the vaccination of all Government dairy farm animals as a whole would be taken up.

The Chairman considered that contagious abortion now deserved more attention, as it appeared to be assuming considerable importance, judging from the evidence which had been presented.

Mr. Wilson stated that while he was at the Hissar Cattle farm, from May 1906 to January 1908, multiple cases of abortion occurred among pony mares and cows there.

Mr. Riley stated that to his knowledge no cases of contagious abortion had been discovered in Bihar and Orissa in cows or mares.

Mr. Harris also stated that no evidence of the disease had been obtained in Assam. During the last few months he had made careful inquiries through the veterinary personnel in regard to the possibility of its existence.

After further discussion the following resolution was unanimously passed :—

n II (d)

*That recent evidence shows that contagious abortion is an important disease of live-stock in certain parts of India, and further investigations should be prosecuted in regard to its origin, regional distribution, susceptibility of the various classes of live-stock to infection, and the institution of proper measures of control.*

**SUBJECT II (e).—TUBERCULOSIS. PREVALENCE OF TUBERCULOSIS AMONG LIVE-STOCK IN INDIA, AND THE DANGER OF INFECTION TO HUMAN BEINGS FROM THIS SOURCE.**

The Chairman said: "Tuberculosis was discussed at the last meeting and it was resolved that the need for investigation of the whole question of tuberculosis in India was urgent. The Government of India commended this resolution to the attention of Local Governments and administrations and stated they had under consideration the question of taking measures to prevent the introduction of bovine tuberculosis with imported cattle.

"I raised this question when Superintendent, Civil Veterinary Department, Bombay Presidency, as cases of imported tuberculosis in cattle had been brought to my notice. I do not know what final orders, if any, have been passed in this connection.

“ I have previously sat with Lieutenant-Colonel Hutchinson on a committee to discuss tuberculosis from the public health point of view. I know that he is an authority on the subject.

“ I will ask him to give us his views.”

Lieutenant-Colonel Hutchinson stated that what he particularly wanted to urge was the immense importance of undertaking further investigations with regard to the whole problem of tuberculosis in India. At the present time they were merely groping in the dark. The prevailing impression was that tuberculosis of cattle was a rare disease in India, but from the returns which had been derived from the village officers for many years, it could well be seen that it was an important disease in man. Human tuberculosis was related mainly with industrial development, and in certain old established centres of industry, such as Bombay, the mortality from tuberculosis was high. The high incidence in industrial centres, however, was gradually becoming reflected in rural areas and undoubtedly was connected with the migration of workers. In some rural areas it had now become a serious disease. The important point was to get reliable evidence with regard to the proportion of cases of human tuberculosis due to infection with tubercle bacilli of bovine origin. So far as one could gather it would appear that by far the greater proportion of cases of tuberculosis in adult human beings traceable to bovine origin was that which comprised tuberculous disease of the bones and joints, the so-called “ closed ” tuberculosis. The other forms of tuberculosis were regarded for convenience as cases of “ open ” tuberculosis. It appeared that the percentage of cases of the closed type was practically the same in India as in other countries. He had attended the International Conference on Tuberculosis in 1920 and compared the figures obtainable from India with those of the whole world. The figures obtainable were derived from the cases which came to hospital for treatment. About 18 per cent. of the cases fell into the “ closed ” type, and this figure was almost exactly the same as that representing the incidence of this type in any other country. The mortality figures of Bombay city indicated that only 10 per cent. were due to the closed type. In Calcutta the proportion was less, namely, 5.5 per cent. He referred to the recent work of Stanley Griffiths upon the strains responsible for the “ closed ” type of tuberculosis. Out of 132 cases of the “ closed ” type examined, 13.6 per cent. were due to the bovine strain. Of the persons under 16 years of age, 20 per cent. were due to the bovine strain. In persons over 16 years of age it was just over 6 per cent. In India, the work hitherto done had been somewhat sketchy, and the number of cases investigated very small; so far as he was aware the bovine type had not been isolated from

human lesions. He suggested that investigations should be carried out in India on two lines : (1) More should be done to ascertain the true prevalence of tuberculosis in cattle ; (2) Work should be done in regard to the differentiation of the types responsible for bone and joint tuberculosis in human beings. He considered that the first line of investigation suggested was of vast importance to the hygiene of man, for the " closed " form of tuberculosis was due in many cases to bacilli of the bovine type, and a very large proportion of cases of the tuberculosis of children was traceable to infection from the milk supply. He described the efforts of the Medical Research Committee at Home at the present time in this direction, and stated that they were now in the course of carrying out extensive investigations on the reliability of tuberculin tests. The information which would soon be available would be of very considerable value. As regards the milk supply, almost every province was now legislating or contemplating legislation on the ordinary lines dealing with the adulteration of food and the prevention of the sale of adulterated milk.

Mr. Edwards first related the action which had been taken recently by the Government of India and the maritime provinces in drafting regulations under the Live Stock Importation Act, 1898, for the prohibition of importation of cattle suffering from tuberculosis. The landing of cattle was now prohibited except at a few ports and all the maritime provinces had drafted regulations for prohibiting the importation of tuberculous cattle. From the available evidence it seemed that the incidence of tuberculosis among animals in India at the present time was low. Where examination of carcasses of cattle at slaughter houses had been undertaken the incidence was found to be about 3 per cent. He summarized the information which had been published in this respect. In quite recent years some careful experimental work had been done on a relatively small scale by Glen Liston and Soparkar in Bombay and by Sheather at Muktesar. It seemed from the results of the former workers that the susceptibility of Indian cattle to infection was rather low, whereas the Muktesar work appeared to indicate that the bovine strain of organism found in India was of a relatively low virulence. In most of the cases recorded, the lesions had assumed the form of localised, discrete tubercles, but in a case which had now been recorded by Mr. Sowerby in an indigenous ox from the Bombay Presidency the lesions seemed to be widely distributed throughout the body. It would, therefore, seem that cattle in India that became infected were quite liable to suffer from the disease in a serious form. However, he considered that a great deal of research work must be done as soon as possible to obtain more information upon these important points relative to the

susceptibility of indigenous cattle and the virulence of the prevalent strains. Although the disease was probably rare, it would perhaps be found on further investigation that, as had been revealed in the course of the discussion on anthrax, it was more prevalent than had been suspected if a more thorough search for the condition was made. Recently, he had approached the Director of the Indian Medical Research Fund Association with a view to obtaining the assistance of a colleague from his staff to collaborate in further work to be undertaken at Muktesar, and he understood that Dr. Soparkar was to be deputed for this work. As had been pointed out in the course of the discussion on contagious abortion, tuberculosis and contagious abortion were now the two most important infectious diseases of cattle in Western countries. It had been stated by a distinguished authority recently that there were probably not ten large herds of considerable size in England free from the disease, and it was said that the average incidence of tuberculous infection in Europe was probably from 20 to 30 per cent. in all cattle. This extraordinary high incidence of infection was undoubtedly connected with the economic development of the cattle industry. This development was correlated with the efforts made to improve the breeds of cattle for the special purposes for which they were destined, which entailed the introduction of individuals from other herds, improved facilities of transport, aggregation of large number of cattle in closed establishments, and the development of the dairy industry. With the economic development of the cattle industry in India, it was not unlikely that the same factors which had operated to cause the spread of tuberculosis in other civilized countries would obtain in this country also. Perhaps on account of climatic conditions there would not be the same danger of spread due to the adoption of systems of housing as there had been in cooler countries. Notwithstanding this, he believed that in places such as the Southern States of U. S. A. and in Argentina, the conditions were not far different from those in India and tuberculosis had become a serious menace to the rapid economic development of the cattle industry. If we were thus confronted eventually with a comparable danger, it was obvious that in the event of proof forthcoming that the incidence of infection at the present time was very low, the most serious precautions should be taken to prevent the disease from obtaining a foothold in the important herds in the country, so that the condition of affairs which existed at the present time in the important herds in Europe should not be allowed to establish itself in India. He would thus like to impress upon the meeting that they should recommend the prosecution of reasearch into the question of the prevalence and nature of tuberculous infection in cattle in India, with the utmost speed, and that endeavours should then be made to

establish measures of control based upon those findings. It was, however, likely that the Government military dairies would commence efforts in this direction immediately with the cattle under their control.

Colonel Pallin stated that as far as his experience went the incidence of tuberculosis in cattle in this country must be small, for, as far as he was aware, no case of tuberculosis had been reported among the cattle in the military dairies and the milk was sterilized before issue. The question of applying the tuberculin test to the cattle at the dairies had not yet been taken up, but he regarded it as a practical suggestion. Evidently, it would undoubtedly supply information of considerable value.

Mr. Hewlett stated that a case of typical tuberculosis in a country bred animal belonging to the military dairy farm at Jubbulpore had been brought recently to his notice by the D. D. V. S., Southern Command.

Mr. Smith stated that during 15 years' experience in the military dairy farms of which eight were spent as Controller of a Circle in which about 27,000 cattle were under his charge and which were maintained in an area extending from Quetta to Wellington, no case of tuberculosis had come to his knowledge in any animal that had died after attaining the age of one year. Post-mortem examinations on at least four out of every five of the cattle that had died were carried out by Members of the Royal College of Veterinary Surgeons and not one authenticated case of tuberculosis was discovered. At one dairy the disease was at one time suspected among the animals and two animals were sent to Muktesar alive for observation. The animals were found to be suffering from Johne's disease. One case was suspected at Quetta some time ago, but it was doubtful whether it was in reality tuberculosis. He admitted that in the districts the disease was sometimes discoverable, but he contended that the chances of spreading infection in this country were very small indeed, as by far the greater proportion of the cattle lived continuously under natural conditions, in the open air.

Mr. Krishna Murthi said that the first case of tuberculosis in cattle was detected by him at the Madras Veterinary College in the year 1916, and in the same year, when he was deputed to work in the Bombay Bacteriological Laboratory, he found that Colonel Glen Liston and Dr. Soparkar were engaged in investigating an outbreak in the Zoological Gardens, Bombay, and testing the susceptibility of Indian cattle. He added that the same subject came up again for discussion at the Medical Research Section of the Indian Science Congress last year. During his experience for the last seven years he had come across about twelve cases of tuberculosis

among bullocks belonging to the Corporation of Madras, and all these cases had been confirmed by him microscopically. Specimens were also sent by Mr. Aitchison to Colonel Glèn Liston who had made mention of it in the *Indian Journal of Medical Research*. He added that last October he had occasion to test a bullock by means of the tuberculin test; a positive reaction was obtained and the animal was destroyed. On post-mortem examination the lesions found confirmed the test. In the cases he had seen, the lesions were of the acute type (involving the pleura, lungs, bronchial and mediastinal glands, mesentric glands and intestines, and even kidneys). Though he was strongly of opinion that the nature of the lesions indicated that they were set up by the common bovine type of organism, yet he had no experimental proof to adduce in support of this contention. He had made inoculations, however, into guinea-pigs, and in one of these small animals he discovered generalized tuberculosis with involvement of the spleen, and demonstrated the lesions in a specimen that he brought with him to the meeting. He said that it was of the utmost importance that immediate steps should be taken to ascertain whether the cases of tuberculosis in cattle met within this country were of the bovine type as found elsewhere.

Mr. Smith further stated that while the Delhi Durbar was in progress he had under his charge 4,500 cattle for the provision of milk for the troops stationed there. About 250 of these cattle were selected at random to be tested by the tuberculin test, but no animal reacted.

Mr. Wilson stated that about the same period several hundred milch cattle were brought up to various places on the railway line for the supply of milk to the royal train. Twenty or thirty cattle were tested by the tuberculin test, with negative results. He considered that a source of great danger to the human population was represented by the cattle maintained singly or in very small numbers of about two or three by Indians of the well-to-do classes within their small compounds and kept shut up always in a small room. There was no means of inspecting these cattle.

Mr. Branford said that his experience corresponded very largely with that of Mr. Smith. About 4,000 cattle were maintained at Hissar and these lived almost entirely out of doors except that at times they were brought in to be given additional food in partly covered yards during the colder weather. All these animals were country-bred animals. Post-mortem examinations were always made. During his twelve years' experience at the farm he had detected only three cases of tuberculosis. Previously, while Colonel Farmer was in charge of the farm, several cases of tuberculosis were detected



and Colonel Farmer claimed credit for eradicating the disease from the farm.

Mr. MacGregor said that he had obtained sufficient evidence in Bengal to make him feel sure that the question of prevalence should be investigated. Out of 48 jail cattle tested by Colonel Raymond, 10 reacted. Four or five were suspicious on the first test and eventually they reacted on retest.

Mr. Farbrother said that three cases of tuberculosis were reported in the Bombay Presidency last year. One of these occurred in a buffalo herd.

The Chairman stated that while he was in the Bombay Presidency a strongly worded circular had been issued asking those concerned to pay particular attention to the investigation of the possibility of the occurrence of tuberculous lesions in cattle.

Mr. Hickey stated that in the United Provinces investigations had been carried out in two centres, namely, at the slaughter houses at Cawnpore and at Allahabad, and about 3 per cent. of the animals admitted for slaughter were found affected with tuberculosis. Recently, a horse which was suspected to be suffering from surra died and was proved to be affected with tuberculosis. The cattle found to be affected in the slaughter houses were mostly old animals and the lesions discovered were small.

Mr. Ware said that he would like to know if it would be of use to carry out investigations on the prevalence of the disease by testing cattle by means of tuberculin. During the last two months he had tested 60 cattle, and four were reported positive, but the disease had not yet been confirmed by post-mortem examination.

Mr. Fletcher asked Lieutenant-Colonel Hutchinson if it had come to his knowledge that recently it had been suggested that cattle should be used as traps to attract mosquitoes away from human beings and that for this purpose they should be kept in human dwellings. He wondered what effect this would have upon the problem.

Lieutenant-Colonel Hutchinson replied that it was beyond doubt that mosquitoes did prefer cattle, but it was about as unlikely that cattle would have any more effect in diminishing the number of cases of malaria than the keeping of cats would have upon the incidence of plague. In certain districts cattle had proved a factor in the spread of malaria by bringing in with them, on their return from their work from the vicinity of irrigation canals, a number of mosquitoes to human dwellings.

Mr. Hewlett stated that he had experienced considerable difficulty in applying the tuberculin test on account of the enormous fluctua-

tions that took place normally in the temperatures of cattle during the hot weather.

Mr. Edwards explained that it was now considered advisable to control the results obtained by the subcutaneous test by performing simultaneously the so-called ocular or ophthalmic, and the intracutaneous or intradermic, tests. He explained to the meeting the methods of performing these tests. The intracutaneous test, which simply involved the injection of a small quantity of concentrated tuberculin into one of the anal, or caudal, folds of skin and observing the occurrence of a sustained thickening in the injected fold, was now considered to be very reliable confirmatory method of testing.

The Chairman stated that he had had experience in testing cattle by means of the subcutaneous test at Lahore, but he had failed to obtain reliable results on account of the uncertain temperatures. He considered that the anal test carried out concurrently would be an ideal form of testing.

Mr. Cameron confirmed the views of Colonel Walker with regard to the unreliability of the subcutaneous test from his experience in Burma. According to the present arrangements all cattle imported had to be segregated for a month and tested. He hoped that the tail test would enable him to obtain more reliable information.

Mr. Wilson asked if in these cases where the subcutaneous test had been unreliable, on account of temperature fluctuations, blood examination had been made beforehand as it was his impression that these great fluctuations might be caused by blood infection.

The Chairman stated that he had made examinations and no blood parasites were found.

Mr. Cameron said that no such examinations were made in the cases he had in mind.

Mr. Edwards said that the Muktesar laboratory could readily supply concentrated tuberculin for the anal test on request, and that the cost of the material used for each injection would be small.

After further discussion the meeting appointed a small committee consisting of Colonel Pallin, Lieutenant-Colonel Hutchinson, Messrs. Branford and Smith, with Mr. Edwards as Secretary, to draft a resolution embodying the views of the meeting. The meeting subsequently unanimously endorsed the following resolution drafted by the committee :—

*The evidence available shows that tuberculosis is present in cattle in India but is insufficient to indicate to what extent it prevails.* Resoluti

*In view of the experience gained in other countries with regard to the spread of infection in susceptible animals, it is clearly indicated that steps should be taken to ascertain accurately the prevalence of infection.*

*Research into the nature of the organisms responsible for the disease and the relative susceptibility of the different breeds of cattle in the country should be prosecuted forthwith. If this research should indicate that tuberculosis is at present rare among Indian cattle measures should be taken to eradicate it and to limit as far as practicable the introduction of the disease from outside sources.*

*The Conference is of opinion that these measures are urgently demanded by reason of the grave dangers to the live-stock of the country, the purity of the milk supply, and the catastrophes of bovine tuberculosis in children.*

**SUBJECT II (f).—PARASITOLOGY (HELMINTHOLOGY AND ENTOMOLOGY); THE NECESSITY FOR INSTITUTING A SURVEY OF THE INCIDENCE OF THE GROSSER PARASITES OF LIVE-STOCK IN INDIA AND FOR THE FORMATION OF CENTRAL DEPARTMENTS TO CONTROL WORK IN THIS CONNECTION.**

The Chairman said: "We all recognize, I think, the importance of further studies in parasitology and the subject is a very wide one. At the last meeting a resolution was passed on the subject which I will read to you. It runs as follows:—'That the meeting is in favour of the creation of a separate organization for the study of the insect parasites of men and animals, the connection with the Civil Veterinary Department being on the line suggested by Mr. Howlett in his notes.'

It is understood that the matter is still under the consideration of the Government of India. We are very pleased to welcome Mr. Bainbrigge Fletcher, the Imperial Entomologist, amongst us, and I will invite him to tell us if he has any information to give regarding the formation of a central organization. At the Punjab Veterinary College a separate chair has been established for parasitology and an Indian professor has been recently deputed to England for further study in the subject. He is first going to the Molteno Institute at Cambridge to study under Professor Nuttall. I found it very difficult to determine where to send him as special courses in veterinary parasitology are almost non-existent at present."

Mr. Ware, who had circulated his views in a note, stated that he was particularly interested in the condition of affairs with regard

to helminthology in India. A large number of species of worms had not yet been described. There was no standard work on the Indian worm parasites and the same thing might be said with regard to ecto-parasites.

Mr. Fletcher, Imperial Entomologist, explained what he was trying to do for veterinary workers. He was at present engaged in writing a text-book that would give information upon the important insects concerned with animal disease, and he exhibited a number of coloured plates depicting these insects. He would be glad if the meeting would indicate to him in what way he could render still more assistance. He was interested in the creation of a Central Entomological Research Institute in which workers would be engaged in all branches of entomology. It would be a great pity to split up the present entomological staff under his charge. He was prepared to send out members of his staff who were specially trained in the various branches of entomology to the assistance of veterinary investigators to elucidate problems connected with insect transmission of disease or for undertaking surveys of the insect population. Strictly speaking, ticks and mites did not come under the heading of entomology and he was not taking up their study at present. However, it had been put forward that the Zoological Survey of India should be reorganized so as to include a staff of special workers engaged in the study of the branch of zoology to which these animals belonged. It was quite possible to constitute a branch of this kind to work in association with the entomological staff. They had a large amount of material representing insect and other transmitters of disease at Pusa, and the collection required examination and identification. He stated that the scheme for the creation of an institute to deal solely with so-called veterinary entomology had been dropped, presumably on account of financial stringency. He thought that it was much better, however, to gather together in a central institute workers engaged in all branches of entomology, rather than have a separate institute for pathological entomology, on account of the economy that would be effected, both in obtaining and maintaining collections, records and literature on the subject and in co-ordinating the labours of the workers.

Mr. Edwards represented that in the present state of our knowledge, the subject which had been taught at the veterinary schools under the name of parasitology might be taken to cover an extremely wide range of subjects. In its exact meaning the word parasitology, that is, the study of parasites and parasitism, was almost synonymous with pathology, and took within its scope the nature of all kinds of parasitic forms, from the largest to the most minute

and their effects upon the hosts. The term, however, in the minds of most people generally implied the study of the larger forms of animal organisms which were parasitic upon man and other animals, and the study of these larger forms came within the range, particularly, of helminthology and entomology, with arachnology. These sciences had now advanced to such a degree that it was not possible to attain competence in either, unless the worker devoted himself seriously to research during the whole of his time in one only, and as Mr. Fletcher would admit, in the subject of entomology, the whole field represented by it could not be understood to such a degree that reliance could be placed upon the opinion of any one worker in even more than one or a few branches of the subject, for the different classes of insects needed special and prolonged study. Likewise, it was too much to expect a man who might have been trained so as to become a tolerably efficient veterinary scientist to assimilate without fail the details of systematic knowledge and technical methods involved in either of these two subjects. In fact, the helminthologist and the entomologist required a natural aptitude and a life training in either class of work. He did not hold much hope, therefore, of obtaining proficient workers in these branches of sciences, by deputing Indian veterinary graduates to attend short courses of study abroad, where these subjects were systematically taught in teaching classes. For the urgent needs in helminthological research in connection with the important diseases of the domesticated animals in this country, it would be best to obtain the services of at least one fully trained, experienced helminthologist for the work; entomological problems should be referred to the Imperial Entomologist, who had consented to depute a worker or workers specially versed in the branch of the subject in view, to assist veterinary investigators during the course of their researches into animal diseases in which insect problems entered.

The Chairman stated that he was not dealing with the research aspect when he referred to the training of a so-called parasitologist for his staff. The man so trained would be required merely for teaching the students going through a course of veterinary study at the college. He was looking at the matter from the teacher's point of view. If the individual appointed would specialize in one branch so much the better. For special studies, he agreed that the best policy was to create central organizations for the purpose.

The committee, already appointed to deal with the subject of trypanosomiasis, was asked to draw a resolution embodying the views of the meeting.

The following resolutions were submitted by it, and were passed unanimously :—

(1) *Entomology.* On account of the great importance of insects **Resolution** in the transmission of animal diseases, as causes of direct injury to live-stock in India, and the high degree of specialization necessary for a proper appreciation of the various aspects of entomology, the staff of the Imperial Entomologist should be strengthened to the degree requisite for rendering assistance to investigators into the insect problems connected with animal diseases.

Similarly, facilities should be rendered for the establishment of a staff attached either to the Imperial Entomologist or to the Zoological Survey of India for the study of ticks and mites concerned with animal diseases.

(2) *Helminthology.* In view of the enormous economic loss caused by, and our present inadequate knowledge concerning the prevalence and the nature of the species of, parasitic worms present in animals in this country, the appointment of a whole-time helminthologist to investigate the subject from the standpoint of animal disease is urgently required in the interest of owners of live-stock in India. This officer should work under the directions of the Imperial Bacteriological (Veterinary) Laboratory.

**SUBJECT II(g).—INFECTIOUS LYMPHANGITIS IN CATTLE : CAUSATION AND TREATMENT.**

On the invitation of the Chairman, Mr. Krishna Murthi read an abstract of a lengthy paper he had prepared describing his investigations upon this important disease in cattle in Southern India. The paper was illustrated by numerous charts and diagrams very carefully prepared by the author and suspended on the walls of the conference hall. He also exhibited preserved lesions and cultures of the causal organisms. Mr. Krishna Murthi said that when he was deputed to attend the conference, Mr. Aitchison (Principal, Veterinary College, Madras) proposed that the two diseases known as infectious lymphangitis in cattle and nasal granuloma in cattle might be included in the subjects for discussion, and that a paper on each of them, recording his observations, might be read and discussed at the conference. He added that Mr. Aitchison selected these two subjects, because, though they were very prevalent in this country, causing endless trouble to cattle owners, yet there was no literature until now concerning the etiology of one, and the literature available regarding the other was controversial. He first

introduced the subject of infectious lymphangitis in cattle (an abstract of his paper is printed in Appendix II). He said that in the outbreak he had dealt with, he noticed the same symptoms and lesions as were observed by previous workers, and in the course of his argument regarding the mode of infection by the causative agent, he pointed out by means of charts and diagrams that the various superficial abscesses of the body were mainly in correlation with the extent of the superficial area of the skin drained by the various lymphatic glands of the body. He added that in his attempt at the elimination of the various possibilities of modes of infection, the only possible conclusion he could arrive at was that the infection must be due to some suctorial insect, especially cattle lice, although he had not actually proved this contention at the time. He quoted here, as an analogy, the belief held by medical experts before and after the work of India Plague Commission regarding the mode of infection in plague. He then referred to the character of the organism and the lesions, specimens of which he demonstrated. He also added that in the treatment of the complicated cases a vaccine was prepared and used by him, which in his opinion was found effective.

The Chairman pointed out that in the short time available for the meeting, it was much to be regretted that it was not possible to attempt a discussion on the technical aspects of Mr. Murthi's paper. The paper should be published *in extenso* in a professional journal so that the members might be able to estimate the thorny parts adduced by the author.

On the motion of Mr. Hewlett, seconded by Mr. Cameron, a hearty vote of thanks was accorded to the author for his paper, and the following resolution was passed unanimously :—

on II (g)

*That Mr. Krishna Murthi's original paper on "Infectious Lymphangitis amongst Cattle in the Madras Presidency" be published in extenso in a professional periodical."*

#### SUBJECT II(h).— NASAL GRANULOMA IN CATTLE : CAUSATION.

On the invitation of the Chairman, Mr. Krishna Murthi read an abstract of a more lengthy paper he had prepared upon this interesting condition of cattle. Structures which apparently represented the causal organisms were exhibited in the form of histological preparations under the microscope and by numerous coloured plates and some photographs. ¶

In introducing the subject of nasal granuloma in cattle (an abstract of which is printed in Appendix III), Mr. Krishna

Murthi said that it was unnecessary for him to describe in detail the lesions of the disease, because he found on his arrival at Calcutta that the disease existed in other parts of India also, causing trouble to cattle owners and was widely known. He added that the cause of the disease was in his opinion a streptothrix, which possessed acid and alcohol fast staining characters. He claimed to demonstrate the presence of streptothrix organisms very close to the papillae of the skin, from which he inferred that the infection must be through wounds caused by the misuse of the nose string or by contact of any other abrasion with infected food or water. In discussing prophylactic measures he deprecated the common method of feeding and watering animals which is at present adopted in the Madras Presidency.

Mr. Edwards said he had examined with great interest the preparations exhibited by Mr. Krishna Murthi and more particularly as he had obtained evidence of the widespread existence of this condition in India from the specimens sent to him for examination at the Muktesar laboratory from Assam, Bihar and Orissa, and the Bombay Presidency. The results of the examinations at Muktesar had been presented to the meeting in a note by Mr. Hugh Cooper, Pathologist on the Muktesar staff. In the preparations examined at Muktesar the clusters of club-shaped structures simulating those seen in actinomycosis lesions were clearly observed and he had at the meeting a number of paintings and photographs taken to show these structures. Hitherto, however, they had failed to demonstrate the causal organisms. He had examined Mr. Krishna Murthi's specimens carefully in order to find out if there was any real evidence of the presence of a streptothrix, as he had mentioned in his communication. Apparently, the author believed that granule and club formation was invariably associated with the presence of streptothrix organisms. He reminded him, however, that even the so-called actinomycosis of cattle in other countries, particularly in Argentina, and also, it was now known, in a very large degree in Europe, was caused not by streptothrix but by a small bacillus, namely the so-called actino-bacillus of Lignieres and Schutz. It had also been stated that club formation could be set up by other organisms. In the preparations submitted by Mr. Krishna Murthi he could see no evidence whatsoever of the presence of streptothrix filaments and apparently the author had not been able to demonstrate these organisms by cultural examination. However, it was to Mr. Krishna Murthi that the credit belonged for having discovered the granule formations in this interesting and apparently widespread disease condition of Indian cattle.



A hearty vote of thanks was accorded to the author by the meeting for his interesting paper and it was resolved :—

on II (b) *That Mr. Krishna Murthi's original paper on " Nasal Granuloma in Cattle occurring in the Madras Presidency " be published in extenso in a professional periodical.*

**SUBJECT II (c).—RABIES : MEASURES OF CONTROL.**

The Chairman said:—" I will read out the resolutions passed unanimously at the last meeting and the subsequent orders of the Government of India : ' That it is considered that any suitable measure that can be adopted for reducing and destroying the surplus population of dogs is desirable, but it does not appear to be possible under the conditions prevailing in India to deal more efficiently with the disease. Power should be given to veterinary practitioners to order the detention and destruction of dogs suffering from rabies.' The orders of the Government of India are as follows :—

' So far as the Government of India are aware the only legal powers at present existing to deal with dogs suffering or reasonably suspected to be suffering from rabies and with stray dogs, which are a potential source of danger to the community, are those conferred by section 68 of the Cantonment Code of 1912 and by corresponding provisions in the Municipal Acts. These provisions empower the cantonment authority or the municipality, as the case may be, to authorize any person to detain or destroy such dogs. It is understood that, the persons so authorized are, in the cases of municipalities, officers of the Civil Veterinary Department, and the Government of India are of opinion that, as suggested in Resolution XIV, veterinary officers are the most suitable agency for the purpose. I am accordingly to suggest that local bodies should be advised, where this has not already been done, to give officers of that department the necessary powers. The question of taking power to destroy rabid or stray dogs in rural areas presents a more difficult problem, and so far as the Government of India are aware, no such legal powers exist at present, although certain Local Self-Government Acts permit the offer of rewards for the destruction of noxious animals. The Government of India doubt

whether it is practicable to go further than this in rural areas, but they commend the matter to the notice of the Local Government.'"

A note had been circulated among the members of the conference beforehand forthcoming from Mr. Aitchison on the subject of prophylactic vaccination of dogs against rabies.

As Mr. Aitchison was not present, his colleague, Mr. Krishna Murthi explained to the meeting the results of the further work intimated in the note.

Mr. Krishna Murthi reviewed the results of prophylactic inoculation against rabies in dogs carried out in Japan and America and said that experiments on similar lines were being conducted by Mr. Aitchison and himself at the Madras Veterinary College. They were, however, very sorry that they could not make the results of the first series of experiments available to the members of the conference as there was a delay in getting the prophylactic vaccine from Colonel Cornwall, who was unavoidably absent at Lucknow for the Indian Science Congress. He raised the question as to whether any legislation could not be passed regarding immunization of dogs against rabies if the results of experimental inoculations conducted at the Madras Veterinary College proved successful.

The Chairman enquired whether Mr. Krishna Murthi thought that even then rabies could be stamped out..

Mr. Krishna Murthi said that he was fully aware that it would be impossible to eradicate rabies altogether, but that its incidence might be greatly diminished.

Mr. Edwards said that the results of the experimental inoculations carried out by Messrs Aitchison and Krishna Murthi should be very carefully considered before any measures could be suggested to Government to deal with the disease in the manner indicated, and should therefore be examined as soon as they were available by a competent technical authority if the authors should come to the conclusion that the method evolved by them was capable of widespread practical application. Tests upon the efficacy of certain forms of vaccine were at the time being conducted in France. He thought that the matter should thus be referred for consideration to the body constituted as the Central Standing Advisory Committee on Epizootic Diseases and Research, the formation of which he was going to propose to the meeting in drafting resolutions after the discussion on Subject III (f) (*Methods to be adopted to correlate technical information and render authoritative advice on professional problems*).

The meeting then resolved unanimously—

on II (i)

*That any proposed measures of control based on prophylactic vaccination should be referred to the Central Standing Advisory Committee on Epizootic Diseases and Research.*

SUBJECT II (j).—DISEASES OF SHEEP ; NATURE, INCIDENCE, AND CONTROL OF THE MORE IMPORTANT DISEASE CONDITIONS AMONG SHEEP IN INDIA.

This subject was inserted in the agenda at the instigation of Mr. Branford, Superintendent of the Government Cattle Farm, Hissar, who had also dealt with it comprehensively in a note circulated to the meeting.

Mr. Edwards stated that from Mr. Branford's remarks the common diseases of sheep which ravaged flocks elsewhere in the World, notably those due to the grosser parasites, also appeared to be frequent in India and caused serious economic loss. The diseases were for the most part in the nature of diseases to be controlled by preventive methods, or combined curative and preventive methods, and were such that an ordinary veterinary practitioner was seldom called upon to treat. The practical suggestions put forward by Mr. Branford were contained apparently in the first and last paragraphs of his note. It was certain that greater attention ought to be paid to the diseases of sheep, but the main question of importance seemed to him to reside in what was the best method of approaching the patient, whether by increasing and very effectively training the veterinary personnel to deal with these conditions direct or by propaganda work among sheep owners themselves. If the sheep population in the country were considerable and the disease conditions frequent, then it might very likely transpire that even many more than at present comprised the entire veterinary services would be found necessary to treat the diseases of sheep alone. There was now available a great deal of published information with regard to the methods adopted for the treatment of such conditions as wire-worm disease in sheep resulting from systematic investigation carried out in the Union of South Africa (Veterinary Research Laboratory) and the United States of America (Bureau of Animal Industry) where this affection loomed largely as a deterrent to the sheep-breeding industry. It would seem that the methods of eradication of such an infection recommended entailed the distribution of certain remedies among sheep owners together with literature couched in very simple language indicating the methods whereby they should be applied.

The Chairman stated that at the present time veterinary students were not taught the methods of diagnosing and treating sheep diseases to any important degree in the Indian colleges. He was not certain as to what extent it would be safe to distribute medicine direct to the owners.

Mr. MacGregor did not think that sheep diseases hitherto had been considered to have a sufficiently high relative importance to have special instruction imparted upon them at the colleges.

Mr. Wilson maintained that in view of the gross ignorance of sheep owners in general the distribution of printed instructions among them would not prove of any use in dealing with sheep diseases.

Mr. Edwards then showed in what form propaganda steps might be undertaken; for example, in South Africa wire-worm remedy was distributed in powder form from the Veterinary Research Laboratory and instructions with regard to dosage took the form of simple notches on the handles of the spoons issued for measuring the single doses necessary for sheep of the various ages. He contended that a sound elementary teaching of students at the veterinary colleges in comparative pathology (including, particularly, parasitology) would necessarily imply instruction in the diseases of the sheep, for there was nothing very particular about the special pathology of this animal, except that certain classes of disease, notably those due to the grosser, worm, parasites, were relatively more frequent and assumed greater importance in it.

Mr. Branford thought that the education of owners might be left out of consideration in the present backward condition of India as an important factor in controlling sheep diseases.

Mr. Krishna Murthi stated that at the Madras Veterinary College the students were taught to identify the gross parasites of sheep, for example, but no special instruction was set apart for sheep disease.

Mr. Wilson thought that useful information concerning the parasites of sheep in India might be collected at slaughter houses.

Mr. Branford stated that he would like to know the views of members regarding the prevalence of rinderpest among sheep, for he remembered great mortality some years ago from this disease in sheep at Mirzapur in the United Provinces.

Mr. Wilson stated that he had not observed rinderpest in sheep during his eight years' experience in the United Provinces.

Mr. Hewlett, likewise, had seen no rinderpest in sheep in Bombay.

Mr. Branford also raised the question as to the prevalence of anthrax in sheep.

It was decided to relegate the discussion of this point to that of Subject IIa (Anthrax).

The meeting subsequently unanimously resolved :—

cn II (i)

*That on account of the economic importance of sheep diseases in India, further steps should be taken to render assistance to sheep owners by means of propaganda and by the better education of the veterinary personnel in the peculiar problems connected with the main classes of diseases affecting sheep.*

### PART III—GENERAL.

#### SUBJECT III (a).—LEGISLATION. THE DESIRABILITY OF INTRODUCING FURTHER LEGISLATIVE MEASURES FOR THE CONTROL OF ANIMAL DISEASES.

The Chairman said : “ The question of the desirability of introducing further legislation was discussed at the last meeting and I will read out the resolution that was passed — ‘ That in the opinion of this meeting some form of legislation is necessary to deal with cattle diseases, especially as regards segregation and the movements of cattle, and that such legislation should be introduced, when possible.’ ”

“ The Government of India doubted whether with the existing staff any practical advantage would be gained by further enhancing the legal powers of enforcing preventive and curative measures against cattle-diseases and there the matter rests.

“ We all agree that more legal powers are required and we have to admit that unless our professional endeavours can be supplemented by legal authority we are frequently in an unsatisfactory position. There are many serious difficulties in the way at present, but the question is open for discussion. Mr. Edwards has brought up the matter again and I will ask him to speak.”

Mr. Edwards explained that in advising the Government of India upon legislation to deal with the problem of anthrax control he had suggested that the time was probably opportune for the enactment of a Diseases of Animals Act on the general lines of the Glanders and Farcy Act and analogous in its application to the Diseases of Animals Act, 1878 and 1894, in operation in Great Britain for the control of contagious animal disease. By means of a general measure of this kind, the various prevalent epizootic, or infectious, animal disease which the Central Government considered from time to time should be brought under legislative control, could be declared scheduled diseases and Local Governments would then be empowered to frame orders, rules, or regulations for undertaking sanitary police measures in connection with these diseases, in the same way as the Ministry of Agriculture at the present time controlled scheduled diseases in Great Britain by means of Orders. At the present time the legislative machinery for empowering Government to deal with disease in animals was very slow in action as was shown in the case

of tuberculosis, for example, in regard to which it had taken about four years for Local Governments to draft rules for the prohibition of importation of tuberculous cattle. A concrete example of an important disease which would undoubtedly be scheduled under an act of this kind was anthrax, which he had discussed at length when that subject was before the conference. It would be a great advantage to the veterinary services and the administrative authorities to have all central legislation concerning animal diseases amalgamated in a single comprehensive measure.

Mr. Hewlett agreed with the last speaker, for although with the machinery available for carrying out sanitary police measures it would be impossible to achieve very much at present, yet a beginning must be made. He had pointed out in connection with rinderpest control that owing to the lack of means of enforcing any method of control at the present time no headway could be made. He insisted that the act should be permissive and the rules provincial.

Mr. Edwards pointed out that it was most important that such rules should be carefully framed by members of the profession who were well versed in the special problems of epizootiology and sanitary police. It might well happen that if Local Governments were left alone to draft regulations, they might be advised by a recently recruited officer who did not have much experience in this class of work and who was not aware of the technicalities of the relevant problem. He therefore impressed upon the conference that any regulations drafted should be carefully considered by a small committee of members who were best acquainted with these problems, so that the policy might be as far as possible uniform throughout the country; likewise, the hands of individual members representing the department in the provinces would be strengthened in rendering advice to their Governments if this advice had the support of an authoritative body that represented the several provinces and had taken pains to collect the best technical information available on the problem at issue.

In the course of a discussion with Mr. Hewlett, the Chairman pointed out that the control of epizootic diseases could not be regarded as a political question, for it was an imminent one in every part of the country and respected no political barriers.

Mr. Ware pointed out that in Madras this form of legislation seemed to have been adopted many years ago, in the form of the Madras Cattle Diseases Act, 1866, and he could not see why a similar act had not been introduced elsewhere. Under this act it was made compulsory on the owner to notify any contagious disease among cattle.

After some further discussion it was unanimously resolved :—

*That this Conference considers that the time has arrived when a Resolution Diseases of Animals Act should be introduced to give permissive powers to Local Governments to frame rules for the enforcement of sanitary police measures for the control of contagious disease in animals.*

SUBJECT III (b).—STATISTICAL. METHODS OF OBTAINING AND RECORDING STATISTICAL INFORMATION REGARDING THE INCIDENCE OF EPIZOOTIC DISEASE IN INDIA ; SUGGESTIONS FOR IMPROVEMENT.

The Chairman said : “ I suggested the subject now before us myself as I have felt for many years that something should be done to effect an improvement in the present position.

“ Accurate statistical information is of the greatest importance to scientific workers and it is also of great use to administrators. International questions are frequently involved.

“ In India the position cannot by any stretch of the imagination be regarded as satisfactory.

“ In perusing the mortality figures in our annual reports I feel that inaccuracy is rampant, but we are in the hands of our informants entirely.

“ The systems of collecting statistical information vary in the different provinces. I shall be interested if any representative regards his local system as satisfactory. Statistics relating to diseases should be checked by professional men if possible, but our numbers are too few. Efforts have been made in several provinces to instruct revenue or police officials, as the case may be, in rough and ready methods of diagnosis, but I doubt if they have had much effect. In the Punjab Veterinary Assistants have to assist *patwaris* in diagnosing diseases.

“ There is no doubt that many animals die of disease that are not reported and unless a disease assumes enzootic proportions what else is to be expected ? ”

Mr. Cameron stated that he was not satisfied with the present state of affairs. He described the system in vogue in Burma. Each village headman kept a cattle deaths register and each death was recorded in this register, upon a foil and two counterfoils. This contained the name of the owner, kind of animal, age, value and cause of death as far as this could be diagnosed. Particulars of each record were collected by the police patrols from the register and a



counterfoil was sent to the Sub-divisional Officer. The Veterinary Assistants in Burma were all touring officers and when they got to a village they inspected the registers, checked the results and signed their name on the last counterfoil. From time to time the inspecting veterinary officer checked the signatures and glanced through the alleged causes of death and ascertained the date of the last death. On the whole this system worked fairly well, but much depended on the village headmen who sometimes were guilty of neglecting their work. For example, in one village no animal was reported as having died for five years. In some districts lectures were given by the veterinary officers in the course of their tours to village headmen and others so as to give them some idea of the methods of notifying cattle deaths. Small text-books were also issued through the Deputy Commissioner for the use of those who were interested, and recently in some districts, as above mentioned, a system of examining men after the course of lectures in regard to their proficiency in this respect had been adopted and prizes amounting sometimes to Rs. 50 were awarded to those who got the highest marks. As a result of these endeavours it had been found that the standard of the entries recorded had very much improved. In Upper Burma, on the other hand, this system of cattle death registration had not been adopted and the number of deaths was estimated roughly by the district authority. The use of the cattle deaths register had been recommended for adoption in Upper Burma.

Mr. Hickey said that the system of recording in the United Provinces was very bad. The recording agency was the Revenue Department and the deaths were reported to the authorities by the *patwaris*.

Mr. Wilson stated that in the Central Provinces information regarding animal deaths was obtained from the police in some districts, and from the Revenue Department in other districts.

Mr. MacGregor stated that this was the system in vogue in Bengal. It frequently happened that the officials were much too busy with their other work to pay the necessary attention to the reporting of animal disease. He suggested that the work might be entrusted entirely to the revenue officials.

Mr. Farbrother stated that in the Bombay Presidency deaths were reported by the Revenue officials through the village *patel*.

Khan Saheb Sheikh Naiz Mohammed stated that the first essential was to educate the cultivators so that they could be induced to report mortality to the revenue officials. At present there was no proper system of obtaining information in his province (U. P.) from the revenue officers. The returns collected were of no benefit to the Civil Veterinary Department. He suggested that the Police

Department might be put in general charge of this class of work and that they should instruct the village *chowkidar* to insist upon the reporting of deaths. He recommended the same system of reporting as was adopted in connection with human disease. He considered that the police authorities were better fitted for this work than the revenue authorities.

Mr. Cameron stated that in Burma statistics with regard to deaths were collected and eventually passed through the Revenue Department, but in the case of rinderpest, the Sub-divisional Officer telegraphed the occurrence of an outbreak to the veterinary authorities.

Mr. Riley stated that in Bihar a system of reporting similar to that described as obtaining in Lower Burma was in vogue. Deaths were reported to the village *chowkidar* who then reported them to the Sub-divisional Officer, and this officer sent one copy of the report to the police and one to the touring Veterinary Assistant.

Mr. Ware stated that in Madras the notification of deaths was done through the revenue officials, who sent one copy of the report to the *Tahsildar* and one copy to the touring Veterinary assistant. There was difficulty in obtaining reliable information from some villages and in cases of delinquency the village headman had to be suspended or fined. In other villages fairly reliable figures were given.

Mr. Wilson stated that in the Central Provinces the village *patwaris* suffered in the event of delinquencies of this kind.

In Bihar, Mr. Riley stated, the *chowkidar* was in some cases negligent.

Mr. MacGregor stated that in Bengal the police *chowkidars* had so much to do that the authorities were not prepared to punish them for their neglect in this direction. It had been well recognized that an unsatisfactory situation did exist and it was thought at one time that it would be a good plan to sanction rewards for the satisfactory reporting of diseases. A simple method of reporting by distributing differently coloured postcards representing different forms of diseases for return to headquarters had at one time been thought of, but officials appeared to be very lax generally in all matters concerning deaths in animals.

Mr. Ware considered that in those provinces where the reporting authority was not mentioned, it was important to try to lay down as soon as possible who was responsible.

Mr. Quirke stated that in the Punjab the reporting of deaths was done through the *patwaris*. They had tried the system of reward, but this method proved quite ineffectual and was liable to

abuse. Many attempts to improve the system were made by circularising the District Boards asking them to offer suggestions as to methods of improving the reporting of deaths, but in the Punjab no result was obtained, so that at the present time nothing better than the village *patwari* was obtainable for the work.

Mr. Harris stated that in Assam a similar system was in vogue. Deaths were reported to the village headman and he passed the information through the police to the Sub-divisional officers and to the Veterinary Assistant. The reports were checked from time to time by the Veterinary Superintendent. However, there was no system of checking the headman, and pressure should be applied to that individual.

Mr. Wilson stated that the statistics available could not be regarded as affording any reliable evidence with regard to mortality. In his experience he found that animal owners were often unscrupulous about the notification of diseases. He had even found that they would report the occurrence of an attack of foot-and-mouth disease in twenty animals in order to attract the Veterinary Assistants into the locality for the treatment of an animal belonging to a particular owner.

The Chairman discussed the question of rewards for the notification of disease and he doubted the advantage of such methods. The Government of India produced a statistical table showing the incidence of disease in the various provinces, but he did not consider that these statistics had much value. It appeared from the discussion that the system of reporting differed greatly in the several provinces. Every annual report contained a paragraph dealing with this perplexity. He considered that this matter should be referred to a central authority in order to have a uniform system throughout the country. The publication of reliable statistics was a matter of vital importance to the Government, to the Veterinary Service, and to foreign countries who accepted these figures as indicating the incidence of animal disease in the country. In all civilized countries the publication of reliable statistical information was regarded as an important economic concern, and therefore if India considered herself a civilized country it was incumbent upon her to take steps to improve matters in this direction.

Mr. Quirke considered that the conference ought to make some suggestions in this matter.

Mr. Hewlett, however, thought that as the control of animal diseases was now a "transferred subject" under the Reforms, this subject should be left to the Provincial Governments who should be asked to improve their methods.

The Chairman contended, however, that as the statistics published by the Government of India referred to disease throughout the whole country it was essential to have some uniform system.

Mr. Edwards maintained that it was particularly for investigating fundamental questions in veterinary administration of this kind that he was proposing a "permanent standing committee on veterinary administration" under *subject III (f) (Methods to be adopted to correlate technical information and render authoritative advice on professional problems)*. Matters of this kind, of far-reaching importance to the administration of the department, could not be hurriedly dealt with at the conference, and for the reasons stated by the Chairman he considered that uniformity in the drafting of improved schemes was essential. The subject of statistical inquiry was a most complex and difficult one at the present time and required expert advice; he recommended therefore to the meeting that the problem involved should be the subject of careful deliberation by the "Central Standing Advisory Committee on Administration" if the meeting approved of the creation of this body.

Mr. Wilson thought that improvement in the system might have to take the form of propaganda work to be undertaken by Local Governments.

Mr. Ware referred to the financial difficulties that might result from attempts to improve the system, for a slight rise in the pay of the village officials in Madras recently amounting to Rs. 4 a month had resulted in the addition of four crores of rupees to the Government budget during the year.

Mr. Harris stated that in Assam the difficulty was an enormous one for the village headmen were not paid for the work, and hence no penalty could be inflicted.

Khan Saheb Sheikh Naiz Mohammed thought that the police should take the work up as part of their duties and should be supplied with a suitable small text-book together with the necessary information connected with it. He found that the *patwaris* were quite indifferent with regard to the notification of the disease. The *chowkidar* would presumably care more and get better information.

The meeting unanimously passed the following resolution :—

*In view of the administrative and professional importance of* **Resolut**  
*obtaining reliable statistics in regard to the mortality incidence in animal disease, a more thorough system of notification than the present very unsatisfactory system of reporting should be immediately investigated and introduced. The system approved, should, as far as possible, be uniform in its application throughout India.*

**SUBJECT III (c).—ANIMAL HUSBANDRY. WHAT IS THE RÔLE OF THE CIVIL VETERINARY DEPARTMENT IN DEALING WITH PROBLEMS DIRECTLY CONCERNING LIVE-STOCK INDUSTRIES IN INDIA ?**

The Chairman said : " I have referred to the subject of animal husbandry in my opening address. I have nothing to add except to say that I shall be glad to welcome any suggestions dealing with the professional aspect, which we can embody in a resolution. I believe that in order to stimulate private enterprise, which is recognized to be an essential step in any efforts destined to improve the cattle breeding industry, we should endeavour to form cattle breeding associations for the various breeds with the idea of eventually creating stud books." He then read the resolution of the Board of Agriculture meeting at Pusa in 1916 regarding the best agency for controlling cattle breeding.

Mr. Smith, Imperial Dairy Expert, who attended the meeting as representative of the Agricultural Department, stated that whatever department, veterinary or agricultural, was to control the subject of cattle breeding in India, they would have to recognize that progress would lie in the encouragement of private enterprise. No progress could be effected until they had got the people themselves interested in the subject. The question of cattle was the most universal one in India and no matter what crop particularly interested the agriculturist, he was everywhere dependent upon the efficiency of the ox as the main factor in cultivation. It was obvious that he could not have an efficient ox unless he had a healthy one and therefore the subject of cattle breeding must always be intimately connected with the Veterinary Service. As the result of his long experience in the country he held very strong views upon the subject, and he took every opportunity of impressing upon the people who dealt with the general question of animal husbandry that the cattle of the country must be made to produce more milk as well as be capable of being used for draught purposes if they were to be regarded as an economic proposition. He had 18 years' experience in this country and had travelled on an average 20,000 miles a year to carry on work in connection with the cattle industry. The basis of all operations undertaken with a view to improving the breeds of cattle must be the economical one, and the best means of economy would be the general introduction of a better milk-producing animal capable of returning the necessary outlay and of proving its utility as a draught animal in addition. He thought that what had been done in other countries in this respect could be done in India also. He referred to the excellent work that had been done in Hissar in producing a good quality of draught animal, and he was much impressed by the good work now

undertaken by Mr. Quirke in the Punjab with a view to improving the milking qualities of the breeds of cattle. At the last meeting of the Board of Agriculture at Pusa, the formation of a Central Cattle Board was recommended, and one of the functions of this board would be to formulate and control herd books in connection with the indigenous breeds. He saw quite well that the Provincial Governments looked for a central authority to give them advice on these matters and efforts in this direction were much more impressive when they were regarded as Imperial concerns.

Mr. Quirke stated that he was in full agreement with what Mr. Smith had said with regard to the improvement of the indigenous breeds with a view to increasing the milk supply. He had already commenced work along these lines and had established a herd book in what he regarded as a suitable area for the purpose in the Punjab. In this area the breed of cattle had been kept pure, as there was no communication by means of railways between it and the outlying districts. He had thought it would be well to make a start even as late as the year 1923 with a herd book so that a permanent record would remain of this breed. It was indispensable to stimulate local enterprise in this subject, but unfortunately at the present time it did not pay the zemindar to breed good cattle as the prices obtained for improved cattle did not run to what would be considered profitable.

Mr. Smith stated that the Chairman had raised in his opening address the very question which had come most prominently in their minds in connection with the cattle industry at the Board of Agriculture meeting held at Pusa, last year; namely, the establishment of a Central Cattle Board.

Mr. Hickey stated that in the United Provinces an advisory board had been established last year for this purpose.

After some further discussion the meeting unanimously resolved:—

*That this Conference strongly favours the establishment of Resolutions  
Cattle Boards, Central and Provincial, and considers  
essential that the veterinary profession should be adequately  
represented on these bodies.*

**SUBJECT III (d).—METHODS FOR FACILITATING AND IMPROVING THE SUPPLY OF SERA AND OTHER LABORATORY PRODUCTS, PARTICULARLY IN REGARD TO THE NEEDS OF REMOTE DISTRICTS.**

This subject was placed on the agenda at the instigation of Mr. Cameron (Burma).

At the meeting Mr. Cameron stated that the conditions in Burma seemed to be somewhat different from those prevalent in India. The journey from Muktesar to Rangoon took 10 days and frequently the serum was conveyed at a high temperature, probably near boilers in the hold of the ship, and deterioration appeared to take place within that time. Sometimes he received a telegram from the borders of Siam asking for a supply of serum. Supplies had to be transported thereto by carts and other primitive methods. The question upon which he desired information was whether some methods might be evolved to prevent the deterioration of serum during transport. The serum which he had in mind was anti-rinderpest serum. Again it was frequently a cause of inconvenience to him that mallein was supplied in bottles containing 100 c.c. It would be a great advantage if it could be supplied in single doses in sealed tubes, as in the provinces it was not required for more than a few animals at a time.

Mr. Hewlett stated that he had had experience in the despatch of large quantities of Muktesar serum during the war to Egypt, Mesopotamia, and elsewhere, and he had had no complaints about deterioration. He had not experienced any difficulty in regard to mallein on account of it being supplied in bulk. He found that he could decant the liquid and issue it for inoculation in the quantities which were necessary.

Mr. Wilson wondered whether something on the principle of a Thermos flask could be devised for the transportation of serum bottles. He found that if the cases were embedded in white sand during transport deterioration did not set in.

Mr. Cameron stated that the kind of conveyances available in Burma in many parts precluded this method of transport.

Mr. Harris stated that in Assam he had encountered no material difficulties in maintaining the quality of serum. He would like to know at what temperature serum commenced to deteriorate. Perhaps cans similar to those used for the transport of perishable goods might be devised for the purpose of carrying serum.

Mr. Cameron stated that he had in mind a publication which had been issued recently by the authorities in the Phillipines with regard to methods for keeping serum cool during transport.

Mr. Hickey stated that no difficulties in this respect had been experienced in the United Provinces.

The Chairman likewise stated that no difficulties had been encountered in the Punjab.

Mr. Farbrother had had no difficulty except when serum had had to be transported to some remote parts of the Bombay Presidency.

Mr. Edwards explained that the question of supplying serum in a more easily transportable form and of preventing deterioration when it became exposed to relatively high temperatures had already engaged his attention. At the present time he had ordered from abroad a plant for drying serum at a low temperature, and if the results obtained after the experimental trials were satisfactory the whole problem brought forward by Mr. Cameron might be completely solved and serum could be issued in a convenient form and in much less bulk, so that it could be readily transported to remote districts. He was also sanguine that the quality of the serum could be retained much longer. He did not consider it necessary therefore at the present juncture to discuss the methods of better dealing with the liquid serum until the results of his experiments were available. Experience elsewhere, in America particularly, with dried serum, such as dried anti-swine-fever serum, had given promising results.

In the course of further discussion with Mr. Cameron, he assured him that there would be no difficulty in supplying him with mallein from the Muktesar laboratory in such small quantities as he desired for immediate use. He also stated that he had recently been engaged in preparing mallein for the intra-palpebral test so as to have available a product comparable with the French *malleine diluée*. The diluted mallein thus prepared was found to be quite as effective as the French product after comparative tests upon experimentally infected animals and it would be issued from the laboratory in small glass tubes at as cheap a rate. Mr. Edwards further stated that he wished at this point to impress upon those who made indents for serum that it would be a great advantage if they all possessed cold storage facilities for the storage of supplies of serum in anticipation of their likely needs. Serum could be manufactured at the Branch Laboratory at Bareilly during the winter months at very much cheaper rate than at the parent Muktesar laboratory. During the few winter months that had just passed large quantities of serum had been manufactured there in anticipation of demands from the provinces. For the last two years, however, it seemed that the demands from the provinces were not as large as had been expected, and large quantities had had to be transported back to Muktesar. It would be advantageous to the laboratory and to the officers in the provinces if adequate arrangements were made in each province for the cold storage of serum in anticipation of likely demands, and if this serum could be indented for while the manufacture of serum was being undertaken in the cold season at Bareilly. He commended to the meeting the passing of a resolution to this effect.

Mr. Hickey stated that he would like the meeting to pass a resolution with regard to cold storage, as in the United Provinces his cold storage facilities were limited to one cool storage chest.



Mr. Harris stated that in Assam a reserve of serum was maintained in the cooler parts of the province, namely, in the hill stations.

Colonel Pallin intimated that if a resolution were passed to the effect that cool storage facilities should be provided in each province where such facilities did not already exist, the case would be met as most of the provinces appeared to be provided for in this respect.

After further discussion it was resolved unanimously :—

n III (d)

- (1) *That adequate cool storage facilities should be provided in all provinces where such facilities do not already exist for the preservation of serum.*
- (2) *That experiments regarding the possibility of manufacturing a satisfactory dried anti-rinderpest serum should be prosecuted as speedily as possible, and, in the event of failure to obtain satisfactory results from these experiments, some convenient method of transporting serum should be devised.*

**SUBJECT III (e).—MEAT INSPECTION. IS IT WITHIN THE PRESENT COMPETENCE OF THE DEPARTMENT TO DEAL WITH THIS QUESTION? WHAT FURTHER ARRANGEMENTS FOR TRAINING PERSONNEL FOR THE SPECIAL DUTIES ENTAILED ARE REQUIRED.**

The Chairman said: "The subject of meat inspection was suggested for discussion by Mr. Cross, who is not here. A number of local bodies in India employ Veterinary Assistants as Meat Inspectors, but it is doubtful if, generally speaking, a satisfactory standard of efficiency is furnished to these bodies thereby or is required by them.

"Veterinary Assistants have not hitherto been taught meat inspection as a separate subject at the Punjab Veterinary College, but the new course provides for special instruction in both meat and milk inspection, with practical demonstrations.

"Perhaps the Principals of colleges from Calcutta, Bombay and Madras will tell us what is taught at those colleges in this connection and Superintendents may give us their experiences.

"It is doubtful if local bodies generally have yet grasped the importance of the subject and there is no doubt the difficulties in applying adequate measures are very great. Milk inspection is quite as important as meat inspection, if not more so, and the question of milk is more likely to be treated seriously in India than that of meat inspection.

“ It is unlikely that much will be done at present, but I consider that if we educate men to perform the duties efficiently there will be a demand for their services eventually.”

Mr. Farbrother, who had stated his views in his circular note, informed the meeting that in certain localities there was at present a demand for this class of worker, but the duties could not be undertaken by the Veterinary Assistant posted in the locality as he had to tour his district for a considerable part of his time, and while he was away from his headquarters there was nobody left to do the work except a *salutri* or compounder. He thought that the work was essentially a matter for the municipalities to take up themselves.

Lieutenant-Colonel Hutchinson stated that the appointment of meat inspectors had now become essential in many parts. He had a great deal of experience in regard to cattle slaughter. Near Bombay there was one large slaughter house in which buffaloes, mainly, were killed and their meat subjected to a process of drying and then exported to Burma. The conditions of the slaughter house were very bad and there was no inspection whatever of the meat. The question which he wished to ask the meeting was to what extent veterinary colleges could undertake the training for this work, as men for the work must be provided.

Mr. Quinlan thought that much useful information with regard to the incidence of tuberculosis and other diseases would be obtainable with an adequate system of meat inspection. He thought that the Military Department could co-operate by assisting them in the system of meat inspection.

Mr. Hewlett stated that the students at the Bombay college were admittedly not given an extensive course of training in meat inspection, but they were given theoretical training at the college and elementary practical instruction at the Bandra slaughter house. He agreed with Lieutenant-Colonel Hutchinson that the condition of affairs at the Kurla Slaughter House, where dried buffalo meat was manufactured for the purpose of export to Burma, was disgraceful. But he did not consider that the state of affairs in the other slaughter houses in Bombay was quite so bad. Before a proper course of instruction could be given to the veterinary students at the slaughter houses, it would be necessary to enforce the inspection of meat at the slaughter houses, and this was a matter for legislation.

Khan Saheb Sheikh Naiz Mohammed believed that the inspection of carcasses at the slaughter houses would give valuable information relative to the investigation of disease in general, for at the present time it was customary for animal owners to send their diseased animals to the slaughter houses to be used as human food.

Mr. MacGregor stated that the inspection of meat was undertaken at the slaughter house in Calcutta by a Veterinary Assistant who had undergone no special course of instruction in the subject before he was posted to this appointment.

Lieutenant-Colonel Hutchinson asked if it would not be possible to institute a special course of study dealing with meat inspection in the veterinary curriculum.

Mr. Farbrother stated that this class of instruction could be undertaken in the slaughter houses as he believed that it would otherwise entail a very expensive curriculum.

The Chairman stated that instruction in meat inspection had been included in the Bombay programme for the four years' course of study.

Mr. Edwards maintained that a system of veterinary training necessarily provided the best ground-work for the education of a competent meat inspector. In reality, meat inspection might be regarded as a very simple form of applied pathology, or study of the technique of *post-mortem* examination. The voluminous treatises available on this subject were almost entirely text-books dealing with the grosser pathological changes found *post-mortem*. If the information concerning these changes were deleted from such books, there would be little left. He admitted, however, that if it were thought necessary to teach students in full detail the processes of refrigeration, slaughter house construction, the utilization of by-products, etc., a special course in meat inspection could be made very prolonged and expensive. Otherwise, he considered that a few weeks' experience in a slaughter house was quite sufficient to give a veterinary graduate all the further information he required to deal with this special work. In England, meat inspection resolved itself very largely into the detection of tuberculous lesions. At the present time, the importance of undertaking meat inspection with a view to minimizing the risk to human beings of contracting tuberculosis from this source was not deemed to be so great as it was a few years ago, for it was admitted that the proportion of cases of human tuberculosis contracted by the ingestion of tuberculous meat must be very low indeed, and the dangers from the tuberculous milk of cattle would seem to be incomparably greater. The really important sources of danger to human beings from the ingestion of meat could not be detected by any system of meat inspection which consisted merely of naked eye inspection of the carcasses. He meant to say that the so-called "food poisonings" which in reality were specific bacterial infections, due for the most part to Gärtner's bacillus, *Bacillus botulinus*, and certain other

organisms, were usually related to no changes visible to the naked eye in the meat.

Mr. MacGregor contended that it would be necessary to train the veterinary graduates further to recognize such conditions as putrefactive changes and changes due to "fevered flesh."

Mr. Edwards maintained that this aspect of the problem ought to be well inculcated in any veterinary student who had been properly taught the pathology appertaining to his ordinary training. Moreover, these were changes which would be readily detected by the consumer himself and were not usually attendant with danger to him, but were such as to make the meat nauseous to the senses. He admitted that the general principle of meat inspection was to safeguard the consumer against any risk of purchasing meat other than that for which he paid, namely, the "wholesome" and "untainted" flesh of the healthy animal from which it was purported to be obtained. In the three years' course of study which had been drafted by the Conference during its proceedings, the subject of meat inspection had been included in the final year of the course of study, in "State Veterinary Medicine." He believed that they could well assure Lieutenant-Colonel Hutchinson that there would be no difficulty in providing municipalities and other bodies with men sufficiently trained for carrying out meat inspection from the colleges when this course of study had been adopted, if these bodies were prepared to pay a reasonable rate of salary for their services.

It was resolved subsequently unanimously :—

*That training in meat inspection is now provided in certain Resolutive  
Veterinary Colleges in India and can be extended in scope as  
the demand for the services of graduates as meat inspectors  
increases.*

**SUBJECT III (f).—METHODS TO BE ADOPTED TO CORRELATE TECHNICAL INFORMATION AND RENDER AUTHORITATIVE ADVICE ON PROFESSIONAL PROBLEMS.**

The Chairman ruled that the substance of the note submitted by Mr. Ware might be discussed under this heading.

Mr. Edwards said that this was a subject he had very much at heart and considered it was one of the most important on the agenda. In order to demonstrate the utility of the profession in the economy of a civilized community, it was essential to harmonize the endeavours of all workers belonging to it in the country and to furnish the individual members with the means of inter-communication and a supply of technical information upon the topical cogent problems that continuously arose in course of their pursuit. He

wished to impress upon them that, although in the course of their previous discussions they had often made reference to the need of specialized workers, yet as a profession they had one common task to perform, namely, the control of animal disease, and one subject to study, namely, the investigation of animal disease. In reality, it was this common pursuit which bound them together and represented the task which they held themselves capable of performing for the public benefit. He wished to impress upon members that political controversies and discussions on administrative matters ultimately led to no benefit either to the public or to the members themselves if they did not, as a professional body, possess a sound ground-work of technical information. Although he insisted that the pursuit followed by the veterinary profession represented an entity in the economy of a civilized country, yet they could not pursue their endeavours in complete isolation, but they must work in close collaboration with workers whose pursuits frequently overlapped their own to a large extent, and in this connection he referred particularly to workers in the medical profession and in animal husbandry. The proposals which he wished to put forward in order to accomplish these *desiderata* might be submitted in a practical form under three heads, namely: (1) The need for the institution of a professional journal as a medium for the dissemination of information of technical interest to the profession in India. (2) The need for the establishment of small central advisory bodies that would be able to collect reliable information and render authoritative advice to Government upon certain of the peculiar aspects of their calling at any time. (3) The need for amalgamation or collaboration with workers in kindred pursuits.

Under the first of these headings he maintained that without a medium for the publication of observations and for obtaining information upon the problems connected with the peculiar conditions of disease of live-stock in India, members who were not in a position to consult the voluminous literature dealing with matters directly or indirectly connected with their professional duties would lose touch with the progress made in modern knowledge connected with their calling. He insisted that if a medium of this kind were established, it was absolutely essential that it should be regarded as a purely technical publication and on no account be allowed to degenerate into a medium for the expression of political or quasi-political information. In the note which he had circulated he had given his reasons for the establishment, as soon as practicable, of a journal conducted along the lines upon which the *Journal of Tropical Veterinary Science*, now defunct, had been conducted in the past. He recapitulated these reasons and maintained that it should be within the competence of the pro-

fession in India to publish a quarterly issue containing original communications to which might be added abstracts of information from other journals regarding matters of relevant interest to them.

Secondly, the need for small standing committees which might be called upon by the Government of India at any time to render representative and authoritative advice on technical questions had become more and more evident in the course of the deliberations of the conference, so that he need hardly dwell upon the urgency of this proposition. He proposed, therefore, that they should establish three Central Standing Advisory Committees, the composition of which would be left to the Government of India and which would be in a position to submit the considered and collective views of the Service whenever there was any need of their advice. He gave examples of the inevitable delays and difficulties which appeared to have been experienced by the administrative authorities at the seat of Government from having to refer questions on technical matters to Local Governments who were separately advised by their veterinary officers. If small powerful bodies of officers could be gathered together, a clear expression of the views of the profession in the country could be formulated for the guidance of the Central Governments and the Local Governments and thereby the position of the individual adviser would be greatly strengthened.

The Committees, he submitted, should be three in number to deal with the following questions :—

- (1) Education.
- (2) Civil Veterinary Administration.
- (3) Epizootic Disease and Research.

Under the third heading it was again hardly necessary to reiterate what Lieutenant-Colonel Hutchinson very aptly stated in his contribution to the discussion upon anthrax, namely, that the problem of disease was one and indivisible, whether it affected men, animals or plants. This general aspect of the problem had been pointed out in very clear terms in the Report of the Advisory Committee upon Research into Diseases of Animals, which submitted its report in 1922 to the Development Commissioners in England. In many cases the investigations of medical workers and veterinary workers covered common ground. Again, in previous discussions they had seen that they could not carry out their work properly without assistance from specialists in various branches of zoology. Next, the important questions of disease and health were relative, and our interests were therefore intimately bound with those of workers who were directly interested with the maintenance of animals in health, namely, of men engaged in what is termed animal husbandry.

Their services as investigators of animal disease might be considered of direct economic importance only to the owners of domesticated animals but it might be stated that indirectly they were of inestimable value in the elucidation of the whole problem of disease, which was tantamount to the maintenance of health in the whole population.

The Chairman stated that Mr. Ware's note did not appear to be admissible, as he referred to the question of creating Directors of Veterinary Service in each of the provinces. The Government of India had ruled that it was not within the competence of the conference to discuss administrative questions, but he was inclined to admit it if Mr. Ware could show that the proposition had a professional aspect.

Mr. Ware said that the professional aspects of his note were quite obvious, for in Madras there was a professional head at the college and an administrative head of the service in the field, and their posts were entirely separate and independent. If the service had a single head the functions of the college and of the service could be co-ordinated. In the case of all other departments in the province there was a local head.

Mr. Hewlett was rather sceptical as to the merits of the advice tendered with regard to reviving a professional journal in India. He pointed out that it would cost a great deal of money and labour to conduct a departmental journal, and this journal would only deal with certain aspects of veterinary diseases. He stated that it was ruled as the outcome of the 1908 conference that no articles would be submitted to other journals than the *Journal of Tropical Veterinary Science* except with the approval of the Inspector-General, but this stood in the way of recording cases. He believed that it would be best to publish professional information in one or other of the journals in the United Kingdom, as, for instance, in the *Veterinary Journal*. He was entirely opposed to any policies of centralization, and although he favoured the creation of central bodies for purposes of research and certain epizootic diseases, he was much against any interference with local administrations.

Mr. Quinlan had no doubt but that the great majority of those present would entirely agree with Mr. Edwards in his proposals for the co-ordination of effort, particularly in regard to education and epizootic diseases. Not only did he think that a Central Committee should advise the Local Governments upon questions of education but it ought to take in hand the examination of teaching institutions and consider the methods of examining students.

Mr. Kerr considered that one of the chief advantages of instituting Central Committees would be that they would strengthen the

hands of the Local Government officers. He felt that this applied particularly to the province in which he was situated. A young veterinary officer recently recruited to the department would undoubtedly feel that he much needed the support and experience of a representative body in tendering advice to his Government.

The Chairman was emphatic as to the need of introducing a Central Board to deal with education. He felt that a local officer would frequently need the assistance of such a body to support his own expression of opinion to his Government. He gave an example of an experience which he had when he wished to institute a 4 years' course of education at the Punjab College. His scheme was examined by his own Government and approved subject to alteration after the results of the meeting of Principals. As the result of some difference of opinion with the Director of Agriculture the scheme was further examined by a special Committee appointed for the purpose. It was approved finally but the procedure would have been simplified had there been an expert central body to refer to originally.

As Principal of a College and as a Fellow of the University he had endeavoured to dissipate the idea that veterinary education was merely an exercise in mechanical methods. His connection with the University had shown him that a properly constituted Board of Studies had advantages and that the deliberations of such a body were more likely to lead to fruitful results than the opinions of an individual. He considered that when the colleges became affiliated to the universities, Veterinary Faculties should be constituted. When that came about, the need of a central body might not be so apparent, provided that sufficient expert advice in the Faculties was available. Even then, however, a Central Board might be very useful. He agreed that a Standing Committee on Research and Epizootic Diseases was indispensable. With regard to Administration he had nothing to say except that the present position appeared to him to be an almost impossible one. The Government of India must have advice from some source and he felt that local veterinary advisers would like to have their advice confirmed by a central body in some instances.

Lieutenant-Colonel Hutchinson stated that he was in whole-hearted agreement with all that Mr. Edwards had said upon co-operation in the investigation of disease, for whatever branch we might represent or wherever we were situated the problem of disease must be regarded as a single problem. This point had been very well brought out by the Advisory Committee on Research into Diseases of Animals. This body had definitely pointed out the utility of research in the diseases of animals in relation to the investi-



gation of human disease and deplored the lamentably small support given to this kind of research at home and in the dependencies. Specialization was certainly an advantage, but specialization should be regarded as a necessary division in the application of labour to the investigation of disease problems. The Medical Research Council in their last report again emphasized the vital need for close co-operation between veterinary and other pathologists. Human pathology was still in a lamentably backward state, and the progress they had made in recent years was due almost entirely to the study of disease processes in animals, correlated with the study of clinical cases in hospitals and elsewhere. If the problem of disease investigation was absolutely one, the need for co-operation was patent. The only question was how was it to be carried out. The Medical Research Council administered funds for the purpose of undertaking research, contributed by the State. In the report of the Advisory Committee on Research into the Diseases of Animals, the establishment of a body analogous to the Medical Research Council was recommended. In India, there was a Medical Research Fund which had been in existence for 10 years and was entirely supported by contributions from Government, and he hoped to get some support for it from charitably disposed individuals. He deprecated any interference on the plea of retrenchment with the efforts of this association. He commended the institution of a small body for the control of research in animal disease, and co-operation between the two associations could be made very close indeed. The point laid stress upon by the Medical Research Council was in regard to interchange of workers. Interchange could easily be arranged in this country. He noted that Mr. Edwards had already commenced efforts in this direction, for he was endeavouring to make arrangements for Dr. Soparkar to work at the Muktesar laboratory. If the Central Standing Committee proposed to the meeting were adopted and if it was in possession of certain funds, co-operation among workers could be made extremely close. His dream had been to see the establishment of a large institution in which the workers of the two professions pursued their objects side by side. He gave the meeting some of the experiences regarding the causes of failure and success of committees; one of the essential factors to success was that a committee should be constituted so as to represent the highest professional authority. The Central Committee on Education could well exercise the same salutary effect upon education undertaken by provincial bodies as did the General Medical Council at home, for although this body did not interfere with the activities of the provincial bodies, yet if they had reason to suspect some defect in the system of training they deputed men to examine on the spot the whole of the method, and this helped to keep up the stand-

ard of medical education at home to a somewhat high level. Another point of great importance in his mind, particularly in regard to medical education, was to create a standard of education at the provincial schools so that the degree obtained would be recognized in other countries, for this reacted greatly on the status and prospects of the graduate. It would be much more difficult for the Provincial Board to secure this recognition abroad than it would be for the Central Board.

Mr. Fletcher cordially supported Mr. Edwards. He further gave his experience of the difficulties encountered by him in endeavouring to centralize efforts in regard to entomology in India. Four years ago the question of establishing a journal of entomology in India came up before the Meeting of the Entomological Conference and the proposal to commence such a journal was not adopted, because it was decided that there were not enough workers in the country on this subject to supply material for the regular issue of the journal. It was felt that the journal might be conducted with enthusiasm at the commencement, and then after two or three numbers had been issued there would be great difficulty in obtaining material. The multiplicity of journals gave great trouble to those workers who had to collect references from all the literature now available. If the journal became defunct it added greatly to the difficulty of the worker, for papers published in short-lived journals were likely to be lost to him. It was an advantage to have articles dealing with one branch of science; or one aspect of it, published as far as possible in one journal.

Lieutenant-Colonel Hutchinson stated that for many years medical literature in India was published in the form of scientific memoirs. When the Medical Research Fund Association got into possession of a grant, the first thing they did was to establish a journal. He was a consulting editor of this journal and though the amount of work he did himself was negligible, he could well see the enormous amount of work entailed in conducting the journal. One of the great arguments in favour of conducting a journal was that a good central library for the purposes of reference could be established with the periodicals obtained as exchanges. The expenditure entailed in producing the journal was almost recovered in this manner by the price of the journals received in exchange.

The Chairman stated that the department had been very sterile for many years in the matter of publications. One of the reasons was that district officers were too busy to undertake research, and officers employed at colleges were largely engaged in teaching and in routine duties. He believed that the *Journal of Tropical Veterinary Science* had been dropped largely on account of its expense

to Government. Veterinary Officers were asked to contribute their publications to the *Agricultural Journal of India*, but this journal was not circulated to any appreciable extent among workers in the veterinary profession. He regarded it as an unsuitable journal for veterinary articles and considered that this ruling of Government had disappointed many members of the service.

Mr. Smith believed that a journal especially published for veterinary workers in India would be much more acceptable to veterinary workers in general. He had experience in editing a trade journal (on dairying) and found difficulty in obtaining material after a few issues, even from the very people who had promised support. However it must be freely admitted that the problem of the ox was an universal one throughout India, unlike crops, which varied in distribution and in nature according to local conditions, climatic and otherwise. The ox was present everywhere so that it was of prime interest to the whole population, and not a matter of mere local interest. Next in importance to the ox itself was the disease of the ox, for the cultivator depended upon the efficiency of the ox to carry out his work. He believed that the institution of central advisory bodies to deal with the various problems connected with the disease of the ox would be a tower of strength to the community, and that the more centralized the control of disease was made, the more powerful would be the opinions of this board.

Mr. Ware asked Mr. Edwards how he proposed to undertake the conduct of the journal with the present numbers of officers in the department.

Lieutenant-Colonel Hutchinson described how it might be possible to undertake the work of the *Indian Journal of Medical Research*, published four times a year, if three professional workers devoted to it a part of their time.

Mr. Edwards, in reply to Mr. Ware's question as to ways and means for conducting the journal, stated that probably one original note or article would become available at Muktesar for each quarterly issue and he expected that at least one would be available from the provinces. In addition, summaries of articles published elsewhere in journals and reviews of literature dealing directly and indirectly with matters of interest to veterinary workers in India would be utilized to make up the rest of the journal. With regard to staff, even if he did not obtain help from without, there were five professional workers of Imperial grade sanctioned for the staff at Muktesar. If these workers were to keep abreast with the information published in connection with the calling in which they defect in to be competent, then they ought to possess an intis- spot the whole nuce with the scientific literature and a sufficient

knowledge of the art of writing for publication so that they ought to be able to conduct the quarterly issue readily among them. He would not recommend to the Government the retention of any member upon his staff who did not possess sufficient literary and scientific ability to express useful information in a printed publication.

The meeting referred the drafting of the resolution embodying its views to a committee consisting of Colonel Pallin, Lieutenant-Colonel Hutchinson, Mr. Smith, and Mr. Branford, with Mr. Edwards as Secretary. The following resolution was subsequently passed, Mr. Hewlett dissenting:—

*In order to correlate technical information and render authoritative advice on professional problems the Conference is of opinion that—* Resolut

- (1) *A journal of veterinary science in India should be established as early as practicable.*
- (2) *Central Standing Advisory Committees should be established dealing with—*
  - (i) *Veterinary Education*
  - (ii) *Civil Veterinary Administration*
  - (iii) *Epizootic Diseases and Research.*
- (3) *The Conference invites attention to the Report of the Advisory Committee on Research into Diseases of Animals presented in February 1922 to the Development Commissioners, and to the statement contained therein: "In India immense opportunities are almost wholly neglected." The Conference strongly advocates the allocation of funds for research, which, while removing this stigma, will be of great economic benefit to the country. It is now generally recognized that the problem of disease and health, whether in man, animals, or plants, is in reality one problem; hence, no real advance in the study of disease is possible without co-ordination of all workers in this field.*

**SUBJECT III (g).—THE ADVISABILITY OF AMALGAMATING CERTAIN VETERINARY SERVICES IN INDIA.**

The Chairman said that this question had been fully discussed by Mr. Quirke in the note which he had presented to the meeting (Appendix IV). The condition of affairs therein reported appeared to be peculiar to the Punjab and the United Provinces.

It did not appear to be within the competence of the meeting to deal with it, but the matter might be referred to the authorities concerned.

Mr. Hickey, representing the Veterinary Department in the United Provinces, said that he agreed with Mr. Quirke and would like a resolution drafted, embodying his recommendations.

The meeting then unanimously resolved :—

a III (g)

- *That the system of control of equine contagious diseases in certain districts of the Punjab and the United Provinces indicates an unsatisfactory duplication in veterinary endeavour. The suggestions presented by Mr. Quirke (Appendix IV) are commended to the authorities concerned.*

## LIST OF RESOLUTIONS.

### I. Education.

- (a) Is any revision necessary of the conclusions arrived at by the Sub-Committee on Education at the First Conference held at Lahore in March 1919 and by the Meeting of Principals of Colleges at Bombay in February 1922 ?
- (1) The system of study drafted by the Meeting of Principals at Bombay is approved as a curriculum representing the present minimum requirements for the training of Indians in India up to the highest standard of veterinary education necessary for the country, as demanded by the Public Services Commission (1912-14).
- (2) The constitution of a Board of Veterinary Studies as recommended by them is urged very strongly, and the Board might be authorized to make minor modifications and additions to the course from time to time as required and in consideration of the needs of the several provinces. The desirability of raising the standard of preliminary education as soon as possible is worthy of early consideration.
- (3) It is considered that Muktesar is unsuitable for such a course and immediate steps should be taken to institute it at one of the existing colleges and, as soon as financial considerations permit of the constitution of an efficient organization for dealing with problems connected with veterinary state medicine, at the other colleges also.
- (4) In view of the circumstances arising out of the existing situation of the country it is not practicable to introduce this system of education generally.
- (5) Less costly, shorter courses must continue (see report of committee upon proposals for shorter courses, page 27).

- (b) What qualifications should be required for :—
- (1) The promotion of subordinate members of the Department to the Provincial Service ?
- (2) The promotion of Provincial Officers to the Imperial Service ?
- (3) The direct appointment of Indians to the Imperial Service ?
- (1) The promotion of subordinate members of the Department to the Provincial Service ?
- (2) In view of the Government policy providing for the promotion of a proportion of Provincial Officers to the Imperial Service, it is considered that promotion to the Imperial Service should be restricted to those Provincial Officers who have at least 10 years' further service to the credit of Government, whose selection is approved by a Standing Committee of Imperial Officers, and undertake to submit themselves to a course of special work to be prescribed by this Committee, and pass successfully the tests laid down for the course.
- (3) Candidates selected for direct appointment to the Imperial Service should possess the diploma of the Royal College of Veterinary Surgeons ; preference should be given to those who possess a university degree in veterinary science of a British university, and have taken steps, moreover, to observe the methods of cattle practice during their course of study ; on their arrival in India they should first undergo a course of post-graduate training at Muktesar and instruction in animal husbandry and dairying at the institutions concerned with these pursuits in India.
- (c) What forms of post-graduate training should be devised for :—
- (1) Veterinary Assistants ?
- (1) Post-graduate courses for Veterinary Assistants should be instituted at all the existing colleges ; the syllabus for these courses should be approved by the Board of Studies.

(2) Provincial Officers ?

(2) The institution of post-graduate courses of study at Muktesar and elsewhere for Provincial Officers is approved by this Conference, and the curricula for these courses should be examined by the Board of Studies.

(3) Imperial Officers ?

(3) Imperial Officers should be given facilities for taking post-graduate courses at Muktesar and abroad.

## II. Epizootic diseases.

(a) (1) Prevalence of anthrax among the various classes of live-stock in India.

(1) The evidence available shows that anthrax is a serious disease of live-stock in India and is much more prevalent than the official records would indicate.

(2) The necessity of instituting legislation to deal with the disease ; the scope and nature of such measures.

(2) The Conference, having considered in detail the incidence of anthrax among animals in India and men handling animal products in other countries and the economic issues resulting therefrom, resolved :—

(i) that as the spread of infection is not limited by geographical and provincial boundaries, measures directed against the dissemination of the disease both in India and to and from India from other countries should be considered a central subject ;

(ii) that disinfection of animal products, while throwing a great financial burden on industry, will accomplish nothing towards the eradication of the disease in animals and thereby improving the condition of stock in India ;

(iii) that the only sure way of dealing with the situation, and at the same time of lasting economic benefit to the country, is by making a persistent effort to prevent the spread of infection among animals, and thereby to secure the control and ultimate eradication of the disease.



The success of any measures designed with these objects will depend upon :—

- (i) Efforts to improve the agency for notification.
  - (ii) An increase in numbers of the veterinary personnel of all grades consistent with the work which has to be done.
  - (iii) Improved facilities for the education of the veterinary personnel recruited in India in the problems connected with the control of epizootic disease.
  - (iv) Legislation (see resolution under Subject III a).
- (b) Rinderpest : to review the experience already gained as to the relative advantages of the "serum simultaneous" and "serum alone" methods of inoculation in India and in other countries.
- (1) The process of active immunization against rinderpest by so-called serum simultaneous method should be prosecuted with the utmost vigour, whenever possible, as it represents the only means at present known of conferring a satisfactory, permanent, immunity upon susceptible animals.
  - (2) In the districts, however, the time is not yet opportune for the wholesale performance of this method of immunization, as the occasional accidents which follow upon its adoption might hinder, in view of the prejudices of the smaller owners, the eventual universal adoption of the method.
  - (3) Investigations upon the nature of the rinderpest virus and upon the factors involved in the safe conferrence of a satisfactory immunity should be regarded as research projects of primary importance.
  - (4) Meanwhile, until the time arrives for the wholesale adoption of a process of active immunization, the "serum alone" method of immunization, though it confers but a passive, or fleeting, immunity should be regarded when properly applied as the system best suited for general adoption in the face of outbreaks in India.

- (c) Trypanosomiasis : Surra.
- (1) Is the existing legislation for the control of surra adequate ?
- (2) The present position in respect to research and the efficacy of methods of treatment.
- (3) Information with regard to trypanosomiasis, other than surra, found in India.
- (c)(i) Investigations into the nature and mode of transmission of the animal trypanosomiasis in India should be prosecuted forthwith. Likewise, the whole problem of the important protozoan diseases of the domesticated animals of the country should be approached concurrently. For this purpose it will be necessary to strengthen the technical resources at present available in the country for research into the different aspects of the above projects, comprising the entomological, protozoological, and pathological aspects, by centralization of the facilities available in each of these pursuits, and the delegation, on request, of workers to assist those engaged directly in the elucidation of the disease problems. An experienced protozoologist should be appointed to the staff of the Imperial Bacteriological Laboratory for research into these problems. Entomological assistance should be derived from the staff of the Imperial Entomologist. These workers would find unlimited scope for their activities, in addition, in the investigation of the economically highly important diseases of live-stock caused by protozoan parasites, other than those of surra.
- (ii) Efforts to obtain a cheap, effective and easily applied remedy for the cure of surra, in particular, and other protozoan diseases should be prosecuted on a large scale in the laboratory and in the field, and the co-ordinated services of the whole veterinary profession in India are required for this purpose.
- (iii) Legislation. In view of our present inadequate knowledge of the trypanosomiasis of animals in India, and the likelihood that the pathogenic trypanosomes find a reservoir frequently in relatively resistant host species, the

present legislative measures dealing with surra should be reconsidered in the light of better information that may be procured on further research directed with the object of elucidating these peculiar conditions.

- (d) Contagious abortion: information regarding its incidence among imported and indigenous stock; proposals for control.
- (d) Recent evidence shows that contagious abortion is an important disease of live-stock in certain parts of India, and further investigations should be prosecuted in regard to its origin, regional distribution, susceptibility of the various classes of live-stock to infection, and the institution of proper measures of control.
- (e) Tuberculosis: prevalence of tuberculosis among live-stock in India, and the danger of infection to human beings from this source.
- (e) The evidence available shows that tuberculosis is present in cattle in India but is insufficient to indicate to what extent it prevails.

In view of the experience gained in other countries with regard to the spread of infection in susceptible animals, it is clearly indicated that steps should be taken to ascertain accurately the prevalence of infection.

Research into the nature of the organisms responsible for the disease and the relative susceptibility of the different breeds of cattle in the country should be prosecuted forthwith. If this research should indicate that tuberculosis is at present rare among Indian cattle measures should be taken to eradicate it and to limit, as far as practicable, the introduction of the disease from outside sources.

The Conference is of opinion that these measures are urgently demanded by reason of the grave dangers to the live-stock of the country, the purity of the milk supply, and the catastrophes of bovine tuberculosis in children.

- (f) Parasitology (helminthology and entomology): necessity for instituting a survey of the incidence of the grosser parasites of live-stock in India and for the formation of Central departments to control work in this connection.
- (f) (1) Entomology: On account of the great importance of insects in the transmission of animal diseases, as causes of direct injury to live-stock in India, and the high degree of specialization necessary for a proper appreciation of the various aspects of entomology, the staff of the Imperial Entomologist should be strengthened to the degree requisite for rendering assistance to investigators into the insect problems connected with animal diseases.
- Similarly, facilities should be rendered for the establishment of a staff attached either to the Imperial Entomologist or to the Zoological Survey of India for the study of ticks and mites concerned with animal diseases.
- (2) Helminthology: In view of the enormous economic loss caused by, and our present inadequate knowledge concerning the prevalence and the nature of the species of, parasitic worms present in animals in this country, the appointment of a whole-time helminthologist to investigate the subject from the standpoint of animal disease is urgently required in the interests of owners of live-stock in India. This officer should work under the direction of the Imperial Bacteriological (Veterinary) Laboratory.
- (g) Infectious lymphangitis in cattle: causation and treatment.
- (g) Mr. Krishna Murthi's original paper on "Infectious Lymphangitis amongst Cattle in the Madras Presidency" should be published *in extenso* in a professional periodical.
- (h) Nasal granuloma in cattle: causation.
- (h) Mr. Krishna Murthi's original paper on "Nasal Granuloma in Cattle occurring in the Madras Presidency" should be published *in extenso* in a professional periodical.
- (i) Rabies: measure of control.
- (i) Any proposed measures of control based on prophylactic vaccination of dogs against rabies should be referred to the Central Standing Advisory Committee on Epizootic Diseases and Research (see resolution under Subject III f)

- with a view to advising Government upon the desirability of enforcing measures of widespread preventive inoculation of dogs against the disease.
- (j) Diseases of sheep : nature, incidence and control of the more important disease conditions among sheep in India.
- (j) On account of the economic importance of sheep diseases in India, further steps should be taken to render assistance to sheep owners by means of propaganda and by the better education of the veterinary personnel in the peculiar problems connected with the main classes of diseases affecting sheep-

### III. General.

- (a) Legislation : the desirability of introducing further legislative measures for the control of animal disease.
- (a) This Conference considers that the time has arrived when a Diseases of Animals Act should be introduced to give permissive powers to Local Governments to frame rules for the enforcement of sanitary police measures for the control of contagious disease in animals.
- (b) Statistical : methods of obtaining and recording statistical information regarding the incidence of epizootic diseases in India ; suggestions for improvement.
- (b) In view of the administrative and professional importance of obtaining reliable statistics in regard to the mortality incidence in animal disease a more thorough system of notification than the present very unsatisfactory system of reporting should be investigated immediately and introduced. The system approved should, as far as possible, be uniform in its application throughout India.
- (c) Animal husbandry : what is the rôle of the Civil Veterinary Department in dealing with problems directly concerning live-stock industries in India.
- (c) This Conference strongly favours the establishment of Cattle Boards, Central and Provincial, and considers essential that the veterinary profession should be adequately represented on these bodies.
- (d) Methods for facilitating and improving the supply of sera and other laboratory products, particularly in regard to the needs of remote districts.
- (d) (1) Adequate cool storage facilities should be provided in all provinces where such facilities do not already exist for the preservation of serum.
- (2) Experiments regarding the possibility of manufacturing a satisfactory dried anti-rinderpest serum should be prosecuted as speedily as possible, and,

- in the event of failure to obtain satisfactory results from these experiments, some convenient method of transporting serum should be devised.
- (e) Meat Inspection : is it within the present competence of the Department to deal with this question ; what further arrangements for training personnel for the special duties entailed are required ?
- (f) Methods to be adopted to correlate technical information and render authoritative advice on professional problems.
- (e) Training in meat inspection is now provided in certain Veterinary Colleges in India and can be extended in scope as the demand for efficient meat inspectors increases.
- (f) In order to correlate technical information and render authoritative advice on professional problems the Conference is of opinion that :—
- (1) a journal of veterinary science in India should be established as early as practicable.
  - (2) Central Standing Advisory Committee should be established dealing with—
    - (i) Veterinary Education.
    - (ii) Civil Veterinary Administration.
    - (iii) Epizootic Diseases and Research.
  - (3) The Conference invites attention to the Report of the Advisory Committee on Research into Diseases of Animals presented in February 1922, to the Development Commissioners, and to the statement contained therein : “ In India immense opportunities are almost wholly neglected.” The Conference strongly advocates the allocation of funds for research, which, while removing this stigma, will be of great economic benefit to the country. It is now generally recognized that the problem of disease and health, whether in man, animals, or plants, is in reality one pro-

blem; hence, no real advance in the study of disease is possible without co-ordination of all workers in this field.

(g) The advisability of amalgamating certain Veterinary Services in India.

(g) The system of control of equine contagious diseases in certain districts of the Punjab and United Provinces indicates an unsatisfactory duplication in veterinary endeavour. The suggestions of Mr. Quirke (Appendix IV) are commended to the notice of the authorities concerned.

## APPENDIX I.

**Report of the Meeting of Principals of the Indian Veterinary Colleges held at Bombay Veterinary College on the 8th to 10th February 1922.**

In accordance with the instructions received from the Agricultural Adviser to the Government of India (D. O.'s 353-2 and 351-2 of 21st January 1922), the above meeting of Principals commenced its proceedings at the Bombay Veterinary College, Parel, at 10 A.M. on the 8th February 1922.

There were present the following members who had been requested to attend the meeting :—

Colonel A. Smith (Principal, Bengal Veterinary College). *Chairman.*

Lieut.-Colonel G. K. Walker, C.I.E., O.B.E. (Principal, Punjab Veterinary College, Lahore).

Major K. Hewlett, O.B.E. (Principal, Bombay Veterinary College).

D. A. D. Aitchison, Esq. (Principal, Madras Veterinary College).

Major E. W. Oliver, Veterinary Adviser to the Government of the United Provinces.

J. T. Edwards, Esq., Director, Imperial Bacteriological (Veterinary) Laboratory, Muktesar. *Secretary.*

On the motion of Colonel Smith, seconded by Mr. Edwards, it was resolved to invite M. H. Sowerby, Esq., Professor, Bombay Veterinary College, to assist in the deliberations of the meeting.

In opening the meeting the Chairman read extracts from the Government of India letter in which the scope and nature of its deliberations laid down Government of India, Department of Revenue and Agriculture (C. V. A.), No. 2073, dated 20th October 1921, paragraphs 2 (c) and 4.

*Uniformity of the curricula in the Veterinary Colleges and standard of the entrance examination.*

The Meeting recommended that the course be extended in all Veterinary Colleges to four years, in English, and that a higher standard of preliminary education be demanded of recruits.

It was further of the opinion that the standard of the Matriculation examination of the local university concerned be insisted upon prior to entrance to the Veterinary Colleges.

*Revision of the curriculum in the Veterinary Colleges.*

After a lengthy discussion the Meeting decided that the principles underlying Mr. Edwards' remarks on veterinary education (previously circulated among the members) which in its opinion represented with still further regard to modern developments in veterinary science the objects aimed at in the recently revised curriculum of the Punjab Veterinary College, should be approved and accepted, and that a system of veterinary education embodying these principles appeared to be applicable to Indian conditions.

The general plan of the curriculum recommended by the Meeting was as follows :—

*First Year's Study—Preliminary Science.*

- (a) Biology ;
- (b) Chemistry (Inorganic and Organic) ;
- (c) Elementary Physics ; and



- (d) **Animal Management.** (Prior to examination all candidates should produce a certificate from the Principal of the College showing that they have satisfactorily passed a test in riding.)

*Second Year's Study—Intermediate Veterinary Science.*

- (a) Anatomy ;  
 (b) Histology ;  
 (c) Physiology ; and  
 (d) Pharmacology (including materia medica and pharmacy).

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**FINAL VETERINARY COURSE (TWO YEARS), COVERING THE THIRD AND FOURTH YEARS OF STUDY.**

*Part I.—State Veterinary Medicine.*

- (a) Elementary Pathology—general pathology, morbid anatomy and histology, and post-mortem technique.  
 (b) Parasitology, including an elementary study of the bacteria, fungi, filtrable viruses, protozoa, helminths, and arthropods parasitic on the domesticated animals.  
 (c) General hygiene (including a study of air, water, soils, foods, pastures, and building construction, in their relation to the health of the domesticated animals) ; toxicology (poisonous plants, etc.) ; disinfection.  
 (d) Principles of breeding.  
 (e) Meat and milk hygiene.  
 (f) Preventive medicine including an elementary study of the causation, modes of infection, methods of spread, immunity, phenomena and prophylaxis involved in connection with the more common epizootics and enzootics of the domesticated animals, having special regard to those diseases prevalent in India.  
 (g) Sanitary law and administration.

*Part II.—Clinical Veterinary Practice.*

- (a) Surgery, comprising surgical anatomy and pathology, surgical diagnosis (including examinations for soundness and estimations of age), and operative methods (including the principles of shoeing).  
 (b) Semiology and diagnosis of internal diseases.  
 (c) Therapeutics.  
 (d) Obstetrics.

The Meeting considered that a permanent Central Advisory Board of Studies ought to be constituted to consider and report upon any important questions connected with veterinary education in India.

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The system of examination recommended was as follows :—

*First professional examination—Preliminary Science.*

This examination shall be held at the end of the first year's course of study.

No student shall be eligible for examination who has attended less than three-fourths of the lectures and practical work in the prescribed subjects and has failed to pass his class examination in riding. All students shall produce at the oral and practical examinations their note books showing a record of the work they have performed in the practical classes, duly initialled by the teacher concerned.

The subjects for examination, method of examination and number of marks allotted to each subject shall be as follows :—

Each student shall obtain the minimum pass marks indicated before he is deemed to have passed the examination.

	Total marks	Pass
(a) Biology (Botany and Zoology)—		Per cent.
Written, two papers of 3 hours each . . . . .	200	50
Practical . . . . .	100	50
(b) Chemistry (Inorganic and Organic)—		
Written, two papers of 3 hours each . . . . .	200	50
Practical . . . . .	100	50
(c) Elementary Physics—		
Written, one paper of 3 hours . . . . .	100	50
Practical . . . . .	100	50
(d) Animal Management—		
Practical and oral . . . . .	200	50

A student who fails in one subject only shall be allowed to appear for a supplementary examination in that subject after a subsequent period of 3 months' study, provided that he had attained 60 per cent. of the total number of marks in the examination and is certified by the Principal to have pursued his study of that subject satisfactorily.

*Second professional examination—Intermediate Veterinary Science.*

The examination shall take place at the end of the second year's course of study.

No student shall be eligible for examination who has attended less than three-fourths of the lectures and practical work in the prescribed subjects after he has passed the first professional, or preliminary science, examination, or the intermediate examination in Science in the same subjects or the preliminary science examination in Medicine of the local university, and, in addition, passes the examination in animal management and the test in riding prescribed for in the first year's study.

Each student shall have dissected the body of the horse at least once and such other domesticated animals or parts thereof as may have been directed to him by his professors.

All students shall produce at the oral and practical examinations their note books showing a record of the work they have performed, duly initialled by the teacher concerned.

The subjects for examination, method of examination, marks allotted, and proportion or marks required in each subject to attain the pass standard shall be as follows :—

	Marks	Pass requirements
Anatomy—		Per cent.
Written, two papers of 3 hours each . . . . .	200	50
Practical and oral . . . . .	200	50
Histology—		
Written, one paper of 3 hours . . . . .	100	50
Practical and oral . . . . .	100	50
Physiology—		
Written, two papers of 3 hours each . . . . .	200	50
Practical and oral . . . . .	100	50
Pharmacology—		
Written, one paper of 3 hours . . . . .	100	50
Practical and oral . . . . .	100	50

A student who fails in one subject only shall be allowed to appear for a supplementary examination in that subject after a subsequent period of 3 months' study, provided that he had attained 60 per cent. of the total number of marks in the examination and is certified by the Principal to have pursued his study of that subject satisfactorily.

*Final Examination in Veterinary Science.*

This examination shall take place once a year only, at the end of the fourth year of study, i.e., two academic years after the student has passed the intermediate examination in veterinary science.

No student shall be eligible for examination who has attended less than three-fourths of the lectures, practical work and demonstrations, and hospital practice prescribed in the curriculum.

All students shall produce at the practical and oral examinations their note books containing a description of the practical work they have executed in the course of their studies, and case records, duly initialled by the teacher concerned.

A student may present himself for examination in both or only one of the two groups of subjects (Part I, State Veterinary Medicine, and Part II, Clinical Veterinary Practice) at one time, but before he can be granted the diploma of the college or allowed the right to practise as a veterinarian or enter the State Veterinary service he must produce evidence of having passed in both groups.

Failure to pass in any of the subjects of a group will necessitate the student presenting himself again for an examination in all the subjects of the group after a further period of one year's study; but, on the other hand, if a student fails to satisfy the examiners in one Part only and passes in the other Part he may be entitled to present himself again for examination in only that Part in which he had failed and receive the diploma if he then passes in that Part.

The subjects for examination, method of examination, marks allotted, and proportion of marks required in each subject to attain the pass standard shall be as follows:—

*Part I.—State Veterinary Medicine.* Three papers of three hours each, with practical and oral examination, to be allocated in the following general manner:—

	Marks	Pass standard
One paper for subjects (a) and (b) . . . . .	100	Per cent. 50
Practical and oral examination in above . . . . .	100	50
One paper for subjects (c), (d) and (e) . . . . .	100	50
Practical and oral examination in above . . . . .	100	50
One paper for subjects (f) and (g) . . . . .	100	50
Practical and oral examination in above . . . . .	100	50

*Part II.—Clinical Veterinary Practice.* Four papers of 3 hours each, with practical and oral examinations, to be allocated in following general manner:—

	Marks	Pass standard
Two papers for subjects (a) and (d) combined . . . . .	200	Per cent. 50
Practical and oral examination in above . . . . .	200	50
One paper for subject (b) . . . . .	100	50
Practical and oral examination in above . . . . .	100	50
One paper for subject (c) . . . . .	100	50
Practical and oral examination in above . . . . .	100	50

The Meeting considered that the scheme of study and method of examination outlined by them was of a sufficiently comprehensive and advanced character to justify recognition by the local Universities as an approved degree course in science and the conference by these bodies of a special degree in science, entitled B. Sc. (Vet.) on students who graduate in this course.

## SYLLABUS.

### GENERAL OUTLINES.

#### *First Year's Study.—Preliminary Science.*

In the subjects of biology, chemistry and elementary physics the scope and nature of the studies in each subject and the number of hours allotted to lectures, demonstrations and practical work shall be on the lines prescribed in the curricula in these subjects of the respective medical faculties of the local Universities (Type, *Bombay University Calendar*, 1920-21, Vol. I, pages 195-97, 1920, Bombay Government Central Press).

*Animal Management.*—The general plan of work in this subject laid down in the syllabus of the Punjab Veterinary College, Lahore, 1921, page 4 shall be adopted, having regard to the domesticated animals of the locality. The course of study in this subject shall cover at least 100 hours of practical work and demonstrations.

#### *2nd Year's Study.—Intermediate Veterinary Science.*

The time given to instruction in various subjects for study shall be as follows :—

1. Anatomy, lectures 100 hours ; practical work and demonstrations 200 hours.
2. Histology, lectures 20 hours ; practical work and demonstrations 50 hours.
3. Physiology, lectures 80 hours ; practical work and demonstrations 50 hours.
4. Pharmacology, lectures 50 hours ; practical work and demonstrations 50 hours.

The general scope and nature of the work in each of these subjects shall be as follows :—

#### 1. *Anatomy.*

- (a) The special anatomy of the horse.
- (b) The structure of the domesticated mammals as compared with that of the horse. The structure of the fowl.
- (c) The body of the horse must be dissected completely at least once by each student, together with such parts of the bodies of the other domesticated animals as may be directed.

#### 2. *Histology.*

The microscope, its construction and uses. The preparation for microscopical examination of the various tissues and organs of the animal body.

The minute structure of healthy tissues.

#### 3. *Physiology.*

- A. Outlines of general physiology.
- B. Comparative physiology of the domesticated animals.
- C. Laboratory work and demonstrations to illustrate the fundamental principles of
  - (i) biochemistry and (ii) the properties of living tissues.

#### 4. *Pharmacology (including materia medica and pharmacy).*

- A. Drugs, their general pharmacological action, classification, sources from which they are obtained, methods of preparation, and doses in which they are administered, having special regard to the common preparations used in veterinary therapeutics. Toxic action of drugs ; antidotes.
- B. Prescribing and prescription writing.
- C. Practical pharmacy, the dispensing of pharmaceutical preparations, including recognition of various drugs.

## FINAL COURSE OF STUDY.

## PART I.—STATE VETERINARY MEDICINE.

A total of 600 hours' instruction, comprising lectures, demonstrations, and practical work shall be given in the group of subjects comprised in Part I, distributed over the 3rd and 4th years of study, in the following manner :—

	Lectures	Demonstrations and practical work
	Hours	Hours
(a) Elementary Pathology . . . . .	40	80
(b) Parasitology . . . . .	80	100
(c) General hygiene . . . . .	40	40
(d) Breeding . . . . .	20	30
(e) Meat and milk hygiene . . . . .	20	20
(f) Preventive medicine . . . . .	80	20
(g) Sanitary law . . . . .	10	20

## PART II.—CLINICAL VETERINARY PRACTICE.

A total of 1,200 hours' instruction, comprising lectures, demonstrations, practical operative work and hospital practice shall be given in this group of subjects, distributed over the third and fourth years of study in the following manner :—

- (a) *Surgery*.—Lectures, 120 hours ; practical operative surgery, 100 hours ; examination of horses for soundness, 50 hours ; shoeing, 50 hours ; hospital practice, 500 hours.
- (b) *Semiology*.—Lectures, 60 hours ; practical work, 180 hours.
- (c) *Therapeutics*.—Lectures, 60 hours ; practical work, 40 hours.
- (d) *Obstetrics*.—Lectures, 20 hours ; practical work, 20 hours.

It was considered unnecessary to draw up a detailed syllabus of the subjects laid down for study during the third and fourth years of the curriculum, as the detailed syllabus of the Punjab Veterinary College, Lahore, 1921, with some re-arrangement of various headings, was deemed suitable to the proposed requirements.

*Staff required for the Veterinary Colleges.*

The Meeting desired to emphasise that a mere revision of the curriculum to meet modern developments in veterinary science would not raise the standard of veterinary education in India unless a staff of competent teachers were provided to ensure a uniform standard of instruction in all the colleges as proposed in the revised curriculum recommended.

It was considered that the staff necessary to teach the subjects of the curriculum was as follows :—

I.—*First Year—Preliminary Science.*

*Biology, Chemistry and Elementary Physics*.—One lecturer in each subject while these subjects are being taught intramurally.

Animal management—to be taught by a hospital surgeon.

## II.—Second Year—Intermediate Veterinary Science.

*Anatomy.*—One professor, with demonstrators at the rate of one per 20 students.

*Histology.*—One demonstrator (to work under the professor of physiology or the professor of anatomy one of whom will lecture upon this subject).

*Physiology.*—One professor, with one demonstrator.

*Pharmacology.*—One lecturer, who would also be the professor of therapeutics in the final part of the curriculum.

One of the professors should be appointed Sub-Director of the course of study in Intermediate Veterinary Science, to control and co-ordinate the teaching of this year.

## III.—Final Veterinary Course.

### PART I.—STATE VETERINARY MEDICINE.

(a) *Elementary Pathology.*—One professor and one demonstrator.

(b) *Parasitology.*—Two lecturers and two demonstrators (the two lecturers should comprise one bacteriologist, to teach bacteriology, mycology and study of the filtrable viruses, and one helminthologist, to teach protozoology, helminthology and entomology).

(c), (d) and (e) *General hygiene, principles of breeding and meat and milk hygiene.*—One professor, one lecturer (who should teach more especially the "principle of breeding" and one demonstrator).

(f) and (g) *Preventive medicine, and sanitary law and administration.*—One professor and one lecturer.

One professor should be appointed Sub-Director of this group to control and co-ordinate the teaching of the subjects contained therein.

### PART II.—CLINICAL VETERINARY PRACTICE.

(a) *Surgery.*—One professor, one lecturer, and clinical assistants at the rate of at least one for 20 students.

(b) *Semiology.*—One professor and one demonstrator.

(c) *Therapeutics.*—One professor (to be also the lecturer in pharmacology) and one clinical assistant.

(d) *Obstetrics.*—To be taken by the lecturer in Surgery.

The Professor of Surgery should be appointed Sub-Director of this group, to control and co-ordinate the teaching of the subjects contained therein.

The Principal of the College should administer the institution and direct and co-ordinate the system of instruction given thereat.

The staff of each College would thus comprise one Principal, 8 Professors (in Anatomy, Physiology, Pathology, Hygiene, Preventive Medicine, Surgery, Semiology, and Therapeutics) and 8 lecturers (in Biology, Chemistry, Elementary Physics, Bacteriology, Helminthology, Genetics, Preventive Medicine and Surgery). The number of lecturers would be reduced to 5 when the teaching of Biology, Chemistry and Elementary Physics is undertaken extramurally at the University.

### *Equipment of the Veterinary Colleges.*

It will be necessary to provide adequate accommodation at the Colleges and furnish sufficient other material equipment for carrying out the instruction proposed in the above curriculum.

### *Pay of the Staffs.*

The Meeting considered that it will be in the interest of Government, in order to obtain and retain the services of men with the necessary qualifications, to provide extra allowances for men engaged on the Teaching Staffs of the Colleges. In addition the Principal or Director of the College, and the Sub-Directors of the groups of subjects, should be given special allowances for the extra responsibilities attached to their posts.

*Prospects of Graduates.*

As the proposed curriculum aims at satisfying the desires of the Government of India to establish a higher standard of Veterinary education in India, and the cost of training is thereby enhanced, the Meeting considered that in order to obtain the necessary recruits it was essential that the pay and prospects of graduates should be considerably improved, so as to compare favourably with those of other scientific professions in India.

*University Status and Affiliation with the Universities.*

The course of study proposed was considered to be of a sufficiently high standard to warrant university recognition and the conferment of a special degree in Science at the Universities [B.Sc. (Vet.)] affiliation of the Colleges with the Universities was regarded as a necessary step towards the attainment of the requisite professional status.

*Path of Ascent to the Imperial Service.*

The Meeting considered that selected students, who had taken the proposed degree in Veterinary Science, might be regarded as candidates for appointment to the Imperial Service after undergoing a further course of post-graduate instruction in India.

*Scheme of post-graduate study suggested by Mr. Edwards to be given at Muktesar to selected Officers of the Provincial Service prior to entry to the Imperial Service (see attached copy).*

The suggested post-graduate course of study was briefly discussed and the Meeting was of the opinion that it had not had sufficient opportunity to study the subject fully and that it could not express definite views on its merits without mature consideration. It was further of the opinion, however, that pending final consideration of the suggested scheme the proposal to send Provincial Officers to England should be held in abeyance and that, in the meantime, Mr. Edwards' scheme should be circulated to Provincial Governments for opinion at the very earliest opportunity.

A. SMITH,  
*President.*

*The 15th February 1922.*

## APPENDIX II.

**An abstract of a paper on " Infectious Lymphangitis among cattle in the Madras Presidency " by Mr. V. Krishna Murthi.**

This disease is prevalent among cattle of the Madras Presidency, especially draught ones. The symptoms exhibited by the animals are similar to those observed by Colonel Raymond, the late Colonel Holmes, and Mr. Sheather in the outbreaks of the disease investigated by them. In the great majority of cases the superficial glands become involved and very occasionally the lungs are affected in which case the prognosis is unfavourable.

The mode of infection has been traced to some pre-existing wounds, especially yoke galls by both Colonel Raymond and the late Colonel Holmes. But the writer is of opinion that the infection seems to occur through some suctorial insect especially cattle lice.

The causative agent resembles the one referred to by Mr. Sheather. This can be demonstrated in smears of pus from natural as well as experimental lesions taken from the affected glands before they have undergone complete caseation. The organism shows extensive pleomorphism on culture media. Intra-peritoneal injection of cultures of organisms produce orchitis in guinea-pigs. Sections of affected glands reveal in early stages extensive formation of new connective tissue with suppurating foci. When the lungs become involved they are found studded with nodules which contain pus similar in character to that in the affected glands. Sections of affected areas of lung tissue reveal catarrhal pneumonia. The bronchial glands have not been found to be affected even in severe cases of lung affections.

The general treatment adopted was surgical opening of abscesses followed by antiseptic dressings. In complicated cases a vaccine prepared from broth cultures of the organism has been used and the results are recorded.



## APPENDIX III.

**An abstract of a paper on "Nasal Granuloma in cattle occurring in the Madras Presidency" by Mr. V. Krishna Murthi.**

Nasal Granuloma is an infective disease prevailing among cattle in the Madras Presidency. The disease is chronic in nature and limited to the nasal mucous membrane where they are found as small rounded growths varying from a large millet seed to a big pea and having the appearance of granulation tissue. The animals affected continuously sneeze and produce a snuffling noise during breathing accompanied by a thick muco-purulent discharge from the nostrils. No constitutional disturbance is generally noticed.

The causative agent is due to a variety of streptothrix. This variety is demonstrable in sections of tissues. In respect of staining characters it differs from *Actinomyces bovis* in its being both acid and alcohol fast and from other varieties of streptothrix described, in the lesions being particularly confined to the nasal mucous membrane. The mode of infection arises through wounds on the nasal mucous membrane coming in contact with infected food or water.

## APPENDIX IV.

## Note on "The advisability of amalgamating certain veterinary services in India" by Mr. T. F. Quirke.

On the grounds of economy I think that it would be possible to maintain greater efficiency of the veterinary services in this country with the same financial expenditure if an amalgamation could be arranged. The present system by which control of equine diseases in the selected horse breeding districts in the Province numbering fifteen is vested in the Army Remount Department (Agricultural Circular No. 4) is very unsatisfactory. Our experience is that there is continually overlapping of work between the subordinates of the two departments, whilst there is undoubted dissatisfaction in the villages in the method of dealing with equine diseases. The present veterinary strength of the Army Remount Department is insufficient to carry out the multifarious duties entrusted to them in addition to the work of dealing with equine diseases in the villages of their districts. Under the present arrangements only cases of equine disease when brought to our hospitals are dealt with by our staff in these districts. A Veterinary Assistant of this Department in course of his work visiting a village in which he detects equine disease is required to report the fact to the nearest representative of the Army Remount Department who will take the necessary measures for dealing with the disease. It would obviate the necessity for a second visit from a similarly qualified member of another Department, if diseases both equine and bovine were in the control of one Department, which could be in a position to allocate work more expeditiously than is the rule at present and so economise staff. In addition, the control of disease in the districts would be under the supervision of officers belonging to a whole-time India service with experience of village conditions and more in touch with the people.

Again, I feel that by the present system of working in water tight compartments the valuable professional experience which is obtainable in Army Remount Depôts, *e.g.*, Mona and Sargodha, on the horse breeding farms, and military dairy farms is denied to the Imperial and subordinate staff of the Civil Veterinary Department. As regards Imperial officers such experience would be invaluable to them throughout their service, whilst for the subordinate staff these depôts and breeding farms both for horse and cattle would act as a training ground under European supervision for gaining experience in the care and management of animals in health and disease before being placed in charge of our district hospitals. When one considers that the progress of veterinary work in this country depends so much on the efficiency of the individual members in the veterinary services it would appear important that such opportunities as the country does offer of gaining professional experience should be opened up for the benefit of the profession.

There are many other points which may be noted in favour of an amalgamation. I feel however that I have noted sufficiently with a view to the subject being discussed at the veterinary conference which I trust will include representatives from the different veterinary services in India.

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PROCEEDINGS  
OF THE  
CATTLE CONFERENCE

*Held at Bangalore on 22nd  
and 23rd January, 1924*

WITH APPENDICES



N2p2, N24  
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No. 550 F. of 1924.

FROM

S. MILLIGAN, ESQ., M.A., B.Sc.,  
*Agricultural Adviser to the Government of India,*

TO

THE SECRETARY TO THE GOVERNMENT OF INDIA,  
DEPARTMENT OF EDUCATION, HEALTH AND LANDS,  
DELHI.

*Pusa, 4th March, 1924.*

SIR,

I have the honour to submit the Proceedings of the Cattle Conference held at Bangalore on the 22nd and 23rd January 1924. These proceedings have been recorded by Mr. W. Smith, Imperial Dairy Expert, who acted as Secretary. The proceedings have been approved by the Conference.

I have the honour to be,

SIR,

Your most obedient servant,

S. MILLIGAN,

*Agricultural Adviser to the Government of India.*

# PROCEEDINGS

OF THE

## Cattle Conference

*held at Bangalore on 22nd and 23rd January 1924.*

The First Cattle Conference was held at Bangalore on 22nd and 23rd January, 1924, under the presidency of Mr. S. Milligan, M.A., B.Sc., Agricultural Adviser to the Government of India and Director, Agricultural Research Institute, Pusa.

The members present were :—

1. S. Milligan, M.A., B.Sc., Agricultural Adviser to the Government of India and Director, Agricultural Research Institute, Pusa. (President.)
2. W. Smith, Imperial Dairy Expert, Bangalore. (Secretary.)
3. G. S. Henderson, N.D.A., N.D.D., Imperial Agriculturist, Pusa.
4. F. J. Warth, M.Sc., Physiological Chemist, Bangalore.
5. H. Cooper, M.R.C.V.S., Pathologist, Imperial Bacteriological Laboratory, Muktesar.
6. Lieutenant-Colonel J. Matson, Assistant Controller, Military Dairy Farms, Northern Division, Kasauli.
7. R. S. Finlow, B.Sc., F.C.S., Offg. Director of Agriculture, Bengal.
8. H. H. Mann, D.Sc., Offg. Director of Agriculture, Bombay.
9. E. J. Bruen, Deputy Director of Agriculture for Animal Breeding, Bombay.
10. R. D. Anstead, M.A., Offg. Director of Agriculture, Madras.
11. R. W. Littlewood, N.D.A., Deputy Director of Agriculture for Live Stock, Madras.
12. D. A. D. Aitchison, M.R.C.V.S., Principal, Veterinary College, Madras.

13. A. C. Dobbs, B.A., Director of Agriculture, Bihar and Orissa.
14. D. Quinlan, M.R.C.V.S., Director, Civil Veterinary Department, Bihar and Orissa.
15. C. H. Parr, B.Sc., Deputy Director of Agriculture for Cattle Breeding, United Provinces.
16. Captain S. G. M. Hickey, M.R.C.V.S., Offg. Veterinary Adviser to the Government of the United Provinces.
17. Colonel G. K. Walker, C.I.E., O.B.E., F.R.C.V.S., Principal of the Punjab Veterinary College.
18. Sirdar Darshan Singh, M.R.A.C., Deputy Director of Agriculture, Punjab.
19. D. Clouston, C.I.E., M.A., D.Sc., Director of Agriculture, Central Provinces.
20. Mr. S. T. D. Wallace, V.C., B.Sc., Deputy Director of Agriculture in charge of Animal Husbandry, Central Provinces.
21. J. Charlton, M.Sc., A.I.C., Agricultural Chemist, Burma.
22. Rai Bahadur Kanak Lal Barua, B.L., Director of Agriculture, Assam.
23. J. N. Chakravarty, B.A., M.S.A., M.R.A.S., Deputy Director of Agriculture, Assam.
24. W. Davison, B.S.A., Live Stock Expert, Mysore.
25. Major R. W. Simpson, G.B.V.C., M.C., Superintendent, Civil Veterinary Department, Mysore.
26. C. V. Sane, M.Sc., B.Ag., Director of Agriculture, Baroda.
27. Mazhar Husain, M.A., B.Sc., Director of Agriculture, Hyderabad.
28. Ganesh Dutt, B.A., M.R.A.C., Deputy Director of Agriculture, Gwalior.
29. Rao Bahadur K. Nadkar, Diwan, Dhar State, Central India.
30. S. Higginbottom, M.A., B.Sc., Principal, Allahabad Agricultural Institute.
31. K. W. Forman, B.S.A., Professor of Dairying and Animal Husbandry, Allahabad Agricultural Institute.
32. Zal R. Kothavala, B.Ag., B.Sc., N.D.D., Dairy Superintendent, Bombay Municipality.
33. F. E. Traynor, Superintendent, Imperial Institute of Animal Husbandry and Dairying, Bangalore.



## PROGRAMME.

The programme before the Conference consisted of the following subjects approved by the Government of India for discussion :—

I. Subjects VII, VIII and IX on the agenda of the Thirteenth Meeting of the Board of Agriculture in India :—

*Subject VII.*—To examine the curriculum of the Imperial Institute of Animal Husbandry and Dairying at Bangalore and to consider the best means of co-operating with Provincial Governments and Indian States with a view to utilizing this Institute to the best advantage.

*Subject VIII.*—To consider the best means of utilizing Pusa, Bangalore, Wellington and Karnal dairy and cattle-breeding farms for the good of India as a whole.

*Subject IX.*—To review the steps being taken by Provincial Governments and Indian States for the improvement of cattle by better breeding and feeding and to make recommendations.

- II. (a) Aspects of the cattle-breeding problem on which common action seems necessary.
- (b) Cattle-breeding problems where the policy of one province or State particularly concerns other provinces or States.
- (c) Breeding operations, the distribution of pedigree stock, and the utilization for educational purposes of Government dairy farms in India.
- (d) Encouragement of the formation of pedigree herds of Indian cattle throughout the country. The control of pedigree records and the issue of pedigree and health certificates for all stock from such herds.
- (e) Grant of special facilities to cattle-breeders with a view to the improvement of their herds.
- (f) The development of the dairy industry in the country.
- (g) Disposal of surplus animals from all herds of Government cattle, and where practicable from private owned pedigree herds, and discouragement of the sale of unsuitable entire animals for use for stud purposes in the country.
- (h) Provision of facilities for the transport by rail of live-stock, fodder and milk.

- (i) Consideration of existing facilities for the supply of milk to large towns and the possibilities of their improvement.

### FIRST DAY.

The President read out the resolutions of the last Board of Agriculture regarding the formation of a Central Cattle Board. He intimated that Government could not see their way to sanction the Central Cattle Board but suggested periodical conferences of those connected with the industry of which this is the first. He added that this Conference would discuss Subjects VII, VIII and IX on the agenda of the present Board and report thereon to the Board, thereby acting as a Sub-committee. He pointed out that a Conference, as proposed by Government, although not fulfilling the functions desired for a Central Cattle Board, would do a great deal of good in that it will periodically bring the people concerned together. He proposed that the subjects on the agenda of the present Board should be taken first, and proceeded to deal with—

**Subject VII.—To examine the curriculum of the Imperial Institute of Animal Husbandry and Dairying at Bangalore and to consider the best means of co-operating with Provincial Governments and Indian States with a view to utilizing this Institute to the best advantage.**

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ation of  
ses.

Mr. Smith referred to the curriculum for the dairy managers' diploma (p. 21), at the newly established Imperial Institute of Animal Husbandry and Dairying, and explained the position as regards the future working of this Institute.

A point was raised by Rai Bahadur Barua as to the educational qualifications, required from students at the Institute.

Mr. Higginbottom referred to the necessity of a revision of these qualifications, and stated that at the end of the first session the question of the length of the course and the educational qualifications of candidates should come up for review.

Colonel Walker doubted if two years would be found sufficient for the course as outlined but agreed that experience alone could decide this. He intimated that he did not consider advanced scientific qualifications necessary as the course was one for dairy managers.

Mr. Dobbs agreed.

Colonel Matson was of opinion that the whole question of these two points could only be dealt with after the Institute had some

experience concerning the class of pupils likely to take this course.

Mr. Henderson said it was much more important that the pupils should know all about the practical and scientific sides of dairy work at the end of the course than high educational qualifications for new entrants should be insisted on. He added that the examination should be conducted by neutral persons and not by the teaching staff.

Mr. Bruen suggested the formation of two more courses, each to last six months, to train men now in Government employment on specified subjects connected with dairying. These courses should be entirely practical.

Mr. Higginbottom thought that any short course lasting less than a year would not be effective because climatic conditions varied much throughout the year. Generally speaking, he was against short courses.

Mr. Parr stated that he was entirely in favour of short courses and that there was a real demand in the country for this class of training.

Mr. Smith suggested that the success of such teaching depended more on the type of student than on his educational qualifications.

Mr. Henderson stated that at the Kilmarnock Dairy School all sorts of people were taken for the special short courses in specific dairy subjects, each case being considered by the authorities on its merits.

Mr. Bruen explained that the type of man he wished training for would only require to be instructed in a particular class of dairy work.

Mr. Davison indicated that he was entirely in favour of these short courses.

Mr. Dobbs suggested that Subject I of the syllabus for the dairy managers' diploma might be entirely eliminated, but after some discussion it was generally accepted that this could not be done without injury to the curriculum.

Mr. Davison stated that he found in his experience as an agricultural teacher in Mysore that more theoretical instruction was necessary in India than amongst Western nations.

Mr. Sane enquired if the men who would get the dairy managers' diploma would compete with agricultural graduates.

Mr. Smith replied this was unlikely.

Mr. Forman proposed the addition of an extra subject to the curriculum for the dairy managers' course, *viz.*, "The principles of Co-operative Dairying." This was agreed to by the Conference.

Dr. Mann concurred in the opinion previously expressed that outside examiners only should be employed in examining for the diploma. This was agreed to.

It was finally proposed by Colonel Walker and seconded by Dr. Clouston and passed unanimously :—

*This Conference approves of the institution of an Indian dairy diploma and of the curriculum drawn up by the Imperial Dairy Expert with the addition of the principles of co-operative dairying.*

Dr. Mann raised the question of the work to be done by post-graduate students at the Imperial Institute of Dairying, and it was agreed that he should later on discuss the subject with the President and Mr. Smith.

The Conference then proceeded to consider—

**Subject VIII.—To consider the best means of utilizing the Pusa, Bangalore, Wellington and Karnal Dairy and Cattle-breeding Farms for the good of India as a whole.**

In opening the discussion, the President said that the policy outlined for these Imperial farms was as follows :—

*Bangalore.*—(1) The system carried out by the military dairy farm of breeding towards Ayrshire and Holstein stock will be continued. (2) A small pure bred Sindhi herd will be maintained, selective breeding on milk records being followed. (3) A small pure Jersey herd for experimental purposes will be built up. (4) A small herd of Murra buffaloes for demonstration purposes will be kept.

*Wellington.*—As at (1) above but a few thorough bred Ayrshires have been imported and an attempt will be made to produce pedigreed Ayrshire cattle there.

*Karnal.*—(1) A pure bred herd of Thar-Parkar cattle has been established and will be developed on dual-purpose lines. (2) A small number of Thar-Parkars will be crossed with European blood for experimental purposes. (3) A small herd of pure bred Jerseys will be maintained to test their ability to stand the climatic conditions.

*Pusa.*—(1) The pure bred Montgomery herd will be maintained and further developed on existing lines. (2) Further selective breeding will be done in connection with cross-crosses. (3) Cross-breeding experiments as hitherto will be maintained. (4) Half-bred Ayrshire-Saniwal cows will be sired by a first class Montgomery bull of a milking strain with a view to preserving the heavy milk yield of the half-bred, and restoring the immunity to disease of the Saniwal.

Dr. Mann asked for information regarding the policy at Bangalore and as to whether half-bred bulls could be utilized for distribution in rural areas.

Mr. Davison explained the difficulties his Government has had in disposing of half-bred bulls from the Mysore State Dairy, and at the request of the President Colonel Matson stated that very valuable data was available in connection with the work which

the military dairy farms had done in the matter of cross-breeding generally with imported bulls.

Mr. Dobbs thought Colonel Matson should be asked to compile a note on the subject giving full details of all that the Military Department had done in this connection.

Rao Bahadur K. Nadkar referred to the experience of the Dhar State in using cross-bred cattle.

Colonel Walker called attention to the low degree of immunity to epizootic diseases which these animals carried.

Dr. Mann suggested that the Imperial breeding and dairy farms should deal with all questions relative to cattle-breeding which were of a general nature.

Mr. Higginbottom pointed out that in the end all these operations must be governed by the economic factor.

Colonel Matson agreed with Dr. Mann and further suggested that breeding farms in the provinces and Indian States should experiment primarily with local breeds. This Dr. Mann strongly supported.

Colonel Walker referred to the importation of outside stock into India and to a resolution passed by the Veterinary Conference at Lahore in 1919 indicating what the Veterinary Department believed to be the dangers underlying the distribution of half-bred or imported bulls. He referred to the conditions prevailing at Hissar and to the methods of working there. He explained that milk records were not kept at Hissar owing to paucity of staff and recommended that the Hariana breed should be taken up for development at Karnal. He believed the Punjab Government would gladly co-operate in providing a nucleus stock of good milking cows from Hissar and he suggested that Mr. Smith should go there and select these.

Mr. Smith stated that he would very gladly take up the development of the Hariana cow on dual-purpose lines at Karnal and thought that the financing of such experiments could be arranged.

Mr. Quinlan asked if it were necessary that the Karnal farm should pay.

Mr. Smith explained the financial position there.

Colonel Matson stated that he thought it would be a good thing if the Karnal farm could also take over the pure bred Hariana stock from the Military Department at Cawnpore. He thought that about 20 animals were available for transfer.

The President and Mr. Smith agreed that this should be desirable if the Military Department wished to part with these animals.

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s- Colonel Matson stated that in his opinion it was no use going further in cross-breeding with imported blood until they know definitely the results of mating the crosses with the crosses.

Mr. Littlewood and Mr. Henderson replied that experiments to determine this point were being carried out at Pusa and Coimbatore.

Colonel Walker referred to the difficulty of keeping cattle in India under ideal conditions.

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eds. Colonel Matson was of opinion that research should be carried out on the lines of proving if any of the Western breeds of cattle would thrive as pure breeds in India.

Colonel Walker was of opinion that at present this should be done on purely experimental lines, and he emphasized the fact that it was unlikely that any Western breed could permanently take the place of the excellent indigenous cattle of the country.

Mr. Sane suggested that experiments should be made in this direction with the Brown Swiss breed.

The President stated that it was the feeling of the meeting that further experiments in this direction should be carried out by the Imperial Department of Agriculture.

Mr. Higginbottom asked if at an early date there was likely to be established in India some central authority from which the results of all cattle-breeding experiments could be obtained by those interested.

The President explained that this question would be taken up later.

• The Conference then proceeded to deal with—

**Subject IX.—To review the steps being taken by Provincial Governments and Indian States for the improvement of cattle by better breeding and feeding and to make recommendations.**

The President called attention to the importance of this subject and invited the representatives of Governments present to express their views.

vinces. Dr. Clouston referred to his note (p. 36) defining the work done in the Central Provinces and gave details of the various activities of his Government in connection with cattle-breeding.

The President asked Dr. Clouston if he did not think it would be advisable in all the various districts of his province to develop a type of animal particularly suitable for that district.

Dr. Clouston replied that their general policy had been based on these lines.

Mr. Wallace emphasized the popularity of the Montgomery bull in his province and complained of the difficulties of obtaining pedigree animals of this breed.

Mr. Dobbs stated that in his province an attempt was being made to build up the local breeds particularly in the direction of milk production, but pointed out that cultivators in Bihar and Orissa would have nothing to do with the Montgomery bull.

Mr. Henderson asked Dr. Clouston what price his Government could afford to pay for suitable Montgomery bulls.

Mr. Wallace replied that after paying freight, etc., on a bull costing Rs. 150 at Pusa, they had no difficulty in obtaining Rs. 250 for this animal from the cultivator.

Colonel Walker asked if the Malvi breed could not be more utilized in the Central Provinces.

Dr. Clouston replied that his Government had a pure bred Malvi herd. He stated that these were first-class draft bullocks but of little use from the milk point of view.

Mr. Bruen described a Malvi type of cattle which were good milkers, and intimated that he hoped his Government would one day provide facilities for developing this breed.

Rao Bahadur Nadkar explained the various localities in which the different classes of so-called Malvi cattle were found.

With regard to Bombay, Dr. Mann explained that his Govern-<sup>Bo</sup>ment had devoted their energies to the development of four different types of Bombay cattle—Kankreji at Chharodi and Surat, the Amrit Mahal at Bankapur and the Sindh and Thar-Parkar at Karachi. Their efforts, he indicated, in developing and distributing these breeds, had of late years achieved a measure of success and the demand for bulls and the general interest taken in the cattle question in Bombay had greatly increased.

Mr. Bruen stated that he was against crossing of any kind whatever, and gave it as his opinion that the present deplorable condition of Indian cattle was due to indiscriminate crossing.

The President complimented the Bombay Government on the work they had done in connection with cattle-breeding, and called upon Mr. Anstead to say a word as to what the position was in Madras.

Mr. Anstead referred to the notes submitted (pp. 27 and 48) <sup>Ma</sup> and particularly referred to the difficulty in financing cattle-breeding schemes. He stated that he was anxious that a member of his

scientific staff should be enabled to undertake special research work on animal nutrition in co-operation with the Physiological Chemist.

Mr. Littlewood briefly described the position in his area as outlined by his note and referred the Conference to the text of the same (pp. 27 and 48).

Mr. Aitchison described to the meeting the evolution of the milk cow in Madras from the pure Ongole of fifteen years ago to the present day situation where 80 per cent. of the milk cattle of that city were European crosses of one sort or another.

Mr. Littlewood described the position in Madras in connection with the development of the Ongole (Nellore) cow, and stated that to-day a good milking cow of any breed in Madras would fetch Rs. 300, whereas a poor milker was only worth about Rs. 40.

The Conference agreed to recommend that the further development of the Ongole cattle farm in the Madras Presidency was urgent and desirable, and that the establishment of a farm for the development of the Kangayam breed of cattle should be established in that presidency.

Mr. Littlewood explained the necessity for a Government buffalo farm in the Madras Presidency and the system of crossing the local buffalo with Delhi buffalo bulls and the issuing of the progeny of this cross in the district.

Mr. Finlow referred to the operations of the Government of Bengal and its policy in regard to cattle-breeding, and stated that the possibility of obtaining a dual-purpose cow at Rungpore by crossing with Hansi type animals was promising.

The President expressed the fear that the breed now being evolved at Rungpore might be found too large for the districts, and that this factor would have to be taken into consideration in future. He also referred to a visit lately paid to the Rungpore farm and to the marked improvement in the cattle there.

Mr. Finlow gave the Conference a brief outline of a scheme drawn up by the Agricultural Adviser to the Government of India for utilizing part of the Pusa herd in Bengal in order to demonstrate the economic production of milk for the Calcutta market.

Orissa. Mr. Dobbs stated that it was necessary in discussing cattle in Bihar and Orissa to remember that there were no definite breeds of cattle in the province.

Mr. Quinlan explained the efforts of his department regarding bull distribution and emphasized the necessity for establishing a Government breeding farm in the Shahabad District with the object of developing a suitable Indian breed of dual-purpose cattle.



There was a strong demand for plough bullocks in the district and for milch cattle in the industrial area (coal fields) near by.

In reply to a suggestion by the President that as an experimental measure a few bulls might be bought and distributed in this area, Mr. Quinlan pointed out that his department could not properly look after one or two bulls. This sort of thing must be done in numbers if the necessary control of the animals was to be retained after distribution.

Mr. Bruen stated that he could provide a nucleus herd of Kankreji cattle for Bihar, but Mr. Quinlan doubted if this breed would be suitable in his province.

Mr. Henderson characterized the breed as showing signs of softness under North Bihar conditions.

In reply to Mr. Parr who asked if he had had any experience of the United Provinces cattle in Bihar, Mr. Quinlan stated that he had no personal experience.

Before the Conference adjourned for the day, Mr. Higginbottom raised the general question of the economic importance of cattle-breeding from a national point of view.

The President suggested that he should prepare a note on the subject which could be utilized as a preamble for the report of the Conference.

## SECOND DAY.

The Conference resumed on the morning of the 23rd January, 1924.

The President called upon Mr. Parr to say what the Government of the United Provinces were doing regarding cattle-breeding in that province. <sup>United</sup> <sup>Provinces.</sup>

Mr. Parr explained that the policy as originally laid down by the Civil Veterinary Department with slight modifications had been approved of by the Provincial Cattle Committee of his province. He went on to say that they had two main breeding farms in the province which principally dealt with two breeds—the Hissar imported from the Punjab and the local Mewati. There was a great demand in his province for bulls of the Mewati type. In addition to those reared at the Government farm, he bought numbers of yearlings and reared them until three years old when they were issued to the districts. He explained that, in addition to these two breeds, his Government maintained a herd of Montgomery cattle for the special purpose of providing stud bulls of a milking

type, but the demand for this class of cattle was practically *nil*, as the bullock sired by the Montgomery was not suitable for field work in his province. Mr. Parr pointed out that a dual-purpose animal was desired but, failing that, draught qualities were considered of more immediate importance than milk. He hoped eventually to start a special herd for developing the dual-purpose type by selection from the Hissar and Mewati breeds, and he would also like to keep a pure herd of Murra buffaloes as bulls of this type were in demand.

Colonel Matson agreed with Mr. Parr that Meerut would be an excellent situation for locating such a farm, and expressed the view that he was quite certain that Hissar cattle would do well there.

The President suggested that the United Provinces Government might consider a slight change of policy and drop the Montgomery breed altogether seeing that there was no demand for the bulls.

Mr. Parr described an experiment he was carrying out in the direction of acclimatizing Montgomery cattle in the Terai districts which gave promise of good results.

The President complimented Mr. Parr on the soundness of the provincial programme, and the Conference cordially supported his scheme for the establishment of a farm in the Meerut District.

The President then called upon Colonel Walker to give the meeting a review of the work being carried on in the Punjab.

Colonel Walker at the outset referred to the great quantity of literature available on the subject of cattle-breeding in the Punjab, and reviewed the history of the progress of Government effort in this connection since its inception. He specifically described the history of the Hissar cattle farm from the time it was taken over from the Military Department until the present day, and explained that a dairy had at one time been maintained on this farm but owing to financial considerations and in order to make sure that calves got all the milk of their dams it had ceased to function many years ago. He went on to say that he was altogether in favour of dairy records, and considered that the dairy managers' course now inaugurated at Bangalore would be valuable in the direction of providing trained managers to run the dairies in connection with the larger cattle-breeding farms. He quoted extracts from a paper submitted by Mr. Quirke (p. 28) and explained very clearly the system of bull distribution in the Punjab, recounting the gradual progress which Government had made in getting District Boards and private individuals to appreciate the supply of stud bulls provided. He added that to-day most of the stud bulls issued by his

department in the Punjab were purchased at half cost by the users. Colonel Walker gave a description of the policy in the Punjab of giving grants of land to encourage cattle-breeding on condition that the grantees maintained pure herds of different types of cattle and complied with stipulations of the Veterinary Department concerning the breeding, rearing and disposal of these animals. He specially referred to the difficulty experienced in distributing Montgomery bulls. He mentioned that the proposals of his department for the establishment of a special breeding farm in the Dhanni tract had not materialized owing to financial stringency, and consequently bulls of this type were being purchased and distributed for stud purposes, but he hoped that the Punjab Government would shortly have a farm in the Salt Range for breeding Dhanni bulls.

In reply to Mr. Aitchison, Colonel Walker stated that there was a very considerable foreign demand for Hissar cattle which was met as far as possible from the Government farm at Hissar.

The President pointed out the importance of cattle-breeding in the Punjab from the point of view of the whole of Northern India, and gave it as his opinion that the Punjab was the premier cattle-breeding province in India. Referring to a paragraph in Mr. Quirke's note (p. 35) which he read out, he stated that reliance on actual performance such as were to be obtained from milk records was preferable than judging animals purely from external appearances.

Colonel Matson stated that in his experience it was necessary to adhere to the Montgomery type if they wished to preserve the milking qualities.

In reply to Mr. Smith, Colonel Walker stated that he believed that more rapid progress in the development of the Montgomery breed would have been made if his Government had established their own breeding farms instead of depending on grantees for this purpose.

Colonel Matson stated that undoubtedly great progress had been made in the Punjab in connection with cattle-breeding, but he felt compelled to say that he considered the policy there fell short of the requirements of that province. He referred to a dairy farm of one of the grantees under official control with a herd numbering 400 Montgomeries without a single bull of known dairy or milk producing lineage.

Mr. Smith stated that he was of opinion that in the future authentic milk records should be kept in the Punjab of all herds of the milk breeds.

Colonel Walker agreed with both Colonel Matson's expression of opinion and Mr. Smith's suggestion.

The President, in calling upon Mr. J. N. Chakravarty to speak for Assam, explained the conditions relative to cattle-breeding in that province as he knew them.

Mr. Chakravarty regretted that up to the present his Government had evolved no cattle-breeding policy and that they had done very little in the direction of developing this industry. He referred to Mr. Blackwood's cattle survey and recommendations of 1912 but added that nothing had been done on this report.

Dr. Mann stated that what Assam required was a definite policy which could only be defined by a qualified expert.

Colonel Matson and Mr. Aitchison called attention to the significance of the mitton or wild ox of Assam, and Mr. Aitchison suggested that a cross between these animals and the cow might prove valuable for Assam conditions.

Mr. Davison explained what had been done in Canada in crossing the American bison with the domestic cattle of Canada and the results achieved therefrom.

It was agreed by the Conference that no definite policy could be laid down for Assam without expert examination of local conditions, and that such expert advice should be obtained and a clearly defined cattle-breeding policy laid down as early as possible.

The President then called upon Mr. Mazhar Husain.

Mr. Mazhar Husain stated that his Government had a cattle-breeding farm under the control of their Veterinary Department. He explained the system of distributing bulls and looking after them after distribution. His State had done nothing in developing milch cattle. The Ongole breed was kept at the Government farm. A system of purchasing bulls for distributing was in vogue and the Veterinary Department distributed these throughout the State. A cross-bred bull between the Ongole and the local breed was popular. Mr. Husain explained that the Agricultural Department hoped to start a cattle-breeding farm soon, and that it was proposed to transfer cattle-breeding operations from the Veterinary to the Agricultural Department at an early date.

On behalf of the Mysore State, Mr. Davison indicated that the cattle problem there was being tackled in two different ways. He gave as his opinion that the milk problem was not so acute as in other parts of India. He described in detail the fine breed of Amrit Mahal draught cattle in Mysore. The demand for export to other parts of India and to foreign countries for this breed was

large, and it was the policy of his State to encourage it. At the present moment the State purchased and issued stud bulls through local boards and maintained similar animals at the veterinary hospitals throughout the State. Mr. Davison expressed himself as in favour of subvention of private individuals or firms to induce them to breed suitable bulls for stud purposes. The Amrit Mahal Department had lately been transferred to the Agricultural Department. The department, which controls a State pure bred herd this is famous breed, was established in the 18th century. Mr. Davison stated that he believed this particular breed was probably as pure and as true to type as anything in the country, and he considered that the prospects of improving the breed and of developing its draught qualities in particular were very promising. In spite of financial difficulties he had to encounter he looked for great results in the future from the 20 large pure bred herds of this breed under his control. The idea of his department regarding dairying was to build up a herd of heavy milk yielding dairy cattle, particularly for the urban areas. For this purpose the State has a dairy farm at Mysore financed by His Highness himself where Sindhi and local cows are crossed with imported Holstein bulls.

Mr. Davison described the small stunted cattle found in the western districts of Mysore (Malnad). He pointed out that so far his department had not been able to tackle the problem of the improvement of this breed.

The President called attention to the fact that the solving of that problem would be of great interest to the country at large, as similar types of cattle existed in many of the wet tracts of India. The Conference agreed that it would be of great value to the country if the Government of Mysore could undertake the work of developing these cattle.

Mr. Warth raised the point as to the nutritive value of the available fodders in the Malnad area for cattle of different ages.

Mr. Davison called attention to the vast importance of feeding problems generally, and especially referred to the total lack of reliable information concerning chemical analyses and especially the digestibility of Indian feeding stuffs. He welcomed the establishment of the Imperial Institute of Animal Husbandry and Dairying in Bangalore and the presence of Mr. Warth at this Institute.

Mr. Warth described the work done by his department in connection with animal nutrition work since the sanction of Government to the appointment of the Physiological Chemist, and emphasized the necessity of increasing the facilities for this class of work in the future.

Mr. Anstead offered assistance in the work from Coimbatore.

At Mr. Parr's request Mr. Davison gave particulars of his system of touring stud bulls and referred to that part of his note (p. 41) which dealt with the subject. He gave it as his experience on the whole that the touring bull did more useful work than the stationary one.

Rao Bahadur Nadkar asked the reason why this touring system had been adopted.

Mr. Davison replied that the touring bulls did more work than the non-touring bulls, and this system was popular with the cultivator. Replying to an enquiry from Mr. Wallace, Mr. Davison said that the Mysore Government charged R. 1 per service for the use of stud bulls.

The President, in calling upon Mr. Sane to indicate what had been done in the Baroda State, drew attention to the very excellent note he had submitted to the Conference (p. 43) on the subject under discussion.

Mr. Sane amplified the points dealt with in his note and asked for an expression of opinion of the Conference on certain specific points raised in the same. He particularly referred to the impossibility of getting the cultivator to use male buffaloes and to the long dry periods as shown by the records of the Gir cows of Baroda.

Colonel Matson stated that in his opinion this defect of irregular breeding was a breed one.

Mr. Henderson thought that certain strains of the same breed showed this defect more than others. He pointed out that the weaning of the calf would facilitate regular breeding, and stated that at Pusa the Montgomery cows which were weaned gave a calf every 14 months and those of the same breed which suckled their calves only yielded a calf every 17 months.

Mr. Traynor pointed out that it was impracticable to wean cows which had their calves with them in previous lactations.

Mr. Bruen entirely agreed with this.

Colonel Matson stated that in the farms under his control the weaning of all classes of cows had been successfully carried out.

After further discussion the Conference were of opinion that it would not be advisable for the Baroda State to introduce Sindhi blood into their pure bred Gir herd for the purpose of obtaining more regular breeding.

Mr. Baluch, a post-graduate student at the Imperial Institute, Bangalore, was permitted by the President to describe his experience in connection with herds of Gir cattle at Junagad and Nava-

nagar and the improvement made in reducing the dry periods of these herds by careful treatment and feeding.

The President called upon Mr. Ganesh Dutt for a description of the work done by the Gwalior State.

Mr. Dutt stated that his Government had a cattle-breeding farm under the control of its Veterinary Department where Hansi cattle were crossed with the local breeds. He intimated that his Government hoped to shortly establish a pure bred herd of Malvi animals. He told the Conference that a dual-purpose animal would be the most popular type for his State.

On being called on by the President, Rao Bahadur K. Nadkar, <sup>Dh</sup> Diwan of the Dhar State, referred to the interest which His Highness the Maharaja of Dhar took in the cattle-breeding question. He explained that part of Dhar State was located in what was known as Malva and part in Nimar, and owing to the fact that two arterial main roads, namely, that from Bombay to Agra and the road from Mhow to Neemuch, passed through his State, they had the opportunity of seeing numbers of cattle of many breeds and types. In his State there were two distinct indigenous breeds—Malvi and Nimari—and these again were divided up into sub-breeds suitable to the various tracts in which they were found. The State gave special facilities to cultivators to breed animals of both breeds and to preserve the purity of these types. Rao Bahadur Nadkar explained the difficulty in introducing milking qualities into the local breeds as the people did not use milk freely in their diet. He gave particulars of the State cattle farm at Dhar where a pure bred Sindhi herd had been maintained. The bulls from this herd were being issued to cow breeders desirous of improving their milking strains. He gave it as his opinion that for milk producing purposes the Sindhi was likely to be more profitable in his part of the country than the Gir.

The President called attention to the fact that this State kept a cattle-breeding farm for an area of some 1,750 square miles and said that this was an example for the whole of India.

Mr. Smith described a visit he had paid to Dhar and expressed his appreciation of the work which the State had done. The Conference approved of the policy and endeavours of this State in connection with cattle-breeding.

A lengthy discussion took place regarding the formation of some <sup>Cent</sup> central body to stimulate interest in cattle-breeding in view of the <sup>Bur</sup> adverse decision of Government on the proposal of the last Board of Agriculture. It was agreed to recommend—

***That a Central Bureau of Animal Husbandry be established at Pusa under the control of the Agricultural Adviser to the Government of India, and with the Imperial Agriculturist as Secretary, and that the Secretary be given sufficient technical and clerical assistance to adequately deal with the work of this Bureau as it develops. The main functions of this Bureau to commence with would be :—***

- (a) *The collection and dissemination of information concerning cattle-breeding and allied subjects.*
- (b) *To assist in the disposal of surplus pedigreed stock specially from Government herds.*
- (c) *The standardizing of methods of milk recording and breed records to be adopted by Local Governments and Indian States.*
- (d) *The maintaining of general herd books of breeds, or of milch cattle as distinct from specific breeds found in more than one province or State.*
- (e) *The encouragement of the sale and use of pedigreed stock.*
- (f) *The keeping of the cattle-breeding departments of Local Governments and Indian States and those specially interested in scientific cattle-breeding in touch with each other.*

The Conference next adopted the following resolution :—

***That in future a Conference on similar lines and of similar composition and size to this be held yearly at centres to be agreed upon, the place of meeting to be selected by each Conference for its succeeding meeting. The Conference further recommends that the necessity for providing facilities to enable all officers interested to attend this Conference be impressed upon all Local Governments and Indian States.***

The President then introduced the subject of breeding records and the establishment of herd books.

Mr. Davison raised the question of the milk records of cows as apart from milk records of breed.

Mr. Higginbottom pointed out the immense importance of the official recognition of milk records, as without such they could carry little value and would not be regarded as authentic.

Colonel Walker stated that he thought milk testing and recording should be done by Local Governments. Mr. Smith agreed.

Colonel Matson, however, pointed out that there must be a central authority to deal with the breed records, as breeds were not limited to provincial boundaries nor would they adhere to such. The importance of inaugurating a standardized system of milk recording and of providing the necessary authority to certify such records was emphasized by the Conference.

The President suggested and the Conference agreed that the proposed Central Bureau should undertake this.



As comparatively few cattle are exported from India to foreign <sup>Heal</sup> countries, the granting of health certificates is one which principally applies to the movement of animals within the Indian Empire, and as the question of health certificates primarily concerns the Veterinary Department, the Conference recommended that it should be considered at the next Veterinary Conference which should define the qualifications necessary for persons authorized to grant such certificates.

A discussion arose regarding disposal of animals from the military dairy farms and from Pusa, and it was agreed from the facts brought to light that the Bureau should act as a clearing-house for information regarding sales, etc.

In dealing with II (e), Sirdar Darshan Singh detailed at length <sup>Fod</sup> a scheme submitted by him to his Government whereby landholders in the Punjab would be given special concessions in the direction of remission of water rate or land revenue or both, in order to induce them to grow more fodder crops and maintain more cattle on their lands. The fodder crops recommended to be catch crops entirely additional to those now grown.

Mr. Parr stated that in the United Provinces concessions of this kind had been given by the canal authorities for growing lucerne, but these had not been of great value owing to intermittent supply of water.

The President suggested that in the first instance such concessions might be given on an experimental scale to see whether Sirdar Darshan Singh's contention that the total revenue would not be lowered worked out in practice. The Conference agreed to this.

The President asked Mr. Z. R. Kothavala, Dairy Superintendent, Bombay Municipality, to explain the position regarding the milk supply of that city as stated in his note.

Mr. Kothavala reviewed the significance of the figures given in support of his written statement (p. 50).

The Conference considered that the foregoing expressed their recommendations regarding subjects (a), (b), (c), (d) and (g) of the provisional programme submitted to them. The Conference regretted that it was unable, owing to want of time, to deal with subjects (f), (h) and (i).

## APPENDIX I.

## The Imperial Institute of Animal Husbandry and Dairying.

(a)

(W. SMITH, *Imperial Dairy Expert.*)

It was originally proposed that two courses should be simultaneously inaugurated at the Imperial Institute of Animal Husbandry and Dairying, Bangalore: one for agricultural graduates who had served two years in the Provincial Agricultural Service and the other for dairy managers. There have been very few applicants for the former course and both courses will commence on January 1st. For the dairy diploma course the full number of pupils which the farm can accommodate (12) have been enrolled and many more suitable men who applied were referred to the Allahabad Agricultural Institute who are also teaching for this, the Indian Diploma in Dairying to be awarded by the Institute. The awarding of this diploma by the Imperial Institute of Animal Husbandry and Dairying to pupils of any agricultural college or institute which has the requisite facilities and staff for teaching practical and scientific dairying has been sanctioned by Government.

The proposed curriculum and conditions for entry for this diploma course are attached hereto (Annexures I and II) and suggestions will be welcomed as to altering or extending this syllabus for future courses.

In addition to the teaching of pupils who wish to take the Indian Diploma in Dairying, the Institute in accordance with an arrangement made with the Military Department will from 1925 undertake the training of some 8 to 10 military dairy farm managers yearly, but the training of these two classes of dairy farm managers will not fully fulfil the purpose for which the Institute has been established, and the following suggestions as to how it could be further utilized by Local Governments and Indian States are put forward:—

- (1) The carrying out of feeding experiments either for or contemporary with Provincial or State Agricultural Departments.
- (2) The testing of the digestibility of cattle feeds.
- (3) The investigation of technical dairy problems, either scientific or practical of any sort which Local Governments or Indian States may find themselves confronted with and which may be considered problems of national importance.
- (4) The giving of short special courses for college students or others from provincial or State colleges who wish to specialize in any particular dairy problem such as: (a) Urban milk supply, (b) Cheese making, (c) Casein manufacture, (d) *Ghi* production, (e) Butter making, (f) Dairy refrigeration and transport of dairy produce.
- (5) Failing the establishment of the Central Cattle Board by the Government of India, acting temporarily as an authority for testing and issuing milk record certificates for pedigreed milking herds in any part of the country.
- (6) Providing material and facilities generally for the Veterinary Departments of Local Governments and States in the direction of experiment in research work in connection with the prevention and treatment of diseases of dairy cattle.
- (7) Testing and reporting to all Local Governments and States on new makes of dairy machines, implements or processes.
- (8) Publishing from time to time bulletins relating to technical and scientific dairying.

## ANNEXURE I.

*Government communiqué.*

The Government of India have decided in connection with the working of the Imperial Institute of Animal Husbandry and Dairying at Bangalore to institute an Indian Diploma in Dairying on the lines of the British National Diploma in Dairying, to be granted to persons who have successfully completed a course of not less than two years' instruction at an institute

recognized by the Imperial Institute as capable of teaching upto a standard required for such diploma.

It is hoped that sooner or later agricultural colleges in India will possess the necessary staff and equipment and will be willing to train pupils for this diploma, but for the present the necessary course of instruction will be commenced on January 1st, 1924, at the Imperial Institute of Animal Husbandry and Dairying, Bangalore, where eight selected pupils will be taken. The course will last for two years with two months' vacation each year, holiday period will be the months of April and May.

The course will consist of practical and scientific training in the principles of cattle breeding, cattle feeding and management, dairy farm management, Indian and foreign breeds of dairy cattle, stock judging, diseases of dairy cattle, dairy farm buildings, milk production, handling and sale, butter and ghee manufacture, dairy chemistry, dairy bacteriology and dairy farm book keeping. Ample scope is available for practical and laboratory work at Bangalore.

Practical instruction will be under the direction of the Imperial Dairy Expert and the scientific training will be carried out under the control of Physiological Chemist to the Government of India.

Students must be of good character and over 17 years of age. The minimum educational qualification necessary for admission is Matriculation or the School Final Examination, but in special cases the Imperial Dairy Expert will have power to waive this condition.

Applications for admission should be addressed to the Imperial Dairy Expert, Bangalore, to reach before the 1st December, 1923.

A tuition fee of Rs. 15 will be charged for each student for each month or part of a month he is actually in residence at the Institute. Accommodation will be provided free of charge which pupils must avail themselves of. No stipends will be paid to students and all travelling expenses must be borne by students themselves.

At close of the course an examination will be held for those students who have satisfactorily completed the course of instruction and the Indian Diploma in Dairying will be awarded by the Imperial Institute of Animal Husbandry and Dairying to the successful candidates.

## ANNEXURE II.

### *Syllabus of studies for dairy manager's course.*

#### *Animal husbandry.*

I. PRINCIPLES OF BREEDING :—Heredity, Selection, Influence of sire and dam, Breeding systems, Mendelism.

II. FEEDS AND FEEDING :—Functions of food, Food nutrients, Digestion of food, Food requirements, Feeding standards including balanced rations, Indian feeding stuffs.

III. DAIRY FARM MANAGEMENT :—Cultivation of special fodder crops for dairy cattle feed Irrigation, Rotation of crops, Dairy farm buildings (cattle sheds, godowns, calf pens, silos, milk recording rooms, and purely farm buildings).

IV. DAIRY CATTLE :—Indian breeds of milch cows, Foreign breeds of milch cows, Indian breeds of milch buffaloes, Draught cattle (bullocks and buffaloes), The dual-purpose animal, Calf rearing.

V. STOCK JUDGING :—Handling and examination of the living animals to estimate age, milking qualities, draught qualities, value, etc.

VI. DISEASES OF DAIRY CATTLE :—Signs of health and disease, Treatment of wounds and minor troubles, Contagious diseases, Prevention of disease.

#### *Dairying.*

I. DAIRY BUILDINGS :—Manager's residences, Dairy factory buildings, City dairies, Farm dairies, Drainage, ventilation, and sanitation of dairy buildings.

II. MILK PRODUCTION, HANDLING AND SALE :—Milking by hand, Milking by machine, Recording of milk yields, Milk pasteurising by different methods, Milk cooling, Milk bottling and distribution, Cold storage and rail transport of milk, Marketing dairy produce.

III. BUTTER AND GHEE MANUFACTURE :—Separation of milk by hand and power machines; Treatment of cream for butter making; Churning by hand and power, Working, salting, and making up, packing, cold storage, and transport of butter; Ghee manufacture, packing and transport.

IV. CHEESE MANUFACTURE :—Manufacture of Cheddar cheese, Curing hard cheese in cold storage, Manufacture and ripening of soft cheese.

V. UTILIZATION OF DAIRY BY-PRODUCTS :—Casein manufacture, Whey butter, Dried and condensed milk, etc.

VI. DAIRY CHEMISTRY :—Testing of new milk, separated milk, butter milk and whey by Gerber or Babcock and quantitative methods; Testing of butter, cheese and *ghee* for fat contents, moisture, salt, etc., etc.; Detection of preservatives in milk and dairy products; Detection of adulterants in milk and dairy products; Analysis of feeding stuffs and detection of adulteration of feeding stuffs.

VII. DAIRY BACTERIOLOGY :—Principles of cleanliness; Estimation of bacterial contents of dairy products, air and water; Preparation of pure cultures for cream ripening and cheese manufacture.

VIII. DAIRY AND FARM ENGINEERING :—Cultivating and harvesting implements and machines; Prime movers, steam boilers, steam engines, internal combustion engines and electric motors; Pumps and water raising apparatus; Farm yard machines, silage cutters, grinding mills.

*Dairy machinery* :—Pasteurisers, milk pumps, coolers, cream separators, churns, butter-workers, milk sterilizing plant, *ghee* boiling plant, milk testers.

*Refrigerating machinery* :—Principles of mechanical refrigeration, compressors, condensers, evaporators, ice making systems, construction of cold storage rooms.

*Milk delivery vehicles* :—Their construction and maintenance.

IX. BOOK-KEEPING AND RECORDS :—Milk records, animal history records, pedigree records. Cultivation registers, commercial dairy book-keeping including preparation of trading accounts, balance sheets and costing systems.

(b)

(SAM HIGGINBOTTOM, M.A., B.Sc., *Principal, Allahabad Agricultural Institute.*)

I consider the course covers the ground very well. My idea of it is that if the men who take it are going to be sent out at the end of their training to set up dairies for Provincial Governments or Indian States then I think the students are too young, and time should be lengthened by one year. If every student passing out from this course could have at least two years in one of the Government military or other commercial dairies then possibly he would be fit to take up work and manage a dairy under a Provincial Government or Indian State.

Under any consideration, I would favour the course being lengthened to three years and the age for those admitted being raised to eighteen. The students who will come will have to undergo such a revolution in their thinking, their manner of living, that the first year will be very largely one of re-adjustment to these unusual conditions. There will be so much practical work which will be done at hours not recognized by the ordinary Indian students as the legitimate hours for study. By that I mean their having to get up early in the morning to feed the cattle, the staying up late at night with a cow about to calve, the milking at hours in the night in order to get the milk out for early morning. These things are so different from what the students have been used to that the first year will largely be occupied with a change of mental attitude and my experience is that it is very difficult to hasten this process.

Again, if the student is to be in charge of a dairy after getting through his course, great responsibility will be laid upon him, and I doubt whether two years' time will be sufficient for development in accepting responsibility. A boy who starts in at eighteen and passes out at twenty-one seems to have a greater chance of success than a boy who starts in at seventeen and passes out at nineteen.

One important matter is not down under this subject but it seems to me to bear on the success of dairying, and that is the training of the ordinary Indian *gowala*. At present he seems to do everything possible to prevent a dairy from being successful. Their honesty could be improved, their sense of responsibility deepened. They are not happy when the calves are taken away from the cows. They do everything they can to prove that the cow will not give milk unless the calf sucks it. In spite of much teaching, they milk with dirty wet hands. Very few of them will milk a cow entirely dry, and experience shows that few things will dry a cow quicker than being incompletely milked. I would like a discussion as to the best way to convert the ordinary *gowala* to what we recognize is for the economic well-being of the dairy industry in India.

## APPENDIX II.

**The best means of utilizing the Imperial dairy farms for the  
good of India as a whole.**

(a)

(G. S. HENDERSON, N.D.A., N.D.D., *Imperial Agriculturist.*)

The Pusa herd has been in existence since 1904 and consists of pure bred Saniwal cattle and a cross-bred herd formed by crossing the rejected Saniwal cows with Ayrshire bulls.

The herd numbers about 400 head and the non-experimental area of the Pusa farm is cropped with a rotation designed to supply the total grain and fodder required by the cattle. The herd is consequently self-supporting, and as more waste land is being gradually levelled and irrigated the numbers of the herd will be capable of considerable expansion.

This farm is thus on a different basis from the other farms mentioned, as no attempt is made to handle the milk. The milk is sold direct from the cows. A good local market is being built up, and it is expected to work up to a sale of Rs. 100/- per day, besides the supply of the Pusa Institute. This would give a return of Rs. 40,000/- for sale of milk and Rs. 10,000/- for sale of surplus stock or Rs. 50,000/- with a budget expenditure of about Rs. 50,000/- for supplies and services for the whole Agricultural Section at Pusa.

The Pusa farm consequently forms a self-contained demonstration such as could be followed by a zemindar without any considerable outlay in machinery and buildings necessary to handle milk

The increase in the average milk yield per cow in 10 years is as follows :—

Year	<i>lb. per head per cow</i>
1913	5.3
1914	7.5
1915	8.3
1916	6.6
1917	7.6
1918	7.2
1919	9.7
1920	10.5
1921	10.7
1922	12.0

During the last 10 years the following young breeding stock with a milk pedigree of 3—4 generations behind them, have been sent to the following provinces in India :—

Bihar, 409 ; Central Provinces, 40 ; United Provinces, 19 ; Punjab, 3 ; Assam, 7 ; Bengal, 28 ; Burma, 6 ; Hyderabad State, 13 ; Madras, 7 ; Travancore State, 6 ; Military Dairy Farms, 6 ; Foreign Governments, 17 ; Number of animals sold, 561.

The results being obtained on the Pusa farm in regard to fodder crops, rotations and up-keep of fertility must prove of considerable value. The annual outturn from an area of 400 acres at Pusa has doubled in 10 years.

In view of the above facts, I would suggest that the best method of utilizing the Pusa farm is to allow it to expand on the lines on which it is at present working.

(b)

(S. T. D. WALLACE, V.C., B.Sc., *Deputy Director of Agriculture, in charge of Animal Husbandry, Central Provinces.*)

There is an increasing demand in the Central Provinces and Berar for cows and bulls of milking breeds such as the Saniwal or Montgomery breed. During the last three years a herd of this breed has been established on the Telinkheri diary farm, Nagpur.

The herd contains at present about 30 cows, and it is not expected that a herd of more than 35 to 40 cows with young stock can be maintained on the farm; moreover, it will be several years before the standard of this herd can be raised to the standards of the herds at such centres as Ferozepore, Karnal and Pusa.

As the Telinkheri herd is still in the early stages of development, it follows that for some years to come the female stock which we have available for disposal to the public will either belong to the aged or draft class or animals of a young age which cannot be considered first class. The quality of the bulls will only improve as the quality of the breeding herd improves.

If we are limited to the surplus which can be sold off this single farm (in the event of another farm being opened under present conditions the stock would have to be built up from the surplus from the Telinkheri farm), then the introduction of an improved milking strain into the Central Provinces and Berar will be a very slow process.

The general public will, therefore, have to obtain a considerable portion of the animals they require from the longer established herds at such centres as Ferozepore, Karnal and Pusa. One of the great obstacles in the way of importing cattle from these centres into this part of India is the high railway freight and the long time occupied on the journey; if wagons are attached to passenger trains the freight charge is still further increased.

- (1) I, therefore, consider that one of the most important factors in utilizing the herds at Pusa, Bangalore, Wellington, Karnal and other centres is the granting of special facilities for the conveyance of stock from these farms by rail at special rates. It is desirable that rates on all classes of live-stock should be reduced, but if that is not possible a special concession should be made for pedigree stock conveyed from these Government farms to other parts of India. Such consignments of cattle should be conveyed by passenger trains at a special concession rate which should be below the ordinary goods traffic rate.
- (2) Before surplus stock is sold by auction a reasonable upset price should be fixed and lists showing pedigree and upset price circulated to the Directors of Agriculture in each province, who should then be asked to state if they wish to have any of the animals shown on the list at the fixed price stated. This arrangement only to hold good in cases where the cattle are to remain in the possession of the Local Government.
- (3) As it is often difficult to get money included in a budget for the purchase of pedigree stock, it is desirable that some form of book transfer should be employed which would do away with the necessity of providing money or the obtaining of special sanction from the Local Government. In other words, cattle required from one of the farms should be transferred to the Local Government and the amount of the upset price credited to the farm concerned from the revenues of the Central Government. Presumably the farms mentioned are to be maintained very largely out of revenues contributed directly or indirectly by the various Local Governments to the Central Government.

(c)

(SAM HIGGINBOTTOM, M.A., B.Sc., *Principal, Allahabad Agricultural Institute.*)

I regard cattlebreeding farms in India, managed and financed by the State, with a well worked out programme which will be strictly adhered to until completed, as being one of the most important factors in bringing economic success to the dairy industry in India. Not five per cent. of the cows of India to-day pay their way. The Government military farm at Ferozepore shows what can be done by the careful selection of animals of a recognized Indian milking breed, and the breeding up and ruthless culling of animals falling below a certain standard.

All the recognized dairy breeds of India should be given a fair trial as has been done at Ferozepore with one breed. In addition to this, I believe that all the recognized dairy breeds of Europe should be tried out by crossing females of Hissar, Kosi, Montgomery, Saniwal, Sindhi, and other Indian breeds with Friesian, Milking Shorthorns, Brown Swiss, Ayrshire, Guernsey, Jersey, etc., and the records carefully kept for a number of years. I think it can be assumed by now that the opinion of the men best qualified to judge in India has settled down to the desirability of the dual-purpose type, and not the dual purpose we speak of in America and England where milk and meat are required, but the dual purpose of milk production and draught. The dual purpose of milk and beef seems mutually contradictory. The dual purpose of milk and draught is ideal; the big boned, big framed, big girthed ox to pull a plough and the female of the same type with ample capacity to handle feed and to turn it into milk. It would not be possible at any one farm to undertake the crossing of all these breeds, but I believe a distribution to different farms could be made and a programme adhered to for at least ten years and then we would have something certain to go upon that would be of saving to the whole of India. We would know then which of these crosses would have the necessary ability to stand the diseases and climate of India and yet to be economical producers of milk and draught. At Allahabad we would undertake to stick to a programme. We have Sindhi and Ferozepore cattle and could undertake to provide American Friesian and Jersey bulls.

It seems also fundamental to establish regular herds of the Indian pure bred and have a herd book and to have auctions at stated intervals when really first class animals would be sold out of these herds. The best cattle to-day are undoubtedly in the Government military dairies but it is not usually possible to buy any of the good ones from them, that is, if a good cow is sold it is usually because of some blemish, there is some reason why the Government military dairies are willing to part with her, so that it is almost impossible for a private individual to get a foundation for a herd of good cattle. If the public knew that they could get really good cattle for a foundation herd I believe there is enough pride and ambition in many of the Indian zemindars and wealthy men to establish breeding farms of their own.

Furthermore, it would be necessary to arrange for an exchange or circulation of the bulls to prevent too much inbreeding, and also to find out the bulls of outstanding merit. A bull in India is usually getting on in years before his daughters come into milking and where bulls of outstanding merit are discovered they need special treatment and mating with selected females. If this were done for a few years the standard would be very much raised.

## APPENDIX III.

## Improvement of cattle by better breeding and feeding.

(a)

(E. J. BRUEN *Deputy Director of Agriculture for Animal Breeding, Bombay.*)

In the Bombay Presidency there are several breeds which have been fairly pure. Each one of these breeds has been bred to suit the particular condition of the tract in which it is found ; for instance, the big-framed, long-legged Kankrej is particularly suited to the sandy, deep-rutted, so-called roads of Gujarat. The Dangi, a small compact breed bred in the Western Ghats, is particularly useful in this stony region with a heavy rainfall. This breed is in all probability the only breed in India which will work in wet rice lands—the buffalo excepted.

Each one of these pure breeds has been bred by a professional breeder. This breeder in the past has been in the habit of leaving his home with the cattle just after Dipavali. He grazed his cattle wherever the conditions were most favourable, travelling for hundreds of miles away from his home often in very dense forests and returning home just again before Dipavali, when he disposed of any saleable young stock males. In itinerating from place to place, the variety of grazing his cattle received was in all probability a sufficiently nutritious ration to keep his stock in thriving condition. Disease was practically unknown as the sick, lame, etc., were usually left behind, to be devoured by wild animals. In this manner it was a case of the survival of the fittest and his breeding was conducted by selection of the fittest. He was, therefore, able to maintain a fair standard.

Stud bulls were obtained by mutual exchange ; no money being paid, he felt it cost him nothing. The extra male progeny being left at home or sold to a cattle or a bullock raiser, there was no fear of indiscriminate breeding as the only bull with the herd was the herd bull, which the breeder selected.

To-day owing to restrictions in forests, the bringing under cultivation of grazing lands, the paying of fees to graze cattle in different localities has restricted this breeder to a particular locality, and owing to the unprofitable business this breeder has now to remain more or less stationary as he has to supplement his income derived from cattle by other operations. This has led to indiscriminate breeding as the bulls and cows must remain together. Disease is spread and remains in a herd; the restricted grazing does not provide the necessary variety and hence the rapid deterioration.

It will be seen that by the above methods cattle were raised very cheaply and a fairly good standard maintained. These conditions having altered considerably within the last few years, it is necessary for some very substantial steps to be taken in substitution of the above, which will at the same time not raise the price of cattle, especially bullocks, to enable the cultivator obtain his necessary draught cattle at a price that will not hinder him carrying on his work.

To obtain these conditions the primary essentials are cheap food and fodder, combined with the raising of good pure-bred stud bulls, the better control of disease and the introduction of castration on a wholesale scale.

*Suggestions for improvement.*

In the Bombay Presidency each pure breed is practically restricted to 4 or 5 taluqs where professional breeders raise cattle. These areas are as a general rule not in a very good state of cultivation and there is a fair amount of land available for grazing, hay and silage-making. The raising of stud bulls must fall on Government, as under altered conditions it is practically impossible for the cattle breeder to produce a really sound good, pure-bred bull. Government cannot be expected, however, to raise sufficient bulls to meet the requirements of the whole country ; but it is possible to situate a stock farm in the centre of breeding of each breed. Thus each stock farm would be required to produce the necessary bulls for 4 or 5 taluqs.

The farm manager would control these 4 or 5 taluqs, a register or herd book being maintained on the farm of all pure bred cows in these taluqs and in time this whole area would be more or less pure and improved. The farm manager would also improve grass lands, teach



and encourage storage of fodder in the form of hay or silage, the grass lands in these areas being let on as reasonable terms as possible.

The annual cattle show, where substantial prizes would be given, would help considerably in improvement.

(b)

(R. W. LITTLEWOOD, N.D.A., *Deputy Director of Agriculture for Live-stock, Madras.*)

*Cross-breeding experiments.* Cross-breeding with Ayrshire, Sindhi and Saniwal cattle which was commenced at the Bangalore Military Dairy four years ago has now been transferred to the College Dairy at Coimbatore. Thirty-two cross-bred cows and heifers born in the experiment were purchased from the Military Dairy in January 1923. Four of these animals died within four months of arrival at Coimbatore, two of the casualties being due to red water.

Cross-breeding is now being continued by using  $F_1$  and  $F_2$  generation bulls on the above stock.  $F_1$  generation heifers are a very promising lot as regards colour and size. The milk yields of  $F_2$  generation taking them as a whole are far better than their dams.

One  $F_2$  generation heifer has calved at the age of 1 year and 11 months. Five others are in calf.

The number of cows and heifers in the college herd now is . . . . .	56
The number of cross-bred bulls are . . . . .	18

The cross-bred bulls are being used also for working purposes on the farm, till the results of their services can be seen.

The daily average milk yield of the college herd has now risen to 15 lb. a day, and in 1912 the daily average was 4.5 lb. a day.

Cross-breeding is being carried on in different parts of the presidency and advice is given by this section as regards feeding and rearing. A cross-bred herd was purchased from Kirkee Military Dairy for the Central Jail, Vellore, and a cross-bred bull from this department has been loaned to the jail authorities.

Two planters have taken up cross-breeding in this presidency and have purchased Ayrshire bulls.

*Madras milk supply.* Six cross-bred bulls and three buffalo bulls are at stud in Madras. These animals took the place of the Ayrshire bulls imported in 1920. Four hundred and ninety-nine services have been performed by the cross-bred bulls and 377 by buffalo bulls. Most of the calves born have been inspected by the staff of the writer. There were quite a number of other births to the animals, but the animals could not be traced as the mothers were sold after they had gone dry. The Agricultural Demonstrator, Madras, advises the milkmen on the feeding and rearing of calves, but the milkmen do not pay much attention to his advice. In the majority of cases the calf is only half fed.

The Government this year, on my recommendation, have sanctioned a sum of Rs. 250 to be given away as prizes at the S. P. C. A. Show this year for the best-cared-for calves owned by professional milkmen and born to our cross-bred bulls. The news has been well received by the milkmen and they are now paying more attention to the feeding of their calves.

*Ootacamund hill station.* The one surviving Ayrshire bull has been at stud in this hill station a year and has got some very good calves. There are a large number of European and Indian gentlemen in this hill station who own Australian, Ayrshire, Jersey and cross-bred cows and the placing of the Ayrshire bull in this station is very much appreciated by the dairy people.

*Coimbatore dairy.* Besides the cross-breeding which is being carried on on this farm, there are also a Sindhi herd and a Montgomery herd. The Sindhi herd consists of—

Cows and heifers . . . . .	18
Bulls . . . . .	2

Two of the Sindhi cows have yielded over 6,500 lb. in a lactation and the two bull calves born to these cows are ready for service, and it is hoped to obtain some very good young stock from these bulls.

The Montgomeries purchased from Pusa are not a success. Out of the five purchased, only one has calved during the last 18 months. The other four are all in calf now and they have been dry for too long to be at all profitable on the dairy farm.

*Ongole Cattle Farm, Chintaladevi.* The Ongole Cattle Farm, Chintaladevi, is now in its fifth year. Two years ago enquiries were made all over the tract for a good breeding bull for the farm but it was impossible to procure the right kind of bull; and so we had to continue with the bulls which were purchased at the beginning of the farm. There are now three very good young bulls which have been reared on the farm and these animals will be kept for breeding purposes. There are 22 bulls over two years old which I intend to sell in Ongole in the month of February 1924. Two Ongole bulls have been put at stud on experimental stations and a small herd of one bull and five heifers sold to a Raja as a nucleus herd.

It is also hoped to supply the experimental stations with work animals bred on this farm.

The herd has been thinned out and all bad breeding cows have been disposed of. The number of cattle on the farm at present is—

Cows . . . . .	41
Heifers over one year . . . . .	23
Bulls over one year . . . . .	26
Calves under one year . . . . .	32
Breeding bulls . . . . .	4

*Kangayam herd.* As funds are not available for the Kangayam farm, the Kangayam herd from Coimbatore was transferred to Chintaladevi 18 months ago.

Five young bulls have been transferred to Coimbatore for stud and sale purposes. The herd now consists of—

Cows and heifers . . . . .	8
Bull . . . . .	1
Calves under one year . . . . .	6

*Buffaloes.* The Buffalo Breeding Station which was commenced about five years ago at Samalkot did not produce the desired result. It was thought that by purchasing good buffalo bull calves from selected dams, and by good feeding, we could obtain a few good breeding bulls. After rearing these animals to the age of three years, I tried to sell them to ryots requiring buffalo bulls, but they all refused to purchase as they were not big enough for the purpose. The three best bulls were kept for breeding purposes in Madras and the remainder sold in the district for work animals. †

A farm has now been commenced at Guntur and it is intended to breed a cross-bred Delhi country buffalo which will produce larger animals and also tend to increase the milk yield. For this purpose the Delhi buffalo bull has been used on the country she-buffalo. I am now working with the first cross.

Bulls of the Kangayam and Ongole breeds are at stud at most of the experimental stations, also Delhi buffalo and country buffalo bulls are at stud.

*Premiums.* Five premiums of hundred rupees each have been granted to societies and private owners towards the maintenance of breeding bulls in various districts.

*Feeding.* Minor experiments have been conducted on milch cows by substituting different cakes, including rice meal, in the ration and silage compound to green grass. The new Assistant Agricultural Chemist is undertaking feeding experiments at the Central Farm, Coimbatore, to find out the digestive co-efficient.

(c)

(T. F. QUIRKE, M.R.C.V.S., Chief Superintendent, Civil Veterinary Department, Punjab.)

In a previous note submitted at the last Board of Agriculture held in Pusa 1922, the results of the cattle census held in 1919-20 were reviewed which disclosed a diminution amounting to 1.9 millions in the cattle population of the Punjab since 1914. This diminution was ascribed principally to epidemics of diseases and fodder famines which are the causes of very serious

mortality, also that for various economic reasons zemindars were keeping less cattle for breeding purposes than formerly. It was noted that there was no need for pessimism as to the actual numbers of cattle which were, we considered, more than sufficient for the normal carrying capacity of the country, provided proper steps were taken by means of more careful breeding and rearing to raise the general standard of efficiency of our animals.

The results of the last census held in 1923 have only recently been published; these may suitably be considered from the following abstract prepared by the Director of Land Records Punjab, which enables an effective comparison to be made between the various classes of stock, for the different census years :—

Year	(MILLIONS)							
	Cows	Cow buffaloes	Bulls. Bullocks	Male buffaloes	Young stock	Total cattle	Sheep	Goats
1904 . . .	3.0	1.9	4.1	0.6	3.7	13.3	4.1	5.5
1909 . . .	3.4	2.2	4.2	0.6	3.8	14.2	4.6	4.2
1914 . . .	3.7	2.6	4.6	0.8	4.0	15.5	4.7	4.4
1920 . . .	2.7	2.4	3.9	0.4	4.9	14.3	4.0	3.1
Corrected . . .	3.0	2.7	4.3	0.5	3.8	..	..	..
1923 . . .	2.7	2.6	4.1	0.4	5.1	14.9	4.1	4.3
Corrected . . .	3.0	2.9	4.5	0.5	4.0	..	..	..

One notes that since 1920 there has been a very appreciable increase in the total number of cattle, sufficient to allay the fears of those economists whose policy it has been to represent the cattle-breeding situation in terms of quantity rather than quality. There has also been a notable increase in the number of bulls and bullocks, the latter indicating a sufficiency of plough cattle for the cultivation of the land. There would, therefore, appear to be no cause for alarm as to the actual numbers of cattle if it could be assumed that the quality was up to the standard required.

Before considering the general question of cattle improvement it is well to consider what are the main causes underlying the very apparent apathy of the ordinary zemindar in adopting a more careful system of breeding, in other words, we need to consider the question from the zemindar's point of view. We see from the reports of co-operative societies of the enormous losses sustained by Punjabi zemindars on account of cattle mortality. In 1919-20 out of 173,763 members more than 25,000 had to borrow over 16 lakhs of rupees to replace cattle; in 1920-21, over 18 lakhs; in 1921-22, nearly 16 lakhs; whilst in, 1922-23, 13 lakhs were borrowed for this purpose.

It seems a reasonable proposal, therefore, from the zemindars of this province that the first essential to progress in cattle breeding is to ensure as much protection as possible against contagious disease, that they may not have to suffer the expense of rearing animals which will afterwards fall victims to contagious diseases. In an agricultural country like India, where the mainstay of the zemindar is his live stock, the necessity for a properly organized Veterinary Department is paramount. In this province the necessity for strengthening the staff of the Civil Veterinary Department has long since been recognized: in fact, the Punjab has for many years enjoyed the reputation for being the premier province in India as regards veterinary organization. The province for the purpose of veterinary administration is divided into three Circles, the North, South and Central Circles, each in charge of a Superintendent with a Deputy Superintendent under him. The subordinate staff comprises 27 Veterinary Inspectors and 213 Veterinary Assistants. It is hoped that in time each division will have its own Deputy Superintendent, each district its own Veterinary Inspector and each zail its own Veterinary Assistant. We must, however, point out that, even with an unlimited staff at our disposal, little headway is possible against contagious diseases in this country unless we can exercise powers to control the movements of diseased animals and to take other necessary effective measures for the control of outbreaks. We consider this a sufficient reply to criticism occasionally made on the

work of this department with regard to contagious disease which we grant in the presence of a Veterinary Department continues to exact a heavy toll on the animal population of the province, for the reason that in the absence of suitable legislation it has no powers to deal effectively with contagious disease in this country.

It should be quite clear then that even the most progressive cattle breeding policy conducted by this department cannot hope to succeed which attempts to ignore the necessity for such protection. It is to be hoped therefore that zemindars will soon recognize the need for more thorough measures being adopted against the heavy mortality from contagious diseases which is largely preventable. The Financial Commissioner, Sir P. Fagan, in reviewing the work of the co-operative societies in the Punjab for 1919-20, noted as follows:—

“Over 16 lakhs, nearly one-quarter of the whole sum lent, were advanced for replacement of cattle. This last item clearly demonstrates the enormous burden borne by the cultivating classes on account of high cattle mortality and leaves no room for doubt that much greater veterinary assistance is needed than is available now.”

In reviewing the work of this department for 1921-22, the Financial Commissioner, Mr. E. R. Abbott, noted as follows on the Punjab cattle breeding industry: “It is desirable both to arouse a desire for improvement and to provide facilities for gratifying the desire when aroused. To secure any general co-operation in cattle breeding it has first to be brought home to the cattle owner that it pays to keep a good rather than a bad animal. Zemindars are far from convinced of this at present owing to the mortality from contagious diseases and from starvation. Veterinary knowledge can assist to remove the former cause but for the latter measures to secure a supply of fodder in famine seasons are necessary. But here again the difficulty arises that the expense of storing fodder is greater than the animals are worth. Fewer animals of better quality, though costing no more to feed, would give the same amount of draught power and of milk. Towards improvement therefore, the first step necessary appears to be a recognition that at any rate in the grazing tracts which suffer from famines a restriction of numbers together with fodder storage must precede any general improvement of breed.”

The success which has so far been achieved in cattle breeding has been entirely due to the efforts of a small but keen band of workers of the Civil Veterinary Department. This success has been the outcome of the very close contact which the department maintains with the zemindars of this province, a policy which the late Colonel Farmer has been mainly responsible in impressing on the staff. There exists throughout the province a network of veterinary hospitals now numbering 173, each in charge of a Veterinary Assistant to whom is assigned the veterinary supervision of a certain number of thanas with an Inspector in control in each district. The Punjab can boast of having the premier cattle breeding station in India, namely, the Government Cattle Farm, Hissar, which is in charge of a Superintendent. The area of the farm is roughly 42,000 acres. About half this area produces in good years fine crops of *anjara* grass, which permits of good grazing and at the same time allows for ten to twenty thousand maunds of good hay to be collected as a fodder reserve. The farm, being situated at the tail of the Western Jumna Canal, does not get a very liberal supply of water for irrigation purposes; however, on an average about 1,600 acres are irrigated and cultivated annually. The number of live stock on the farm amounted to 5,533 on 31st March, 1923. An indication of the breeding operations carried on may be gathered from the fact that there are on an average 1,650 births on the farm each year. At the annual distribution of bulls, which is held in November each year on the farm, attended by representatives from the various District Boards, up to 250 bulls are available as District Board stud bulls for the districts. There are now over 1,700 Hissar bulls at stud in the province (all of which are specially selected animals with known pedigrees) compared with 637 in 1914, and the demand is steadily increasing. These are being bred and afterwards distributed in the districts with the primary object of breeding plough bullocks, fit to take their place in the agricultural development of the province. That these are the best procurable and are suited to zemindars' requirements is evident from the popularity which they have gained in the districts. That their progeny are superior to the village type is evident to any one who has visited the villages where these District Board bulls are at work, and to those who keep their eyes open at fairs throughout the province wherever District Board produce are exhibited. It is a matter of general knowledge that the prices zemindars can realize for the progeny of District Board bulls in the open market are far higher than for the ordinary village type. This is why even as a financial proposition it should pay District Boards to invest more money in the encouragement of cattle breeding, as with a properly organized system of cattle fairs as in other countries they can recoup themselves out of the increased revenue from the sale of these animals.

The Civil Veterinary Department depends entirely for the maintenance of the bull power of the province on private help from zemindars aided by District Boards when their resources permit of expenditure under this heading. Unfortunately District Board funds are not always very flourishing, whilst the demands made on them for objects which are popularly supposed to be more important than cattle breeding are steadily on the increase, with the result that

there is little to spare for cattle breeding : and what financial help is granted for the purpose is often won after a very hard struggle. It will be understood therefore why the department is obliged to pursue the encouragement of cattle breeding on such cheap lines, and at the same time one can recognize the difficulties which for this reason are met with in popularizing cattle breeding.

Through want of financial help we are constantly in the position of having to refuse very desirable applicants for bulls notwithstanding that they are prepared to pay part of their cost without any further liability to the District Board once they are issued. The idea is fortunately gaining ground amongst zemindars that District Boards as dispensers of the district funds should come more to their assistance in the purchase of stud bulls. It would appear, however, that, owing to the inordinate demands of education and medical relief, the zemindar members of the Boards are powerless when it comes to securing a fair proportion of the District Board funds for that purely zemindari object—the encouragement of cattle breeding. As the department is responsible for the promotion of cattle breeding in this province, we are not satisfied with the present precarious system of securing financial help and would welcome a fixed contribution out of the District Board funds in accordance with the resources of the different districts together with a yearly subsidy from Government to meet special requirements. Provided sufficient funds were placed at our disposal, we would be in a position to guarantee to make good all casualties, to replace more quickly than at present bulls which had passed their prime and to ensure that in the villages there would be continuity of results by having all stud bulls regularly replaced.

That a distinct advance has been made through the persistent efforts of the department is evident from the record number of bulls which have been indented for this year, namely, 256 compared with 171 in 1914, the majority of which have been supplied to zemindars who have paid half the cost, the remainder of the price being found by the District Board. The liability of the District Board ceases when the bulls have been supplied, as under the present system the feeding charges of all District Board bulls are borne either by the zemindar, who has accepted the bull, or generally by the inhabitants of the village in which the bull is located. With the very limited funds allotted to cattle breeding we cannot afford to entertain any expensive system of bull stands and wisely in our opinion are devoting all available funds in the actual purchase of bulls.

The District Board bulls in the majority of cases are allowed to wander at large with the village herds and on the whole are well cared for, more especially in those districts where fodder is plentiful. One must realize that it requires a certain amount of public spirit for the ordinary zemindar to accept the responsibility and expense of the feed and keep of a District Board bull for the benefit of his neighbours' cattle, and that so many are forthcoming to undertake this is a very encouraging feature of cattle breeding in this province and makes one feel that the department's efforts in the cause are being appreciated. What however is most essential is, that there must be a steady flow of approved bulls into the districts maintained for many years to come, and to ensure this the necessary steps should be taken.

It will be understood therefore that to hasten the progress of cattle breeding in the province it will be necessary to largely increase the number of District Board bulls which find their way into the districts annually. For some years to come we have to centre our hopes for the improvement of the breed of cattle on the number of approved bulls at work in the province ; these are all specially selected animals, the history of whose antecedents is well known. The propinquity of these animals will be a guarantee that we can expect them to breed animals of their own type, so that we are spared the uncertainty of breeding from animals the history of which is unknown to us. It is hoped that in course of time, when these District Board bulls have left their mark on the cattle of the province, more reliance can be placed on the village product ; meanwhile we must rigorously place our faith on these approved bulls.

In these days of financial stringency there is a tendency on the part of some District Boards to overestimate the value of the comparatively small number of approved bulls now working in their districts. The Director of Agriculture in his review of cattle breeding in the province in 1919-20 estimated that over 50,000 approved bulls in regular stud work were necessary. We consider this a reasonable estimate of the number required to effect anything like appreciable progress, and in view of the economic importance of cattle breeding in this province have suggested that Government should come to the assistance of District Boards in quickening our present rate of progress which is roughly about 250 each year under the present very precarious system of finding funds.

In anticipation of a large demand for stud bulls to satisfy the requirements of the province additional farms for the breeding of Hissar cattle under the supervision of the Civil Veterinary Department have been started in the Lower Bari Doab Canal Colony in the hands of private owners. The stock of these farms are all transferred Hissar bred animals, so that the breeding arrangements on these will be a duplicate of the breeding done on the Hissar farm, subject to

such differences as will hereafter be noticeable owing to the change of climate and environment in a canal irrigated area.

The Hissar cattle breeding grants include :—

Name of farm	Area in acres	Strength of herd
1. Fazal Dad Farm . . . . .	3,140	8 bulls, 400 cows
2. Bahadarnagar Farm . . . . .	3,131	8 " 400 "
3. Kidarabad Farm . . . . .	1,000	3 " 125 "

The total number of young stock on these farms at present is 1,000 approximately.

There is a tendency on these grantees farms to reckon the breeding of cattle as a side line, towards which the grantees feel compelled to devote a certain amount of attention in order to retain a hold on their farms. It is to counteract the evils attending this that the necessity has been repeatedly urged of an increased staff to supervise and control the work on these farms. Whilst the activities of the department are rapidly on the increase, the supervising staff is not being adequately increased to cope with the extra work. One cannot, however, close one's eyes to the fact that, with the present prices of fodder, the inducements in the way of increased profits which the growing of non-fodder crops offer, the comparative cheapness of animals even in their prime in this country, cattle breeding alone does not pay unless other side lines are adopted. Until such time as cattle breeding can pay its way independently we cannot therefore expect the enthusiasm from the cattle breeder which a more paying industry would develop in him, and for this reason the industry must be subsidized either directly or indirectly.

All these cattle breeding grants have now reached the full strength of their herds; the original herd cows are gradually being replaced by farm-bred heifers. The latter are decidedly promising and have developed well with the generous treatment which it has been possible to provide for them on these farms. These herds, however, have not been in existence sufficiently long yet to have had any appreciable effect on cattle breeding generally in the province, since the majority of the farm-bred female stock have been drafted into their herds by the grantees. Specially selected male stock (aged 3 years and over), however, have been issued to District Boards for breeding purposes at the usual concession rates, the remainder on reaching this age have been castrated and sold as bullocks to zemindars.

We have to acknowledge the readiness with which the grantees generally carry out their instructions; they have very gradually come to recognize the necessity for proper supervision over the many details in connection with animal management which means so much towards the success of their herds. The limiting factors to any rapid progress in developing these farms is, firstly, their want of experience in up-to-date methods of animal husbandry, and, secondly, the extra expense entailed, for which at the present prices of cattle ruling in this country, the grantees cannot always foresee an immediate return.

Reckoning pedigree Hissar stock there are now about 1,400 cows being maintained in regular breeding on the Government Cattle Farm, Hissar, and 925 on the Hissar cattle grants in the Lower Bari Doab Canal Colony. In addition there are over 1,700 pedigree bulls at work in the province which number is steadily increasing; from these we can normally anticipate a birth rate of 60,000 youngsters annually.

How these youngsters will turn out will depend on the amount of care and attention given to them by their owners. They start life with a big initial advantage in their favour, as the progeny of pure bred sires with a tendency to develop under proper treatment into strong, vigorous, and shapely animals. No amount of good breeding, however, will overcome the ill-effects of bad rearing and insufficient feeding which is so often practised, so that it is idle to anticipate good results when these essentials are neglected. On the whole, however, the situation is hopeful, provided there is fodder in abundance and the zemindar can be made to realize that an animal worth rearing at all is worth rearing well.

Unfortunately we are only too well aware of the existence of large numbers of ill-bred, half-starved cattle which compete successfully with the more useful animals for the ever diminishing supply of available fodder. We notice the gradual advance of canal irrigation into the grazing grounds of the best breeding stocks, the draining away of some of the best cows and buffaloes to provide milk for the towns without any suitable arrangements being made there to utilize them to any advantage for breeding purposes. Notwithstanding, however, all difficulties in

the way of rapid progress we are confident from the steadily increasing number of good bulls now being employed in the districts that the foundation stock in this province is being consistently improved, and that so far as our experience in the Punjab goes the deterioration of the Indian breeds so often referred to by certain authorities can very effectively be stayed by a more liberal system of feeding especially for the young growing animals. There appears to be such a desire on the part of certain enthusiasts to attempt to unduly hasten the progress of cattle breeding by crossing with imported European breeds that we feel it necessary to call their attention to the suitability of the pure indigenous breeds for Indian conditions of climate and feeding and their very marked insusceptibility to the contagious diseases in this country.

The Civil Veterinary Department has a fixed and definite policy with regard to cattle breeding, namely, the preservation and improvement of the indigenous breeds of the province by a process of selection from amongst the best specimens procurable. By the very thorough application of this principle on the Hissar farm the famous Hissar breed has been established, the progeny of which are so popular throughout the canal irrigated tracts of the province. Where a special local breed exists such as the famous Dhanni or Awankari breed in the Dhanni tract comprising parts of Attock, Jhelum and Rawalpindi Districts, a special effort is made to encourage it. The department, with a view to preserving this breed, has started a Dhanni cattle breeding scheme under which 69 approved bulls are enrolled for stud purposes in specially selected villages within the tract. These, whilst remaining the property of their owners, are subsidized with amounts varying up to Rs. 20 per month on condition that the services of these bulls are available for the villagers' cattle.

With the continuance of good harvests the scheme has become well established in the tract and has popularized the work of this department throughout these districts. As far as funds permit the number of subsidized bulls has been increased in order to serve a greater number of villages where the need for good bulls exists. The District Boards of Attock, Jhelum and Rawalpindi testify to the excellent effect which the scheme has had in the encouragement of cattle breeding and to the very noticeable improvement in the number of well bred Dhanni cattle now available in the tract. A keen demand exists especially for the better class Dhanni bullocks which find a ready market at very favourable prices.

A preliminary survey of the tract having been completed, steps are now being taken to start a herd book for this breed as a very necessary step towards maintaining the purity of this breed in future. To make a beginning, it will be necessary to offer some inducement to the owners of registered stock to abide by the conditions which need to be imposed in the interests of the breed. The District Boards concerned have been addressed on the subject. It is hoped that as soon as finances permit effect will be given to the recommendations made. It may safely be said that owing to the absence of railways and other ready means of communication with this tract, the Dhanni breed of cattle more especially as found in the Tallagang area is one of the purest indigenous breeds in this province. Conditions are, therefore, exceptionally favourable for the revival of this famous breed, and provided the necessary staff and financial support are available, it should be possible to make considerable progress. This statement, however, needs to be qualified with the proviso that ample fodder storage against the constantly recurring fodder famines will also be made. We look to the Agricultural Department to solve this difficulty.

Likewise in the Hariana tract, which comprises the districts of Rohtak, Gurgaon and Hissar, steps are being taken which are merely a duplicate on a large scale, through the agency of the local cattle breeders in villages, of what has already been done on the Hissar farm to revive what is popularly known as the Hariana breed. Efforts are being concentrated on selected villages of this area where the best specimens of this local breed are available. It is hoped that in time, by the judicious expenditure of money amongst cattle breeders in this area towards the purchase of stud bulls, and with the necessary supervision over the working of the scheme, considerable progress will be effected in grading up the local breed, and that selected bulls for stud purposes will be available for distribution in other parts of these districts as the scheme expands. It marks the beginning of a serious effort towards the development of the natural resources of the Hariana tract as a cattle breeding centre, and as a business proposition the scheme should commend itself to the attention of Government. The new irrigation works now in course of construction will increase considerably the area of cultivable land in the province for which plough bullocks will be required in large numbers. The importance therefore of developing the Dhanni and Hariana cattle breeding tracts to meet the requirements of the rest of the province will readily be admitted. Since the majority of the present irrigated districts are not by any means self-supporting as regards the plough bullocks they need, they are dependent on such tracts for the superior types of bullocks which are available there. This source of supply needs therefore to be encouraged where the cattle breeding industry can for economical reasons prove most remunerative to breeders. †

To meet local prejudices, a number of specially selected young male stock have been purchased by the District Boards of Rohtak and Gurgaon in the Hariana villages and sent to the Hissar farm to be reared until fit for issue as breeding bulls. The Gurgaon District was

ast year supplied with 116 stud bulls from Hissar and this year up-to-date 110 bulls have been distributed in that district, part of the cost being advanced in each case by the applicants.

A survey having been made of the bulls ordinarily employed for breeding purposes in the district, it was found that a large number were quite unsuitable stud animals; these are being replaced by bulls purchased from the Hissar farm. Zemindars in the Hariana District are fully alive to the advantages of developing the cattle breeding industry to meet the demand of other districts for better class bullocks—all that is needed is organization. The starting of co-operative cattle breeding societies by the Co-operative Department is, therefore, particularly opportune, which it is hoped will be of considerable help towards the success of the scheme. I wish to acknowledge here the readiness with which the District Boards of Rohtak and Gurgaon have adopted the scheme and the very considerable encouragement they have given since the scheme was started.

The efforts of the department have been principally directed towards helping the zemindars of the province to breed animals of a type which they most urgently require, namely, plough bullocks. We have preached the cult of the pedigree bull ever since we have been a department and can now claim to be one of the few departments in India with any real results to show in the districts. We feel that this success is in no small measure due to the policy of continuity adopted by this department, and in preaching consistently the preservation of the valuable indigenous breeds we have had the sympathy of all cattle breeders in our efforts. We can confidently state that we have achieved progress in proportion to the number of District Board bulls that have found their way into the villages, in proportion to the financial assistance we have received and in proportion to the cadre (subordinate and supervising) which has been placed at our disposal.

With the limited means available we grant that it has not been possible to give the attention to the improvement of the milking breeds as we desired. In this direction our energies have been directed towards the establishment of Montgomery cattle breeding farms. These include:—

Name of farm	Area in acres	Strength of herd
Jahangirabad Farm . . . . .	4,226	8 bulls, 500 cows.
Chaudhri Allah Dad Khan's Farm . . . . .	3,800	3 " 125 "
Sir Louis Dane Cattle Farm, Kaliana . . . . .	2,300	3 " 150 "
Rakh Chandrai, Lahore Dairy Farm . . . . .	1,137	6 " 300 "
Montgomery Dairy Farm . . . . .	485	3 " 150 "

The total number of young stock on the farms at present is 1,000 approximately.

Also Government lands have recently been granted on lease to certain Junglis and Sayads of Shergarh and Hussaingarh villages in the Montgomery District on the condition that they maintain a specified number of Montgomery cows for breeding purposes to the satisfaction of this department. The locality chosen was once a famous centre for the Montgomery breed of cattle and is naturally well suited to the revival of this very famous milking breed. It should be possible to organize a big milk supply out of this area when the scheme has made some progress.

The distribution of Montgomery bulls to certain municipalities and the increase in the number of approved buffalo bulls throughout the province is also part of our programme. Private enterprise in the establishment of dairy farms for the milk supply of the large cities is being steadily encouraged as far as possible by Government, on condition that the breeding operations carried on should be controlled, so that the short-sighted policy of the *gowala* in having his cows covered by non-descript bulls may not be perpetuated.

The department is fully alive to the necessity of aiming at breeding higher milk yielding cows in greater numbers than are now available, and in the selection of stud bulls of all breeds the milk pedigree is carefully considered before they are issued to the districts. It is not always practicable with the limited staff available and the liability to fodder famines as on the Hissar farm to attempt the carrying out of reliable milk tests of all the herd cows; the slower but less expensive system of testing in smaller numbers as at present adopted must be continued. Of necessity our further plans in this direction are largely governed by the staff and funds available for this work. It is intended that all the breeding farms responsible for the issue of stud



bulls to the districts should be given facilities to maintain accurate milk records of the herd cows with a view to more careful selection for milk yield. This arrangement is being adopted on all farms. The grantees of both the Hissar and Montgomery cattle grants realize the commercial value of recording the milk yield of their cows which enables them to weed out unprofitable animals from their herds. The Hissar bred cows, though wild and unmanageable at first, are with extra care and attention rendered more amenable. Arrangements have been made on the Hissar breeding grants for tying up cows as they come in milk and recording their milk yields throughout the lactation period; it is hoped that in time these herds will be rendered more docile and that the best milkers can be readily ascertained. We believe that with proper care the Hissar breed can with advantage receive more attention in the matter of selection for milk yield amongst the herd cows without any danger of reducing the value of the progeny as plough animals. We are therefore pursuing the development of the farms on these lines. Small beginnings have naturally to be made on account of the additional expense involved in the extra handling and management required.

In the improvement of the Montgomery breed we have certain very big difficulties to contend with, namely—

- (1) The best Montgomery cows are being purchased by the military dairy farms, some of which are crossed with an imported breed, the Ayrshire, for the production of cross-bred cattle, which is at variance with the settled policy of this department in the preservation and grading up of the indigenous breeds in this province for the benefit of cattle breeders in the districts.
- (2) That a large number are also being exported to Calcutta and other large cities outside the province. In both instances this is a direct loss to the progress of Montgomery breeding in this province, as in neither case do any of their offspring find their way back into the districts, or at any rate only a very small percentage.
- (3) By the extension of canal irrigation to the Montgomery District, which was the original home of this breed, the Junglis in whose hands the breed rested were gradually ousted, grazing areas disappeared and with them the breed gradually dwindled.

Whatever Montgomery breeding is done at present is being done either in the breeding farms or by the Gujars of the large municipalities, *e.g.*, Amritsar, Lahore and Lyallpur. The latter unfortunately have no further interest beyond securing milk, and therefore allow their cows to be covered by non-descript bulls: this is to be particularly regretted as undoubtedly some of the best Montgomery cows fall into their hands.

If we consider the progress which has been effected in Europe in improving the milking breeds by means of milk records and milk testing associations, when we consider the effort which are being made to induce farmers throughout the country to adopt such measures, we are struck with the possibilities which the military dairy farms offer in this direction towards the improvement of the indigenous milking breed of this province and what little use has been made up to date of these possibilities. As already stated, the best cows are bought up from the districts and are retained so long as they can be economically maintained as milch animals, whilst a very small percentage of young stock find their way back into the districts. This continuous drain of the best cows from the Montgomery District is accountable for the state of the Montgomery breed of cattle as we find it to-day.

The establishment of cattle depôts in connection with the military dairy farms would seem to be necessary where dry cows can be economically maintained until they come in calf and where the young of cows with good milking yields can be properly reared and nurtured. As the cows used on the military farms are all selected animals, surely, notwithstanding the economic tendency to dispose of them, their progeny should be catered for in the interests of the dairy industry. We are glad to note that lately this principle has been adopted: it is hoped that, in the interests of the milking breeds in the province, it will be extended as far as possible.

There are certain factors which militate against very rapid progress being made in reviving the Montgomery breed, namely, that very few specimens, if any, of the pure Montgomery breed are now available, and so little attention has been paid in the past towards maintaining the breed pure, that its resuscitation presents very great difficulties. It is questionable if it would not be wiser at this stage to forego the sentiment attached to preserving the characteristics of the Montgomery breed, and instead direct our energies towards producing an efficient dairy animal rather than an animal for show purposes. This is practically what the zemindar who values the milk rather than appearances has been doing with the original Montgomery cow as a basis, and this is why in Montgomery District, or in any part of the province, it is so difficult to find so-called Montgomery cows of which it could be said that they are really characteristic of the breed. We are inclined to the view therefore that we might in this province pursue the movement that has already made such progress in England and other European countries namely, the registration of dairy cows or its equivalent. In England the register is not confined

to pedigree animals. A cow of any breed, type or cross can be entered only if she has been awarded the Ministry's certificate declaring that she has yielded not less than 8,000 lb. of milk during a milk recording year or not less than 6,500 lb. milk on an average of two or more consecutive milk recording years.

The objects of the register are :—

- (1) To assist and encourage the breeding and improvement of dairy cattle of any breed, type or cross by publishing annually particulars of cows which have been proved by certificated milk records to possess high class dairy qualifications.
- (2) To provide authentic records of high class dairy cattle with a view to bringing buyers and sellers together.
- (3) To encourage the keeping of particulars of cows and heifers (including their certified milk record), which in course of time would make it possible to establish a register of cows with milk recorded pedigrees into which an animal of any breed, type or cross would be admitted, provided that a satisfactory number of its female ancestors possessed satisfactory milk record certificates.
- (4) To encourage the use of pedigree bulls for grading up non-pedigree herds.

We have given the details of what is a very definite movement in Europe and elsewhere, aiming at improving the efficiency of milch animals, which after certain modifications would be applicable in this country and would embrace both milch cows and buffaloes. There are certain details which it would be difficult to work in this country, but there is a policy involved in the movement which in our opinion is applicable in this country at present; it is therefore suggested as a guide to future policy in the encouragement of the dairy industry in this province.

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(A. C. DOBBS, B.A., *Director of Agriculture, Bihar and Orissa.*)

The Government of Bihar and Orissa have adopted the policy of breeding cattle primarily for milk with a view to making the production of bullocks on arable holdings where stall feeding is necessary, profitable. Herds of milch cows are started whenever a demand for milk gives an opportunity of maintaining them economically, cows of any breed being purchased and the best milkers retained, and bulls of the Montgomery breed being used because this is the only Indian breed of which bulls with a good milking pedigree are obtainable.

There is a herd of about 60 cows at Ranchi and smaller herds on each of the large farms of the department at Cuttack, Sepaya and Sabour. It is proposed to establish a large herd at Monghyr to supply the Railway Settlement at Jamalpur.

The defect of this policy is that the Montgomery type of bulls and bullocks are unpopular owing partly to their slowness, which is undoubtedly a disadvantage when using a small country plough, and partly to their large amount of loose skin, against which there is a prejudice, justifiable or unjustifiable.

The question of introducing a single Hisar or Ongole cross in the male line, with a view to splitting the progeny into a large number of types as regards characters independent of milk, is under consideration. The objection to doing so is the small number of good milking cows available and the necessity of using them all for breeding pedigree bulls. The establishment of a herd book of purely Indian cattle and of some standard of milk production by which cows could be compared so that only cows above a certain standard and their progeny could be admitted to the herd book would advance breeding by a definite stage. In the first instance would it be possible to make milking capacity and resistance to rinderpest the only criteria for admission to such a herd book, so as to allow as much latitude in the matter of form, etc., as possible. It would then be possible to split up the breed so constituted into as many types as could inspire sufficient interest to define them.

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(D. CLOUSTON, C.I.E., M.A., D.Sc., *Director of Agriculture, Central Provinces.*)

*Cattle breeding.* The steps being taken in the Central Provinces to improve the local breeds of cattle have been described in some detail in the cattle surveys for Chhattisgarh and for Nagpur and Berar Divisions. The department now has 9 breeding farms and 2 dairy farms including

the College dairy farm at Nagpur. Much difficulty was experienced in getting the basic stock for these farms, for there are no pure breeds in the provinces. Our cattle, like our crops, are hopelessly mixed, and in a tract famous for one particular breed the proportion of pure to mixed types is very small. We have, therefore, had to start our breeding operations with stock of poor quality and to improve it gradually by selection. On the 9 breeding farms, there are 6 different breeds of cattle. Of these 9 farms, 2 have been in existence for nearly 20 years and the herds of Gaolao and Malvi cattle kept thereon are now fairly true to type. The other 7 farms are of more recent origin and the types of cattle kept on them are not yet fixed. The total number of cattle on these 9 cattle breeding farms at the close of last year was 1,032. The expenditure amounted to Rs. 38,699-2-1 and the receipts to Rs. 27,733-5-1; the net expenditure was thus Rs. 10,965-13-0.

The results obtained on the Telinkheri dairy farm and on the College farm at Nagpur in crossing cows of our local breeds with Ayrshire bulls are promising as far as the milking qualities of the off-spring are concerned; but the cross-bred bullocks produced are not of the type which would appeal to the ordinary cultivator. They are inclined to be thin and leggy and are much less immune to rinderpest, foot-and-mouth disease and other contagious diseases than Indian cattle. On the College dairy farm the Ayrshire crosses are now being mated with a Montgomery bull with a view to giving the off-spring greater resistance to disease. On the Telinkheri dairy farm the crossing of cows of the Gaolao breed with bulls of the Montgomery or Saniwal breed has produced promising results. The Montgomery-Gaolao cross is an improvement on the pure Gaolao both as regards milk and draught; the cross-bred bullocks are well built, strong and tractable animals; and the cross-bred cows yield nearly twice as much milk as those of our local breeds. Given a herd of such cross-bred cows the owner can, after providing for his calves, add to his income by the sale of surplus milk, the value of which should more than cover the cost of feeding his herd. In the Montgomery-Gaolao cross, in short, we have a type of animal which fills the pail and gives satisfaction in the yoke. These results open up a vista of great possibilities for the cattle breeder of the Central Provinces, showing him as it does how he can, by combining dairying with breeding, add to his farming profits. This experiment in crossing is now being tried with three other herds. If the results prove to be satisfactory these herds will be gradually graded up to the Montgomery type by continuing to use bulls of that breed. The danger is perhaps that the Montgomery trait of slowness when at work will become too pronounced in time, though it has not done so in the first cross. In anticipation of a demand arising for Montgomery bulls a herd of selected cows of this breed is now maintained on the Telinkheri dairy farm from which bulls are being supplied to cattle owners desirous of producing dual-purpose cattle. For these bulls the demand is far in excess of the supply at present available.

The feeding experiments carried out by Mr. Allan on the College dairy, Nagpur, show that when a mixture of cotton seed cake and *chuni* were the concentrates used and *juar* (*Sorghum*) and hay the bulky fodder, the best results were obtained in the case of milch buffaloes when the quantity of concentrate fed daily was 58 to 60 per cent. of the milk yield. In the case of cows 40 per cent. gave better results. He has observed, too, that the careful rearing of buffalo calves has more effect on their size and milk yield on reaching maturity than in the case of cow calves.

A reference will be found in the cattle survey for Nagpur and Berar Divisions written in 1921 to the proposal to give small annual subsidies to cattle owners who maintain in their villages "certified" stud bulls whose services they are prepared to lend to other cattle owners. We are convinced that some such state-aided system of maintaining stud bulls in villages should help considerably to stimulate the interest of cattle owners in animal husbandry. It should serve as a most useful demonstration in scientific breeding, and encourage cattle owners to rear good bull calves with the hope of getting them certified by Government as suitable for breeding purposes.

*The fodder problem in the cotton tract.* In the Central Provinces there are three fairly well-defined agricultural tracts, namely, the cotton tract, the rice tract, and the wheat tract. In the cotton tract, the fodder question is not a very serious one, because as the grazing areas are very limited the cultivator is obliged to grow *juar* on a large scale for his cattle, and his draught bullocks are relatively good in consequence. In years in which the *juar* is a partial failure he generally manages to obtain grass from the forest or fuel reserves in his tahsil; in famine years he pays for baled grass railed to him from other districts. Realizing as he does the importance of stall-feeding he makes a point of storing fodder whenever he can, and supplements the daily ration of *juar kadbi* or hay by a small allowance of cotton seed, *tur* husk and other concentrates. One of the advantages of stall-feeding is that the owner knows exactly how much food his cattle get per day: the man who makes no provision for stall-feeding does not. In this tract there are no irrigation facilities worth mentioning and *juar* is the most profitable fodder for the cultivator to grow as a dry crop. The Department of Agriculture is assisting him to increase his yield by supplying him with seed of improved varieties. How to make

*juar* silage is being demonstrated by the department on Government farms and at agricultural shows and other gatherings.

Experiments were carried several years ago to ascertain whether it would be possible to grow some of the best local grasses in rotation with the staple crops of this tract. Seed of these grasses was collected and sown in plots which had been carefully manured and cultivated. The results obtained showed that even the best varieties were never likely to take the place of *juar*; for *juar* yields much more fodder per acre and gives in addition a valuable food grain. It is thus a dual-purpose crop, supplying as it does food for the bullock and the man who works it. It will be very difficult to find a crop which is better suited to the soil and climatic conditions of this tract; but what we do look forward to is the possibility of getting cultivators to make ensilage of at least a small part of their crop, and of inducing them to grow some of the sweeter and thinner stemmed varieties purely for fodder.

*The fodder problem in the rice tract.* In Chhattisgarh Division, which constitutes the greater part of the rice tract, there are large stretches of level but very poor lateritic soil on which the only grass that thrives well is spear grass (*A. contortus*), the feeding value of which is low. An attempt was made by the department some years ago to introduce better grasses such as *Ischemum sulcatum*, *Ischemum laxum*, *Andropogon annulatus*, *A. caricosus* and others which are commonly found on black soil. They did not thrive well on laterite and the area was soon overrun again by the hardier spear grass. Spear grass being a slow grower is a poor pasture grass as it provides little or no grazing in the early part of the rains when cattle are emaciated and when other fodder is very difficult to obtain. Towards the end of October it starts flowering and produces hard sharp spikelets which tend to injure the mouths of the cattle which eat it. An experiment extending over three years was carried out some time ago to ascertain how far the feeding value of this grass could be improved by cutting it before the middle of October, i.e., before the spears formed. Ten young animals of about one year in age were brought from cultivators in surrounding villages and were grazed and stall-fed on it for a period of three years. At the end of that time these ten young animals had developed into useful draught bullocks which were much superior to those of the same age in adjoining villages. The experiment proved that spear grass cut before the middle of October is an edible and fairly good fodder. The failure of the average cultivator in this tract to provide his growing stock with a maintenance diet during the hot weather accounts very largely for their being so small and weak. It occurs, too, for the heavy mortality among his cattle in the early part of the rains when death is often due to their gorging themselves in rice fields in which they are allowed to graze at this season. The fodder problem is thus a serious one in this tract where rice straw is the principal fodder and where there is not even enough of that to satisfy the hunger of the large herds kept in every village. The comparatively large areas reserved for grazing produce spear grass—a short season variety of poor quality. But so long as such extensive areas are available for grazing, large numbers of useless cattle will be retained; no attempt will be made to grow suitable fodders, and the cattle problem will continue to be one which the department can do but little to solve.

*The fodder problem in the wheat tract.* In the wheat tract, the conditions as regards grazing facilities are more or less similar to those of the rice tract; but in this tract there are, in addition to the areas reserved for grazing, large stretches of deep fertile soil overrun with *kans* grass (*Saccharum spontaneum*). *Kans*, however, is one of the least palatable of our local grasses and is not worth including in the category of fodders. Fields of tall *kans* grass may be seen even in the beginning of the hot weather, a clear indication of the fact that it is not readily eaten by cattle. In this tract so little attention is paid to the storage of fodder that *juar* stalks are often left standing in the fields, the heads only being removed to the threshing floor. That the cattle problem in the tract is a serious one may be gathered from the fact that such a large area of good land is allowed to lie fallow owing to the weakness of the draught bullocks. Here, as in the rice tract, the area available for grazing is too large. No real steps are taken to grow and store fodder and the tendency is to keep more cattle than is needed. What is badly wanted is an increase in the area under crops such as *juar*, *bajra* and *berseem* and the cultivation by mechanical power of the large *kans*-infested areas of this tract. In the wheat and rice tracts the irrigation facilities provided under Government tanks and canals should in the long run result in the area under these crops being increased and in their being more straw available for fodder. In course of time the cultivation of *berseem* will also be taken up in irrigated tracts.

The whole problem of how to improve the efficiency of draught cattle in the province by better breeding and feeding is bristling with difficulties owing to the attitude of the people concerned. Even educated men who play an active part in public life make the mistake of opposing the slaughter of useless cattle and of demanding that village and forest grazing areas should be still further increased. If this policy were to be adopted the problem would become still more difficult. What is required is an improvement in the quality and a decrease in the number of cattle maintained; but any great improvement in the quality is well-nigh impossible so long as the cultivator relies as much as he does at present on grazing as a means of subsistence for his cattle.

The Department of Agriculture has for years been testing different kinds of fodder crops. Of those tried up to date, *berseem* (Egyptian clover) is one of the most promising; a fairly large area is sown with it on Government breeding farms where water is available. Some seed has been given out to selected landholders, too, with a view to encouraging them to take up its cultivation under tanks and canals. The method of raising a second crop after rice is already well known and widely practised; there is no reason why clover should not be grown in this way. It has been grown in this way on the Telinkheri farm for the last 12 years. The cultivation of the smaller bamboo (*Dendrocalamus strictus*) on the light lateritic soils of the Chandkhuri breeding farm has given promising results.

To enable the department to give more attention to the whole subject of cattle-breeding, cattle feeding and dairying the post of Deputy Director of Animal Husbandry was created and filled last year. The Deputy Director has as his first assistant a Provincial Service officer who has had a sound training in animal husbandry. This assistant devotes part of his time to propaganda work with a view to stimulating interest in the improvement of cattle by better breeding and feeding. He has been supplied with a magic lantern and several sets of slides dealing with different aspects of cattle breeding, feeding, and dairying, and he delivers lectures on subjects connected therewith.

The whole question of cattle improvement is intimately bound up with that of the fodder supply available in the province. During our long period of dry weather extending from October to June our village grazing areas though large are parched and dry, and do not provide the large herds grazed thereon with a maintenance diet. Herds sent to forest grazing areas are but little better off. Sufficient fodder to meet requirements is not stored with the result that outside the cotton tract cattle have to live on a starvation diet for the greater part of the year. The department cannot hope to effect any real and widespread improvement in the cattle of the province until it has first succeeded in converting cattle owners to a belief in its methods. The indications are that this can be done but it may take many years. There is already a good demand for stud bulls, including bulls of the Montgomery breed for which some of our more go-ahead land owners are willing to pay big prices. It will be the duty of the Deputy Director of Animal Husbandry to stimulate the interest which these men are taking in his work and to devise ways and means of getting them to lead the way in cattle improvement in their districts.

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(S. T. D. WALLACE, V.C., B.Sc., *Deputy Director of Agriculture, in charge of Animal Husbandry, Central Provinces.*)

The following is a brief statement of the measures taken up to date for the improvement of cattle in the Central Provinces and Berar:—

Before the year 1922 there were nine cattle breeding farms and two dairy farms. The nine cattle breeding farms contained two pure bred Malvi herds, one pure bred Gaolao herd, one Khamgaon herd, and the remaining herds consisted of local cows crossed with Malvi or Gaolao bulls. Since the development of the Saniwal or Montgomery herd on the Telinkheri dairy farm, it has been decided with the approval of the Central Provinces Board of Agriculture to grade up all the herds on these cattle breeding farms by the use of pedigree Montgomery bulls as soon as these become available. On one farm, however, a pure Malvi herd is being maintained and on another a pure Gaolao herd with the object of supplying pure bred bulls of these breeds which are greatly in demand for draught purposes. The remaining farms on which cross-breeding is to be carried out are to be devoted to the production of milking strains and will eventually become practically pure bred Saniwal cattle.

In 1922 a scheme for the improvement of village herds by the use of premium bulls was introduced by the Department of Agriculture and approved of by the Local Government. Funds were placed at the disposal of the department for the purpose of granting premia to suitable persons who agreed to keep approved bulls in accordance with the regulations laid down. The applications for bulls under this scheme exceeded the number of bulls available from Government cattle breeding farms, but the scope of the measure has been widened by giving premia to good bulls bought from private breeders. It is yet too early to say whether the scheme has produced the desired effect or not. With a view to stimulating interest in improvement of cattle by better breeding and feeding a number of bulletins and leaflets published in the vernaculars have been prepared. Experiments with various types of fodders and small-power plants for the preparation of fodder have been and still are being carried out by the department.

In May 1922 the Local Government agreed to sanction the post of Deputy Director of Animal Husbandry whose whole time is devoted to work connected with the cattle industry; popular lectures illustrated by magic lantern have been made a feature of this section of the Agricultural Department's activities.

One of the chief obstacles to cattle improvement in this province is the impossibility of getting rid of useless animals through the agency of a slaughter-house. Efforts made by Government in this direction did not meet with success. In consequence, the cattle population of the province is now more than equal to the amount of natural fodder available to keep cattle in good condition. Work-cattle are on the whole inefficient and two or more pairs are kept where one good pair properly fed and cared-for would be capable of doing the same work.

There is a continual cry for the Forest Department to throw open more and more of the jungle areas to grazing. So long as this demand is complied with, large herds of cattle will be turned loose to graze at little expense and trouble to the owner who obtains a small return for each animal and must therefore keep large numbers at the expense of quality in order to get any return at all.

If some system could be devised of permitting the removal of grass in the form of hay from jungle areas instead of its removal by large herds turned loose to graze, then the cattle owner would be compelled by the labour involved to realize that it was better to keep a few good cattle than a large number of inferior ones. This is a proposal which it may be difficult to carry out on political grounds as the erection of slaughter-houses and tanneries has proved to be on religious and sentimental grounds.

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(J. N. CHAKRAVARTY, B.A., M.S.A., M.R.A.S., *Deputy Director of Agriculture Assam.*)

The principal work of the Agricultural Department in Assam in the improvement of cattle has been the maintenance of a herd of improved cows at the Shillong farm. The farm was started in 1897 and a small herd of cows was located there almost from the beginning. A few cows belonging to what is popularly known as Taylor breed were obtained originally from Patna. This is a cross between the local cows and Australian bulls. The herd has been found to be thriving very well in the Khasi Hill. Crosses were also made between these and Bhutia breed as well as with Montgomery bulls. It was felt, however, that the money available and the supervision which it was possible to give to this farm did not admit of any definite crossing or other complicated experiments to be made. During the last four years, the experiment has been confined to attempts at improving the milking capacity of the cows by careful selection and management. To prevent inbreeding new bulls have been imported from time to time direct from Patna. 500 lb. per lactation is considered a very good average for Assam cows and that for Khasi cows is still less. It may be incidentally noted here that Khasis do not, as a rule, drink milk but rear the animals for ploughing and slaughtering. Very few of the farm cows give less than 1,000 lb. per lactation, and by weeding out all inferior animals the average has been brought up to about 1,500 lb., some of the cows giving 2,000 lb. or more. It is hoped to raise this to 3,000 lb. within the next few years. This of course is not a very high yield. But it must be considered that the main object of the farm is to breed cows suitable for the average house-holder who has now got a cow giving an average of 300—400 lb. only and who wants a cow which can be reared comparatively cheap. The young heifers of this breed are in great demand among the cattle owners of the Shillong town, where they thrive very well and where they are gradually replacing the indigenous breed. The bulls have so far been taken mostly by tea planters most of whom keep a considerable number of cows in each plantation. A very successful feeding experiment carried out at this farm is the preservation of green fodder in ordinary pit silos throughout the winter. The bulls, however, have not proved invariably successful in the plains of Assam. In many places they have succumbed to infectious diseases or wild animals. Whenever it has been possible to use these for very considerable periods they have left a distinct mark on their progeny—particularly regarding milk yield. Accurate information about their progeny is being collected with a view to determining how far they will be suitable for the plains of Assam. The male progeny, however, have no distinct humps and are not, therefore, very popular as plough animals. Cultivators want rightly or wrongly a distinct hump in all their plough bullocks. What they want is an animal somewhat of the Hissar type but smaller. A larger number of up-country bullocks are now purchased by the cultivators of Assam every year for ploughs. The first object of any scheme of cattle improvement must be the production of an animal somewhat of this type. It will, however, be some

time before this province can have a cattle farm of its own. With a view to make a beginning 8 bulls were purchased from the Rungpur cattle farm last year. The bulls have been for the present kept at the Government farms and with selected private persons for the use of the public. Steps are being taken to reserve about 1,000 acres of Government waste land in Central Assam for a cattle farm which may be started when funds permit.

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(W. DAVISON, B.S.A., *Live Stock Expert in Mysore.*)

In a note placed before the Board of Agriculture at the session in February 1922, the methods being employed and planned for the improvement of the cattle of Mysore State were outlined. As it may interest the members of the Board to know what progress has been made in this work, the present note will aim at very briefly stating progress made up-to-date, in so far as this can be measured in the space of two years.

*Draught cattle.* In the previous note referred to, it was stated that the improvement of draught cattle must be done chiefly through the use of good draught bulls. The maintenance of bulls at veterinary hospitals and Government farms for public service has been adopted as a means of awakening an interest in this matter, and several of these have been put on a circuit to widen their sphere of influence and enlarge the territory of demonstration. Owing to financial difficulties it has not been found possible very materially to increase the number of animals used in this way, the actual increase being only 4 bulls over a previous total of 14 in December 1921. The actual progress made by this system is not easy to measure, and can only be gauged by the number of services given, and by any tendency there may be towards an increased demand for good breeding bulls by private owners. The number of coverings has been steadily on the increase as the following table shows, though the coverings on tour have shown a decrease in 1922-23 to those of the previous year. This, however, shows some signs of recovery. The number of tour coverings from July 1st to November 30th, 1923, is 47, and as December, January and February are usually the months in which the largest number of coverings take place, it is reasonable to expect that the number for 1923-24 will equal that of 1921-22, and that in spite of the fact that 4 bulls have been temporarily withdrawn from circuit on account of the difficulty of obtaining fodder for these due to the fodder shortage in the areas in which they travel.

No.	Items	1921-22		1922-23		From 1st July 1923 to end of December 1923	
		Hd. qr.	Tour	Hd. qr.	Tour	Hd. qr.	Tour
1	Number of coverings from 1st July 1923 to end of December 1923 and for the last 3 years July to July.	672	128	988	94	513	47

The number of services is, moreover, a criterion which is liable to misinterpretation unless carefully analysed. In most cases, the veterinary hospitals or dispensaries at which the bulls are stationed are at the headquarters of either a district or a taluq, and analysis of the covering registers brings out the fact that, in the case of bulls which are not on circuits, a large percentage of the cows covered are either the property of the various Government officials stationed in the town or belong to merchants or other towns people. In these cases, the owners are usually interested only in getting their cows in calf, fostering hopes for milk in due course, the calf being looked upon only as an accessory nuisance. Coverings such as these cannot be regarded as furthering the production of better cattle nor of any propagandistic value, though they may swell the annual figures. The figures available were recently tabulated with a view to compare the value of touring and stationary bulls from the coverings made on town cows *versus* country cows and the results were of interest. It was found that of the cows covered while the bulls were in headquarters, between 50 per cent. and 90 per cent. were owned by town residents, and of the cows which were taken to the veterinary hospitals during the absence of the bulls nearly 90 per cent. were again town owned. On circuits, all cows covered were owned by ryots. By following up the calves born to these bulls, it has also been made quite apparent that in

the great majority of cases, the calves born to these town owned cows are neglected, and that the covering was made for the sake of getting the cow in calf for future milking purposes, the calf being looked upon as a necessary nuisance. On the other hand, in the case of the ryot owned cows, the calf has usually been the objective and has been carefully reared. The natural conclusion, therefore, is that the bulls sent on circuit, though they actually cover less cows, do far more good than those permanently kept in veterinary hospitals and dispensaries. While it is obvious that the number of bulls which can be reasonably maintained by Government agencies can never be sufficient to make an appreciable effect on the stock of the country, the propagandistic effect of these bulls depends upon the number of good calves sired in such places where they will be an object lesson to the ryot population. From this standpoint, the circuit system seems to fully justify itself. It is also a fact that where bulls have been on circuit for a year or more, castration has been on the increase and a demand has arisen for breeding bulls, which, though not yet very strong numerically, is at least encouraging and indicative of expansion. The number of castrations performed has shown a marked increase, and a decided difference can be noticed in the attitude of the ryots toward this operation, who come forward and ask the veterinary staff to visit their villages for this purpose.

Items	1920-21		1921-22		1922-23		From 1st July to end of Dec. 1923	
	Hd. qr.	Tour	Hd. qr.	Tour	Hd. qr.	Tour	Hd. qr.	Tour.
Number of castrations for the same periods.	870	6,150	1,906	16,376	2,289	20,529	686	11,163

To make it possible that an increased number of good bulls may become available for purchase by ryots at reasonable prices, and assist in satisfying an already strong demand for this class of animals, proposals have been put before Government which will make it possible to turn out annually from 200 to 250 sound and suitable bulls. The scheme entails the utilization of the existing Amrit Mahal herds, which have been maintained by Government since before the days of Tippu Sultan in a comparatively pure state. These herds which number 9,000 head in all have heretofore been used solely for the supply of transport bullocks for military use. The decreased requirements for this purpose and changed views with regard to the necessity for assisting in the improvement of live stock have resulted in the transfer of these herds from the Military to the Agricultural Department which took place during the year 1923. It is anticipated that the proposals now under consideration of Government will be favourably received and that some really substantial work will be possible in the near future. The Amrit Mahal breed has been developed originally from the better class of indigenous stock and is admirably suited to combine with the bulk of the cattle of the State. The cattle of this breed are noted for their quality, quickness and courage, and although not very heavy animals (bullocks running from 800 to 1,000 lb. in weight on the average), are excellent draught cattle and especially suited to road work. These cattle are, however, poor milkers, which is true of all the cattle of the State. While the cows can supply what milk is required for the family use of the ryot owners, they are totally inadequate as dairy cattle such as are required to develop a dairying industry in its purer sense, or to cater to the demands of the larger cities and towns. To develop these animals in this direction would require generations of strict adherence to a system of selective breeding. In the writer's opinion, the length of time required would be antagonistic to a continuity of policy and the ultimate accomplishment would be of a confused nature, if indeed it reached the stage when the development could be regarded as an accomplishment. The present policy, therefore, with regard to developing a dairy breed does not aim at the dual-purpose animal and this problem is being attacked in a different way.

*Dairy cattle.* Experimental work with this class of cattle is being carried on at Mysore on the Rayanakere dairy farm, which is the property of His Highness the Maharaja of Mysore who has graciously permitted its use for this purpose and who finances the farm from his personal funds, thus showing an interest in the subject of an extremely practical nature. Two breeds are being used as foundation stock, the local Mysore or Hallikar cows and Sind cows. The latter constitute three-quarters of the herd which is now 90 cows strong. Crossing is being done on all cows with Holstein Friesian bulls, of which three are now in service. In the matter of milk yield, the herd is in much the same condition as it was two years ago, as very little changes has been effected beyond the weeding out of some low producing animals and the addition of some Sind heifers which have recently come to their first lactation. As the cross-breeding operations only commenced two years ago, none of the half-breds have yet been bred, the oldest being now fourteen months old. Altogether fifty heifer calves have been born from these crossings. The calves got from this cross are, however, quite promising. Birth weights have



exceeded those of any other animals born on the farm, including some Ayrshire crosses on the same female parent stock, and the rate of growth has been good. The oldest heifer referred to above weighed almost 700 lb. at 12 months of age, and throughout all calves have done well. It yet remains to be seen how they will develop and milk.

*Fodder crops.* Vitally connected with the improvement of live stock is the subject of fodder crops. The cultivation of crops purely for fodder purposes is a phase of agricultural activity which needs extensive encouragement and increase. To find out the most suitable crops for this purpose, the best cultural methods, and the highest yielding varieties, etc., is an extensive work in itself and has not so far been tackled in the Mysore State to any extent. Preliminary work in regard to grasses has been carried out by the Botanical Section, but no field scale investigations have been started. Sun-flower has been introduced and has shown itself to be a valuable fodder crop, with an ability to withstand severe drought and yet yield well. Being a short season crop, it can be grown at times when *Sorghum* would be unable to complete its growth and is also valuable as a means of controlling weeds. Some experimental work was done during the past season in the matter of cultural methods, but it is hoped that more extensive operations in this direction will be possible in the future and the formation of a special fodder crop section of the Botanical Section will be accomplished before long.

For the last three years, efforts have been made to popularize silos, especially in the Malnad areas where large areas of good grass are allowed to be wasted or burnt every year. The difficulty of getting labour at the right season has been one of the factors operating against success in this direction. However, some interest has been awakened and several clients are making ensilage in these tracts, while in the Maidan areas a few members of the Agricultural and Experimental Union have grown sun-flower and ensiled it during the past year. The extremely unfavourable season, however, prevented a number from so much as sowing the seed, so that the spread of this system has not been as large as it otherwise would have been.

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(C. V. SANE, M.Sc., B.A.G., *Director of Agriculture, Baroda.*)

The establishment of the Baroda cattle breeding farm and the palace dairy, although conceived long ago, has been a matter of only a couple of years and represents rather a chequered history of changing vicissitudes.

The dairy or what may be considered as the nearest approach to it in the old days, namely, the Gaushala, has been a feature of the palace requisites for a long time. Up to the year 1884, the animals constituting the Gaushala were freely grazed and milk sent to the palace. The inherent weakness of this method soon became apparent and a system of contract for dairy supplies of the palace was resorted to up to 1904. The remedy in this case proved worse than the disease as could have been easily foreseen in letting such an important matter affecting the health and comfort of Their Highnesses to be without proper supervision and control. For another decade, a new turn was given to the subject, and it was attempted to run the show on a business footing without much of an improvement, until in 1915 it was again taken up by the Department of His Highness' Household and placed in charge of a special officer trained for the purpose. The Gaushala now began to function as a dairy proper and supplied the palace kitchen with dairy produce in the shape of not only milk as of old but with cream, butter and *ghi* also.

We entered on the final stage of the evolution of the present institution in the year 1920, and for this we are mainly indebted to the advice of Mr. William Smith, Imperial Dairy Expert, when he paid us his first visit. Not only the possibilities but the necessity of such an institution for public benefit in the improvement of cattle breeding had not escaped the searching foresight of His Highness the Maharaja Saheb, but the combination of a keen desire for such an institution in the mind of His Highness, the encouraging advice of Mr. Smith and the driving force behind the movement of Mr. Seddon, the Minister for the department, was needed to make it an accomplished fact. It has now borne fruit in the shape of a cattle breeding farm and the palace dairy to-day.

It will be easily seen that the raw material for cattle improvement in an institution of such a chequered history and an uncertain aim is bound to be of a mixed character. Thus the Gir, the Sindhi and even the Saniwal of Punjab in the cows, and the Surti, the local, the Delhi and an occasional Jafferbadi in the class of buffaloes were to be found in the herd. The question on what breeds to concentrate first attention was an important issue, and decision has been taken for first effort with regard to the Kathiawar breeds of cattle, Gir cows and Jafferbadi buffaloes. To those who are conversant with conditions in Kathiawar with regard to these breeds, the reason of this first choice of far off Kathiawar in preference to work nearer

home and the centre of administration is readily explicable. Interests in Kathiawar are so minutely fragmented that none barring the Baroda State, although its interests there are the least of all its possessions, can meet a problem of such a general character. A lack of such close interest in this breed has resulted in a complete degeneration of the breed as a distinct type, and but for the intervention of this State, even at this late stage, it would have been a matter of only a few more years for the total extinction of the breed as a pure type. The hopelessness of the situation can be easily pictured when we consider the fact that in spite of our scouring the country lengthwise and crosswise, with plenty of funds in hand, we have not been able to secure even one first class typical specimen of the Gir cow or the Jafferabadi buffalo. While both species have been found to be tending to mongrelism, the case for the buffaloes is even worse than is the case with the cows.

The Gir cow has engaged our attention for some time past, and we can say without exaggeration that nowhere else would such a typical collection of the Gir breed of cows be found inside or outside of Kathiawar. The task of building up of the Jafferabadi buffalo we have but commenced of late, but we think we have adequate raw material to found a pedigree herd.

The Gujarat breed of Wadhia and the Kathiawar breed of the Gir cows have of late filled the minds of the public considerably, largely on account of the coincidence of their export by foreign purchasers and the rising price of milk and milk-products. There is little beyond this coincidence in the nature of cause and effect in these happenings as any one with an impartial consideration of the subject will find, but the fact remains that when one tries to secure typical specimens of the breeds, they are hard to find. The lot that is left behind is distinctly of a deteriorated kind. The providential existence of the Chharodi cattle farm has to a certain extent kept up the Gujarat breed in some form, at any rate there is the material to build from, but of the Kathiawar Gir, what is left behind is a mass of mongrel material. The embargo on export of the typical specimens cannot further be delayed if the situation is not to be reduced to one of sheer hopelessness.

The project of the cattle breeding farm is to maintain 40 Gir cows and an equal number of Jafferabadi buffaloes which could all be pedigreed in course of time. To-day we have 39 cows and 32 Jafferabadi buffaloes and the herd includes animals with the following performance :-

Seven buffaloes with milk yield per lactation of—5,945, 4,865, 4,721, 4,432, 4,371, 4,152, and 4,072 lb.

Seven cows with milk yield per lactation of—4,057, 3,509, 3,242, 3,081, 2,989, 2,900, and 2,659 lb.

We have begun by selling a farm bred 2½ years old bull at a modest price of Ra. 300 and hope shortly to be in a position of almost a monopoly for pedigreed animals of the two Kathiawar breeds.

While we are doing this, some important questions regarding the improvement of these breeds arise and in the absence of the Cattle Board that was recommended to be instituted at the last Board Meeting, none but this Board can authoritatively deal in their direction and settlement. These questions are both of an internal and external character. The advisability of dealing with breeds out of their natural environment has always been a moot point. A question is often asked as to why the problem of the improvement of Kathiawar breeds is tackled under other conditions. The question is a pertinent one. The Baroda Government had once considered the possibility of making the breed improvement as an adjunct of the existing farms, and whether it is not an advisable course under the present conditions of breed standards and their acknowledgment deserves more than a passing consideration. While conceding the point regarding natural environment, the Baroda Government have taken up this work in Baroda on a variety of considerations, not the least of which are the necessity of an institution for palace and hospital milk supply and the certainty of close supervision. Still it is a point on which the Board may express an opinion.

The other points are with regard to internal improvement. In Gujarat, the Gir breed is the only dual-purpose breed, better so in fact than the Sindhi or the Saniwal. It gives a much harder type of draught animal, while as a milk-producer it is not of an inconsiderable importance. As a milch animal, its chief drawbacks are irregularity of breeding and lack of steady milking. While these may, to a certain extent, be modified by careful feeding, and judicious selection in course of time may overcome them, they appear to be basic in the present day formation of the breed characters. The breed nearest to it in the way of situation as well as constitution of the fundamental characters, namely, the Sindhi, shows positive factors regarding both these defects. If we consider a whole colour as the natural one, we will have to consider the Gir as a mixed breed as speckled is the prevailing colour in the breed. There is little doubt that Sindhi and Gir breeds have some common genetic factors in their constitution. Is it desirable, even if possible, to make use of this early blood relationship to infuse Sindhi blood to improve the typical irregularity of breeding and lack of steady milking apparent in the Gir breed of to-day?

No matter how much we may hope for greater utilization of the cow for dairy and draught purposes, so long as *ghis* remains one of the most important articles of diet of the people of this country, the unrivalled superiority of the buffalo as a *ghis* producer will always find a place for the buffalo in farm live stock keeping. On the other hand, no matter how persuasive we may be in the better utilization of the male buffalo, one-half of the normal progeny of the buffalo must be considered as without economic value. The type to breed from in the case of the buffalo must, therefore, be different from the one fixed for the cow where both the male and female progeny are of economic value. The type to breed from in the buffalo class must be one which will persistently milk for a long period without annual intervention of the stimulation by calving. Of course, the persistent milking must be on an economic basis, but whether there should be this difference in the ideal to be built up to in the cow and buffalo class needs serious thought for reasons discussed above.

The expression of an authoritative opinion on these points by this Board would be most welcome in clarifying the position with regard to the difficult question of cattle improvement.

(j)

(K. W. FORMAN, B.S.A., *Professor of Dairying and Animal Husbandry, Allahabad Agricultural Institute.*)

I wish to write briefly on one phase of the subject under discussion:—

I am not familiar with what the Provincial Governments and Indian States are doing for the improvement of cattle by better breeding and feeding. I am of the opinion that it is so planned that each province and State will have its own Cattle Council and this is to be indirectly under the direction of an Indian Cattle Council.

One of the most important steps, in my opinion, that this National Cattle Council should take up is to establish herd books of each breed of cattle and encourage cattle breeding by holding official tests on milch cattle through an organized Cow Testing Association. Such a system will encourage all owners of cattle to register their cattle in such an Association by making a record. This will increase the value of their cattle and they will be in a position to sell breeding stock. This will affect and improve the cattle of the whole country. All records of such an Association will be sound and infallible and all persons will feel confident in buying registered cattle.

The largest Association of breeders of pure-bred cattle to-day, namely, the Holstein-Friesian Association of America, places all breeders on a par, rendering it very easy for any breeder to establish the value of a pure-bred cow, just as the mile-track will establish the value of a trotting bred horse, and the expense is very moderate.

The Association not only charges nothing for the entry of such a cow and her record in the advanced register, but to encourage the breeder in that direction, it pays out every year large sums of money in prizes; neither do the State Agricultural Colleges make any charge for their supervision in the matter of making these records, their only charge being for the time and necessary expenses of their supervisors who are sent out by the professors of Dairy Husbandry to conduct the testing, and as several cows may be under test at the same time, the expense per animal may be made light. The Association started its activities by making seven-day, fourteen-day and thirty-day tests six days after calving. It increased the efficiency of its system by authorizing other official records to be begun not less than eight months after calving and semi-official yearly tests. This gave the breeders a chance to show the staying qualities of their cattle. The results have proven very satisfactory.

Prizes are awarded for the best records made in four of these divisional tests, so any breeder may win three prizes in each division or twelve prizes in all.

The rules for the entry of cows in the Holstein-Friesian Advanced Register are very stringent, being designed to place every record beyond even a shadow of a doubt. Every milking during the period of test must be watched, weighed, sampled and tested by a representative of some State Agricultural College and, because of resulting expense, the bulk of its records are or short periods, largely for one week.

All cattle are classified in eight sections:—the first class is for bulls—a bull must be a sire of four or more daughters which have been admitted in the Register. The second class is for junior two-year old cows. The third class is for senior two year olds, and so on until the eighth class which is for all animals calving at or above the age of five years.

I wish to close by quoting Mr. S. Hoxie, a former Superintendent of this Association. He writes in favour of the Holstein-Friesian breed, but this can be viewed in the light of all breeds regardless of country or breed. Speaking of this system he says:—

“What will be its effect upon the general interests of the breed? This naturally will be the first question in regard to this system. The answer as naturally follows: If the publication of milk and butter records in fugitive ways, in the past, has given a worthy reputation to the breed, how much more should the substantiating and gathering together of such records add to that reputation? The records of our grand cows are a common heritage, and no friend of the breed can doubt the utility of gathering and preserving them in some unquestioned form. In this work large and small owners have equal opportunities. In public journals large advertisers take precedence. It would seem that on the ground of common justice some work of this kind is needed to awaken in all breeders equal incentives to improvement, and especially to inspire smaller owners to join in further building up a reputation for the breed in which all shall continue to feel a common pride.

“The information gathered by this system in regard to the structure and style of our noted cows must be of value to all who are interested in improving the breed. The means are here afforded of determining models, and of intelligently seeking such combinations of breeding as will produce our ideals in form and structure. Years will add especial value to this part of the work. The time is coming when it will be regarded quite as important to trace peculiarities of structure and peculiarities of qualities in the lines of ancestry as to trace pedigree.

“This system is also a light offering to science. There is yet to be a science of cattle selection and cattle breeding. But such a science can never be established without a multitude of observations such as this system records. Finally, it may be said that it is a step in the direction in which all progressive breeders and thinkers upon cattle subjects are looking. It destroys no institution to take its place. It is simply a step forward into an unoccupied field.”

It seems that any such system of recording for the whole of India should be done by a National Cattle Council with the Imperial Dairy Expert as superintendent whose office would be the headquarters of this Association. He could utilize the different agricultural institutions in India that are qualified to send out supervisors; and some supervision could also be carried out through the Government military dairies and other Government institutions. The working out of such a scheme should not be difficult to handle. It seems that without some system of cow testing and recording of records and pedigrees in herd books, we cannot hope to get the full enthusiasm in the improving of live stock and also anything very fundamental to carry on any extensive breeding programme all over India among private persons as well as private and Government institutions.

## APPENDIX IV.

## (a) The veterinary aspect of a cattle breeding policy.

(J. T. EDWARDS, B.Sc., M.R.C.V.S., *Director, Imperial Bacteriological Laboratory, Muktesar.*)

The whole question of cattle breeding, particularly when it is subjected to discussion by a central representative body, is intimately interwoven with principles upon which expert veterinary guidance must be obtained, for it is the general experience of all countries that no progress can be made in developing the cattle industry unless the breeder is reasonably assured that his efforts will not be nullified eventually by the incursions of disease. Items Nos. 1 and 2 of the topics suggested for discussion are therefore of profound veterinary interest, and as it is imperative that both agricultural and veterinary authorities should act in unison in order to secure advancement in the cattle breeding problem, I would commend to the close attention of the conference the resolutions passed by the Second Veterinary Conference, held at Calcutta in February-March last, in which the main issues concerning animal disease problems in India were discussed, and I would enjoin the conference to pass a resolution to the effect that they endorse the findings of the Veterinary Conference. The experience of field and laboratory workers in this country shows that disease in cattle is a factor meriting greater consideration in India than in perhaps any other country in the world, for investigations show that the cattle population is afflicted with almost every known form of serious contagious disease which acts as a deterrent to the development of cattle breeding as an industry. Outstanding examples are rinderpest, hæmorrhagic septicæmia, foot and mouth disease, blackquarter, anthrax, the piroplasmoses (including tropical "red water," *Theileria mutans* infection, and, it now transpires, a condition which appears to be indistinguishable from the formidable East Coast fever of Africa), the trypanosomiases ("surra"), severe worm infestations ("helminthiases"), diseases caused by ectoparasites (ticks *per se*, mange mites, and biting flies), contagious abortion, and (but happily to a small extent only) tuberculosis. All these are certainly "cattle breeding problems where the policy of one province or State particularly concerns other provinces or States," and "aspects of the cattle breeding problems on which action seems necessary."

In other countries, with a federal system of Government, the importance of disease as a limiting factor to the economic development of the cattle industry has been recognized so fully by the Central authorities that they disburse annually large sums of money for the elucidation of disease problems.

Thus, from authoritative information obtained, in the Union of South Africa the total capital expenditure in buildings at the Veterinary Research Laboratory, Onderstepoort since its inception in 1903 amounts to about £300,000, and the voted budget grant for the year 1922-23 to over £100,000 (salaries £44,688, expenses connected with research work, routine work and general upkeep and maintenance of the parent and branch laboratories £46,000). This annual expenditure is balanced by a revenue derived from the sale of laboratory products, etc., varying from £35,000 to £45,000.

In the United States of America during the year 1922-23 a sum of 6,968,076 dollars was indicated for the Bureau of Animal Industry (the veterinary bureau of the United States), and in addition a sum of 3,000,000 dollars for meat inspection. This total of approximately 10 million dollars was expended as follows: (2) for measures for the control and eradication of animal diseases such as tuberculosis, 4½ million dollars; (3) for scientific research, approximately, one million dollars. In addition to these sums appropriated by the Federal Government, each State makes some provision for similar activities within its own borders.

The above figures illustrate convincingly the attitude adopted by countries which consider the development of their cattle-breeding seriously. There is hardly any need to draw comparisons between cattle as an economic problem in the life of the country in India and in South Africa, and yet the sums allotted for research into animal disease in the two countries exhibit great disparity.

## (b) Cattle pro. em in Madras.

(R. W. LITTLEWOOD, N.D.A., *Deputy Director of Agriculture for Live Stock, Madras.*)

*Registration of breeding bulls.* For a commencement this could be confined to large towns, such as Madras, Madurai, Coimbatore, etc.

Anyone keeping or wishing to keep a breeding bull for breeding purposes must apply to the Corporation or Municipal Council for a license. The bull will then be inspected by an officer of this section or the Civil Veterinary Department, and if approved a fee license will be granted. If the bull is undesirable and the owner refuses to castrate it and is determined to use it, he may be called upon to pay a tax, say, of Rs. 50 per year for his license.

Anyone using uncastrated bulls in these cities and towns will be fined up to Rs. 100.

*Slaughter of good cows.* Slaughter of good cows and heifers, after they go dry, should be stopped as far as possible. Government could possibly lease out forest reserves to Milkmen's Associations or Agricultural Co-operative Societies, etc., for grazing grounds at a nominal sum. Government could purchase good cows when dry from the milkmen and then when they calve sell them back to the milkmen at the same price plus cost of feeding and labour. Government could take a large forest reserve, graze these animals and give a little concentrated food. Agreement would be drawn up and signed by milkmen.

*Cattle shows.*—Cattle shows should be encouraged in breeding districts, and substantial prizes awarded to good calves, heifers and cows.

Besides awarding prizes for the best bulls each village could compete and send its best breeding bull to the show, a special class could be formed and a medal awarded for the best bull, thus creating competition between villages. A village once it won the medal would become keen and its cattle would become well known.

(1) *Breeding operations carried on at Coimbatore.*—*Cross-bred herd.* Ayrshire-Sindhi and Ayrshire-Saniwal.

We are now getting the third generation calves and these are good animals.

(2) *Pure Sindhi herd.* Proposed to grade up by selection. Two good bulls from dams which have yielded over 6,500 lb. of milk in one lactation are now ready for service and will be used.

(3) *Pure Montgomery herd.* Five cows and one bull were bought from Pusa. Cows are not good milkers. The bull is a fine animal and we may get good calves by him. None born yet.

(4) *Cross-bred herd.* Cross-bred breeds with various breeds all mixed up, these are the progeny of the cross-bred cows served by a bull of Ayrshire-Montgomery strain named "Pusa."

The cattle are used for education purposes for the students; they are taught the proper system of feeding and rearing. They have to work in the yard and do the feeding themselves. They are taught butter-making on up-to-date lines.

The stock and dairy are viewed by the ryots of all the neighbouring villages who bring their friends along to inspect them. Every assistance is given in explaining to them what is going on; they are very interested in the cattle.

In another year or so I shall have too many animals and it is proposed to hold an annual sale each year at Coimbatore, the same as at Pusa and so distribute good milk animals, etc.

*Pedigree herd.* I hardly think this is practicable at present. The average stock keeper will not trouble over this as the breeders will keep only 5 or 6 cows each; this applies to both Ongole and Kangayam breeds. Pattagar of Palayakottai refuses to keep registers. I have asked him several times to open one but he declines and prefers to rely on his memory.

I persuaded the Buckingham Mills to open a cattle register and they have done so; they also keep milk records.

The Rajah of Undur keeps records of a kind of his animals; he promised to keep milk records also.

*Special facilities to cattle breeders.* The Government of Madras have already passed an order granting land to cattle breeders who are keen to expand their business, but on this matter it is better to go slowly as applications have been turned down by this department of men who applied for land for this kind of work and who had no interest in cattle breeding but simply wanted to procure the land. Land has been handed to one large cattle breeder for this purpose and two other applications are still pending. This is a step in the right direction if only we can.

get good and keen stock breeders to come forward, and I encourage this system if when they have got the land, they carry out our advice and only keep good class stock.

*Dairy industry.* This can be done by Government placing good dairy bulls for pedigree stock in large towns and educating the milkmen to feed and look after their heifer calves better. At present these are neglected. In places where Government stud bulls are stalled, it is advisable to offer substantial prizes for female calves born to these bulls. This is being tried in Madras this year. The dairy cattle in most of the large towns and cities are stalled either in the yards or houses of the milkmen and these people live in the slum parts of the town and so the places are in a very unsatisfactory condition. The Corporation of Madras decided to build a cattle yard so that milkmen could stall their animals under sanitary conditions but the site they selected was not suitable. It was near a refuse tip and so the stalls are only half filled.

The Corporation could insist on :—

- (1) Milk standard.
- (2) See that the animals are stalled under sanitary conditions preferably on the outskirts of towns and city.
- (3) Assisting milkmen's associations or agricultural co-operative societies in opening milk depôts where pure and clean milk could be purchased. Price paid for milk will be according to the amount of fat present in the milk. This is done in the College Dairy at Coimbatore.
- (4) Distributing good milking cows to the milkmen on reasonable terms, provided the milkmen look after their animals well.
- (5) Purchase of heifer calves from good milkers belonging to the milkmen; that is, if he has no accommodation to keep the animal after the dam has gone dry, and then re-selling it to one after the heifer calves through his association or society.

*Disposal of surplus Government animals.* This has been encouraged. Cattle are bought from military dairy farms for private customers in this presidency, that is if none are available from the college herd.

List of animals available for sale at all Government dairy farms and breeding farms could be circulated through each Director of Agriculture. There were a number of useless breeding bulls in the Madras City and several of these have been eliminated now through my placing six good bulls at stud in the city and charging a less fee to the milkmen.

*Transport facilities for live stock.* The railway authorities should be approached to allow calves to travel in the luggage van of passenger trains provided they are tied in gunny bags, the same as done in England. Instead of this, one has to engage a truck or part of a truck and the expense is very great.

I approached the Southern Mahratta Railway on this subject but they declined to do it. The railway freight in several instances is more than the value of the calf.

Fodder and cattle food should be carried on the railway at a concession rate.

### (c) Encouragement of cattle breeding in Assam.

(J. N. CHAKRAVARTY, B.A., M.S.A., M.R.A.S., *Deputy Director of Agriculture, Assam.*)

In Assam, apart from other natural disadvantages, the greatest obstacles to improvement of cattle are the difficulties of securing suitable grazing grounds and breeding bulls. In the Surma Valley there is now hardly any land where cattle breeding can be carried out on an extensive scale except in isolated areas in the District of Cachar. In the Brahmaputra Valley, however, there are still fairly large tracts of waste land where cattle-breeding can be carried out on a commercial scale. A good deal of this, however, is being rapidly taken up for cultivation by the pressure of increasing population. If the breaking up of fresh land goes on at the present rate, there will, in a few years, be little pasture left, and the areas which are at present being used for the purpose are also likely to be encroached upon. Steps should, therefore, be taken to reserve certain areas for cattle breeding, before it is too late. As most of the waste land in this province belongs to the Government, this should not present very serious difficulties. To enable this to be done, a careful survey should be made of the sites likely to be suitable for the purpose.

The question of supply of bulls is still more difficult. Few people, including the professional graziers, realize the importance of good bulls, and are willing or able to incur the expenditure necessary to procure and maintain these. Moreover, unless steps are taken to minimise the risk of casualty from contagious diseases, it may not, in many places, be really profitable to invest any money on high breed pedigree bulls. The present practice of grazing several herds together will also have to be discontinued. An extensive propaganda should, therefore, be conducted to educate people in the importance of using good bulls only. The propaganda should include actual demonstrations. Steps should also be taken to supply good bulls to breeders who are willing to maintain them. In the beginning these bulls have to be supplied free or at partly reduced prices. As, however, people begin to realize their importance, it should be possible to gradually increase the price until the cost price is charged. Good bulls produced by any breeder should also be purchased by the Government to be distributed in suitable centres in accordance with the above scheme. It is extremely doubtful whether the initiative will come, at least in this province, from the breeders or the general public. Nor are they likely to spend any money on superior bulls unless they get some help in the initial stages. Without some such scheme, the task of introducing superior bulls and effecting any improvement in cattle appears, therefore, to be very remote.

#### (d) City milk supply.

(i)

(ZAL R. KOTHAVALA, B.A.G., B.Sc., N.D.D., Dairy Superintendent, Bombay Municipality.)

One of the most unsatisfactory features of the milk supply of cities in India is that the major portion of the supply is obtained from cattle stabled in the very heart of the cities. Taking the example of Bombay, nearly 78 per cent. of the total milk consumed is produced by about 15,000 head of cattle stabled in the city itself. This system apparently dates back to the time when there were no railway facilities and land in urban areas was cheap. The only merit contained in this system is that the milk is produced just near the place of its consumption and can be supplied fresh without raising any problems of transportation, but this is many times outweighed by the dangers which attend its production in a crowded city by methods which are very primitive. There is further the great danger to the health of the inhabitants on account of the proximity of the stables. Besides these objections from the point of sanitation, certain economic factors have arisen of recent years which make clean and cheap production of milk in urban areas economically impossible. The first step, therefore, in the improvement of the milk supply of any Indian city is the removal of the stables from the town and the supply of milk from rural areas. Production on dairy farm should be the ultimate goal. But during the several years that must elapse between the substitution of a city supply by a country supply certain important economic problems arise which must be solved. Of these, the two most important are :—

- (1) The slaughter of milch animals brought to city stables for milk production ; and
- (2) the supervision of the milk supplied from the suburbs.

As regards the first, the slaughter of prime animals, it is not anticipated that the last stable in the city will disappear before a score of years yet. Till then the wanton destruction of useful animals will continue as at present if not checked. This practice, which exists to a fearful extent in Bombay, has not only drained the Bombay Presidency alone of its best breeds, but its effects are felt even in North India whence the Delhi buffalo is imported in fairly large numbers for the Bombay milch cattle stables. Figures of the buffaloes slaughtered at the Bandra municipal slaughter-house annually show a rise from 8,371 in 1915 to 11,536 in 1922 ; this gives a vivid idea of the annual destruction of the precious animals and emphasizes the necessity of devising some measures.

The Bombay Municipality recently made a move in the matter by adopting a resolution for the prevention of the slaughter of all animals under the age of 8 years at the municipal slaughter-houses. This measure though full of good intentions will work to certain grave disadvantages in practice as far as the agriculturist is concerned, for the only venue of the disposing of the weedy and useless animals will be closed. At the same time some such measure as would save the useful animals without preventing the slaughter of useless animals is urgently necessary. With this end in view the measure requires, in my opinion, to be so modified as to make it ap-



plicable only to milch animals brought to the city stables and not to all animals in general slaughtered at the slaughter-houses. Comments on this are invited. The proposal can be given effect to by maintaining a register of all animals imported into Bombay, in which age will be the determining factor. The animals so registered, if they are below the age limit, should be prohibited from being slaughtered at slaughter-houses when they run dry. The adoption of some such measure appears to me to be the only remedy within the powers of the municipality for the evil under the present circumstances. As for the animals thus saved, if proper inducements were offered by providing facilities for land by Government, not far away from the city, they could be kept till their next lactation either by individuals or through the efforts of limited concerns. Here a remark is necessary as to the experience in the past with these dry animals. It has been said they cannot breed any more and the reasons advanced are :—(i) That the food given in city stables is too rich in nitrogenous matter and on account of want of exercise fatty degeneration sets in and the animal is incapable of further breeding. (ii) The pernicious “ phuka ” method practised by the *gowlis* in avoiding to cover the animal while in heat, incapacitates the animal from bearing calf again.

While there is truth in the first statement it does not in itself form any unsurmountable difficulty. On the other hand, it has been ascertained that if the animal is served in right time instead of waiting till it gets dry, it bears calf like any other animal in spite of the rich food it gets. And this is being done in case of exceptionally good animals by the city *gowlis*. If any doubt is still felt about it the Local Government cattle experts should take up this question and thoroughly investigate it.

As for the second reason, if the *gowli* is forced to dispose of his animal when dry in any other way than to sell it to the butcher, by adopting some such measure as suggested above, he will undoubtedly be forced to abandon the present pernicious practice if he wants a customer for his dry animal, which must of necessity be a cattle breeder.

This question is brought before the Conference in view of the fact that the prohibition of the slaughter of the cattle is being decided upon by most of the principal municipalities in this country. At some places only a partial prohibition is carried out, while at places where religious sentiment is running high, total prohibition is advocated. The result of such a policy would be disastrous as far as the agriculture of the country is concerned and would prove ruinous to any scheme for the improvement of the cattle. The Conference, therefore, after debating on the question, should make its recommendations to the municipalities concerned and insist on co-operation from Government on the following points :—

- (1) The inadvisability of the total prohibition of the slaughter of cattle in municipal slaughter-houses as detrimental to the agricultural interests of the country.
- (2) The desirability of protecting useful milch animals brought to the cities by some such method as suggested above.
- (3) The desirability of substituting the present method of milk supply from cattle stabled in the city by a supply of milk produced on dairy farms in the country.
- (4) The grant of conveniently situated land by Government at concession rates for the purpose of maintaining dry animals obtained from city stables.
- (5) The grant of concessions by railways for the transport of dry animals from the city to the breeding grounds.
- (6) Introduction of stud bulls by Government in the city stables.

As regards the supervision of milk supplied from the suburbs, this factor is more important from the point of health of the community than from any economic consideration. Mere removal of the cattle from the city to the suburbs or to any place beyond the municipal limits will not solve the problem of a cleaner and cheaper milk supply for the city. On the contrary, were the animals to be shifted to places where the municipality has no jurisdictional powers or where there is no organized system of supervision, the milk imported into the city from such places will always be attended with grave dangers so that the remedy may prove worse than the disease, even if powers were obtained by the municipality by legislative enactments to control and supervise the areas roundabout which form the milk supplying sources of the city, due to the present unorganized state of the milk trade and the great number of herds in which the milch animals will lie scattered. Supervision over the production by a single municipality will prove very difficult and expensive if not impossible. Production on dairy farms started for the purpose would be ideal and the only possible solution of the problem, but before this stage of perfection is reached measures such as would ensure a safe milk supply from the suburbs through efficient supervision are very necessary and discussion on this subject is invited. This, in my opinion, could best be achieved through the co-operation of the local bodies and the municipalities lying within a certain radius of the city to which the milk from those areas is supplied. This system can be given effect to by adopting a uniform and common standard of laws and by-laws as regards the stabling of animals, sanitation, etc., so that when a permit for selling milk

in the city is applied for by a producer his ability to produce safe milk could be attested to by the local municipality in which the animals are stabled. In case of areas without the jurisdiction of any local municipality the Government must co-operate by taking up the responsibility and even extending the services of its inspectorial staff to the local municipalities whose revenue does not permit of adequate staff being kept for efficient control.

The advantage from such a control to the city will be that the public will be assured of a safe milk supply, while the local municipalities or the controlling bodies will gain by increased revenue obtained through the fees for stabling of animals within their jurisdiction.

## (ii)

(ZAL R. KOTHAVALA, B.A.G., B.Sc., N.D.D., *Dairy Superintendent, Bombay Municipality.*)

The problem of the milk supply in Bombay city is a most pressing one to-day, and I feel it might interest the members of the Board to know something of the difficulties which have to be contended with and the measures that are being taken to contend with those difficulties.

The problem is not of course confined to Bombay; it is common all over the country. It is vast and intricate and the efforts of one or more individuals or of a city or Corporation, will not go very far. The problem must be tackled as a national problem. In Bombay city with a population of 11,75,914 the total quantity of milk consumed per day amounts to 23,000 gallons. That means that the per capita consumption amounts to 3.1 oz. This figure as compared with the per capita consumption in U. S. A., which amounts to 20 oz., and in the United Kingdom, which amounts to 10 oz., is very low. With its large vegetarian population, Bombay ought to consume more and it shows that if more milk were procurable more would be consumed. The supply is smaller than the demand and the present unsatisfactory and dear milk supply is the result. Of the total quantity of the milk consumed daily, 18,000 gallons, i.e., 78 per cent., are produced within the city itself. To produce this quantity in all about 15,000 head of cattle are stabled in the very heart of the city. Of the remaining quantity, 4,855 gallons, i.e., 21 per cent., are brought by rail from the suburbs and beyond, while the remaining 142 gallons, i.e., 1 per cent., are brought to Bombay from outlying places by road.

The distribution of all this milk is being done either by the producers themselves or by retailing at milk shops and through city dairies. Of the last, it is very disappointing to find that there are only two or three which are worked on up-to-date principles of business and sanitation. The distribution of milk in the city leaves much to be desired. Little or no attention is paid to cleanliness in handling, while the method of transportation is crude and imperfect and the risk of contamination during transit is very great.

As regards control and inspection of the city's milk supply, it is unfortunate that I cannot deal with this part of the subject as fully as I would like to. Strange as it would appear, the supervision of the city's milk supply forms part of the duties of Assistant Health Officers in charge of the different wards. The city can boast of a splendid set of milk ordinances, but they are like arms lying useless without any soldiers to use them. Till 1922 there were only 5 Sub-Inspectors to look after the milk supply of the entire city. These men, in addition to inspecting milk while in transport through the agency of about 5,000 milk vendors and a large number of milk shops and taking test samples for examination, had also to issue summons and attend Courts. The effect of inadequate staff and the consequent inefficient supervision was reflected in the quality of the milk sold. In 1921 about 989 milk samples were examined. Of these, 650, i.e., 65 per cent., were of adulterated milk. The amount of water added varied from 15 per cent. to 86 per cent. From the middle of last year, the work of taking samples was assigned to the Medical Inspectors in addition to the Milk Sub-Inspectors. The number of samples taken every day increased from about 4 to 29. In 1922-23 the number of samples analysed amounted to 2,866. Of these, 1,760, i.e., 61.4 per cent., showed adulteration. Up to June 1923, 2,464 samples were analysed. Of these, 43.1 per cent. were of adulterated milk. It will thus be seen that since the inspectorial staff was supplemented and more rigid steps taken to inspect milk, the percentage of adulterated samples that were detected decreased from 65 per cent. to 42 per cent.

The responsibility of the supervision of the milk supply and the licensing of the trade is not only divided amongst several executive officers, but it is even divided between two departments. The fearful child mortality of Bombay is an eloquent testimony to the imperfect method of production, distribution and supervision of the city's milk supply. It has now been

definitely proved by the experience gained in some of the principal cities in U. S. A., that the milk supply has a direct bearing on child mortality. The price at which milk is sold in Bombay is 13 times dearer than in U. S. A. and 12 times dearer than in United Kingdom. This high price of milk is due partly to the demand being greater than the supply but principally to the production of 78 per cent. of the milk in the very heart of the city where conditions are anything but favourable for cheap production. Another very undesirable result of this system of stabling milch cattle in the heart of the city is the slaughter of prime animals brought to Bombay for the purpose of milk production. No fewer than 11,536 buffaloes were slaughtered at the municipal slaughter-house in 1921-22, while at Kurla, a suburb near Bombay, almost a similar number was slaughtered. All these animals come from the Bombay milch cattle stables and in most cases they are in the prime of life having been imported with the 2nd or 3rd calf. This unrestricted destruction of really useful animals that has been going on for so many years is causing a serious drain on the economic resources of the country of which the effects cannot but be felt. It is here that Government can be of great help by devising ways and means to meet this situation. The Bombay Municipality has already decided to put a stop to the slaughter of all animals below the age of 8 years, with a view to save the wanton destruction of milch cattle coming to Bombay. But if this measure is not to result in harm in another direction, it should be confined only to the milch cattle imported for the city stables.

This state of affairs is not by any means one of which any municipality or executive body could feel proud, but it brings forth clearly both the importance and the extent of the problem to be solved. Not only is the trade required to be rebuilt on sound principles of business and sanitation, but before this can be done the deep-rooted evils established by ignorant and unqualified producers are to be eradicated first. The Municipality was alive to the situation and its first efforts to bring about an improvement can be traced as far back as 1912. It was not, however, till the year 1915 that some results of these efforts were visible. In this year the Milk Committee appointed by the Corporation approached Dr. H. H. Mann to advise them in the matter. The Committee could not have selected a better man for the purpose. At that time Dr. Mann after studying the whole situation carefully, submitted in 1919 an interesting report over which he devoted considerable energy and labour. One direct and immediate result of the report was that the Corporation decided that no more milch cattle stables should be allowed to be erected in the city, and that on sanitary grounds the existing stables should gradually be removed to a suitable place outside the city, where the cattle should be housed in up-to-date stables with clean surroundings. It was also realized that for the purpose of reorganizing the milk supply and devising ways and means to improve it, it was essential that there should be a whole-time officer. This brought about my appointment in April 1922.

As a first step towards reorganizing the supply of milk from the suburbs, the Municipality decided to build a set of model stables at Trombay about 12 miles from Bombay. The Development Department, which has undertaken the development of Trombay, has earmarked an area of about 350 acres for milch cattle stables, of which 40 acres are being acquired immediately. To begin with, it is proposed to construct a yard of four stables to accommodate 500 cattle with necessary buildings and the provision for paddocks for exercise and open ground for the grazing of the cattle. These stalls will be let out to *goultis*, and in the case of owners of a large number of cattle, the Municipality may allow the owners to construct stables at their expense according to sanctioned plans on land leased from the area reserved by the Municipality. The Municipality will be responsible for water supply and sanitary services and it is hoped that a supply of electricity will be available also. With all these facilities and clean stables constructed on the most up-to-date principles the milk will be produced under almost ideal conditions. As regards the transport of the milk from Trombay to Bombay, there is a fine road connecting the two places and the Municipality will provide the necessary vehicles. Later, it is expected that there will be a direct connection by railway of which a beginning has already been made. In the light of experience gained, further stables will be erected at Trombay.

The Trombay scheme, while forming the basis of a suburban milk supply, cannot by itself solve the whole problem, unless it was supplemented by some other scheme to meet the enormous demand that will be created by the removal of cattle stables from the city. In the circumstances at present existing there was no private enterprise forthcoming to start a dairy farm unless some help was guaranteed by the Municipality. The only alternative to this was the starting of a dairy farm by the Municipality itself. As regards the former, a private limited company proposes to start dairy farms at two places, one at Telegaon on the G. I. P Railway and the other at Bulsar on B., B. & C. I. Railway. All the milk produced at these places would be sold in Bombay through the company's agency. The company is prepared to grant the Municipality the right of inspection of the farm and the accounts and to take such measures as would ensure proper management of the concern. In return, the company has asked that a dividend of 5½ per cent. per annum should be guaranteed to the share-holders for ten years, the Municipality to make up the deficit in case the profits of the company do not allow the payment of this dividend. The advantage of a private enterprise, even under these terms, to a municipal enterprise which has nowhere succeeded, are obvious. Both the proposals are at

present under the consideration of the Municipality. I should not fail to refer here to the invaluable assistance received from Mr. W. Smith, Imperial Dairy Expert, both in connection with this scheme and the general policy to be adopted.

Even after the establishment of a suburban milk supply certain measures will be quite necessary as regards the inspection and control of the milk, after it enters the city, to ensure a clean supply to the public. Unless there is proper and efficient supervision, the traders in unadulterated milk will have no chance against those who adulterate their milk with water. It is necessary to emphasize this point very strongly otherwise all the grandiose schemes for clean and cheap milk supply would come to nothing.

In the first place the present system of inspection needs complete overhauling. The prime factors in efficient control and supervision are the centralization of the administrative powers and an adequate and well-trained staff. These have been urged upon by all the Milk Commissions investigating the problem in various parts of the country, and wherever they have been adopted a clean and safe milk supply to the public has been assured. The division of responsibility between more than one department and between different executives and the secondary importance given to milk inspection work where this forms part of the other duties of an official, has to a great extent been responsible for the present deplorable state of affairs. If any headway is to be made in the direction of improving the milk supply, it is in my opinion necessary to have a separate milk department, where all work in connection with the inspection, supervision, etc., of the milk supply could be centralized.

Before concluding I should like to refer here to public apathy in this matter; whatever be the magnitude of a scheme involving the welfare of the public, progress with it is difficult, if not impossible, if there is no intelligent appreciation by the public of the measures undertaken. In order that the progress of the measures in contemplation by the Municipality may be expedited, co-operation from the public was sought for by making proposals which were conducive to a cleaner and cheaper milk supply. But neither an appeal to the religious sentiments of the people nor to the profits involved in the enterprises had any effect.

The whole situation has been and is under very careful consideration. I must admit that very little progress has so far taken place and there is hardly any tangible result to which I can point with pride. But you will agree that progress must of necessity be very slow where a public body like Municipal Corporation is concerned, where the problem is so vast and intricate, where the evils connected with the problem have been deep-rooted for so many years and where we have to deal with a class of people of so backward a type as the *gwalis*. Fortunately there is at the head of the Health Department and also at the head of the Corporation officers who are keenly interested in this particular problem and they are doing all they can toward its solution.

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(iii)

(J. N. CHAKRAVARTY, B.A., M.S.A., M.R.A.S., Deputy Director of Agriculture, Assam.)

Although the question of milk supply to large towns is the main topic for consideration, it is hoped that the question of small towns is not to be rigidly excluded. Even in small towns the supply of pure milk is getting an increasingly difficult problem everyday. In Jorhat and many other towns in Assam, milk, or whatever passes by that name, is sold at 5 to 6 annas per seer and delivery can be rarely obtained before midday. The only course open to a person who wishes to have a supply of pure milk in the morning is to keep his own cows. As the demand of each individual is rather small, the maintenance of one or two cows separately is not economical. Moreover facilities for grazing are getting scarce in all towns and the price of fodder going up very quickly. There is also the danger of infectious diseases where animals from different house-holders are grazed together. If one has a good cow there is also the additional difficulty of securing a good bull for service. Taking all these facts into consideration, it will be realized that even in small towns it is not economical to keep one's own cow. The number of professional *gwalas* in these towns is very few and the business is largely in the hands of men with whom cow-keeping is only a side occupation. He has other important work to attend to and can only devote part of his time and attention to his cow.

The cases of these small *gwalas* are not very much better. They have to face all the above difficulties to a greater or less degree. An ordinary Assamese cow, of superior type, will only give one to two seers of milk, many giving much less. It is not a paying proposition for any one to maintain such cow, but under the present conditions very few *gwalas* are willing to invest

in superior cows. The main reasons why the milk is getting scarce in almost every locality may be summarized as follows :—

- (1) Gradual deterioration of the cows, due to want of good bulls and good feeding.
- (2) Want of grazing grounds.
- (3) High price of fodder and food grains.
- (4) Want of professional men to devote their whole time to the business.

It seems to the writer that unless regular dairy farms are started where superior types of cows can be kept without danger of infection from outside and where arrangement can be made to grow fodder crops, very little improvements can be expected in the milk supply even of small towns. For various reasons, which need not be gone into detail here, a joint stock dairy farm is not likely to be successful in small towns. Success in dairy farming will depend very largely on the honesty and the capacity of the manager. A suitable man will not be available except on a very high pay, which a comparatively small farm will not be able to afford. The time has not yet come when substantial businessmen will invest money in this trade. They will first have to be shown by actual demonstration that it will bring a fair return for the capital invested.

The only course which appears to have some chance of success in small towns is for a few interested people to combine together and start a dairy farm on a co-operative basis. The farm should be situated within 2 or 3 miles of the town, so that the question of supervision and delivery of milk may not present great difficulties. 50—100 acres would perhaps be a suitable size for such farms. In many mofussil towns, at least in Assam and North Bengal, it may be still possible to secure suitable land for the purpose at reasonable cost. In some cases it may be necessary to acquire land for the purpose. If necessary, this should be done by the Government on behalf of the co-operative society. Membership should be confined to actual consumers who should subscribe the bulk of the capital, in any case not less than half, the balance being borrowed from the central co-operative banks. An officer of the Agricultural Department should be an *ex-officio* member of the managing committee, and advice and help should be freely given by the officers of the department. One or two suitable bulls should also be supplied by the department and the male progeny may be taken over by the department at a reasonable price for use as stud bulls, as the bulls of these farms are likely to be superior to the ordinary bulls, provided they are fed properly. To avoid all risk it may be desirable to begin with local and acclimatized cows, but as experience is gained animals of superior type from other provinces might be imported. But in any case none but the best animals should be used, as with a good nucleus, it may be possible, later, to build up a really good herd. A careful milk record should be kept for each cow, so that all inferior animals may be discarded. By following these methods systematically for a few years not only will the supply of pure milk be ensured but there will be a distinct improvement in the cattle.

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REPORT

OF THE

*IMPERIAL DEPARTMENT OF  
AGRICULTURE*

FOR THE YEARS

1905-06 and 1906-07.

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REPORT  
OF THE  
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AGRICULTURE*

FOR THE YEARS

1905-06 and 1906-07.

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PART I.

REPORT OF THE INSPECTOR-GENERAL OF AGRICULTURE.

1. *General duties.*—The duties of the Inspector-General are advisory as regards agricultural investigations which are being carried out in each Province, but they are direct as regards the work carried on at the Government of India Research Institute at Pusa. The Provincial Directors have consulted him freely, and have also readily accepted advice. They have co-operated very freely with each other. Good arrangements have been made for continuity of work in each Province and there is no special overlapping of work. Mr. F. G. Sly, I.C.S., held charge of the office of the Inspector-General of Agriculture in India until 26th February 1907, when after over two years' leave, Mr. J. Mollison, M.R.A.C., permanent incumbent of the post, again took over charge. As the work of the Imperial Department of Agriculture developed it was considered necessary to appoint an assistant to the Inspector-General. Mr. T. F. Main, B.Sc., was appointed in August 1905. His chief work has been to collect information regarding ordinary field and garden crops, agricultural implements, agricultural practices and the like. He was recently specially employed to make full enquiries regarding Coffee and Pepper cultivation in Southern India, to study the methods of keeping Farm accounts in all Provinces in order to offer suggestions to improve them and on an enquiry regarding the natural grasses and pasture plants of India. General work of this kind will be continued. One or two enquiries at a time will be taken up and fully dealt with.

2. *The staff and means for agricultural improvement in India.*—The proposals made to the Secretary of State for India for the expansion of the Agricultural Department have been generally sanctioned excepting those which refer to a third Entomologist and Crop Specialists for Tobacco, Sugarcane, Wheat, Rice and Fruit and Mycological and Entomological Experts in each Province. The appointment of a Cotton Expert has been sanctioned and is likely to be filled soon by a very experienced officer. A fibre expert has been appointed and now works under the Government of Eastern Bengal and Assam. His head-quarters and laboratories and experimental plots are at Pusa. His work in regard to the extension of jute cultivation and other fibres extends all over India, but his chief field experiments are at present arranged for at Pusa.

There are now eighteen appointments in the Imperial Department of Agriculture, *viz.*:—

1. Inspector-General of Agriculture.—J. Mollison, M.R.A.C.
2. Assistant Inspector-General of Agriculture.—T. F. Main, B.Sc.
3. Director of the Agricultural Research Institute and Principal of the Agricultural College, Pusa.—Bernard Coventry.
4. Imperial Agricultural Chemist.—J. W. Leather, Ph.D., F.I.C., F.C.S.
5. Imperial Mycologist.—E. J. Butler, M.B., F.L.S.
6. Imperial Entomologist.—H. Maxwell-Lefroy, M.A., F.E.S., F.Z.S.
7. Second Entomologist.—F. M. Howlett, B.A.
8. Imperial Bacteriologist.—C. J. Bergtheil.
9. Imperial Agriculturist.—E. Shearer, M.A., B.Sc.
10. Imperial Economic Botanist.—A. Howard, M.A., A.R.C.S.
11. Imperial Cotton Specialist.—Vacant.
12. Supernumerary Agriculturist.—A. G. Birt, B.Sc.
13. Supernumerary Agriculturist.—W. Roberts, B.Sc.
14. Supernumerary Agriculturist.—G. H. Garrad, N.D.A.
15. Supernumerary Specialist.—C. W. Mason (Entomologist).
16. Supernumerary Specialist.—H. E. Annett, B.Sc. (Chemist).
17. Supernumerary Specialist, R. J. D. Graham, M.A., B.Sc. (Botanist).
18. Supernumerary Specialist.—W. MacRae, M.A., B.Sc. (Mycologist).

The Imperial Bacteriologist has been employed by the Bengal Government in Indigo Research work. He will be able to continue this work when he takes up his permanent appointment at Pusa in April next, but there is much other work which requires his special attention at Pusa. We have found considerable difficulty in getting experienced

Agricultural Experts for particular sections. Therefore, young supernumerary officers have been appointed who are being trained at Pusa and by deputation to various Provinces. The second Entomologist and the supernumerary Mycologist have been selected, but have not yet arrived in India. The former is specializing in work which will be of value to India. The latter has gone to Germany for special studies. In each Province a great advance has been made in the organisation of its Agricultural Department. Each has a nucleus staff consisting in most cases of the Principal of the Agricultural College, a Chemist, a Botanist and one or more all-round practical Agriculturists. There are in all 38 sanctioned appointments for the Provinces as shown in the following table :—

Province.	Deputy Director of Agriculture.	Second Deputy Director of Agriculture.	Principal, Provincial College.	Botanist.	Chemist.
Madras . . .	R. W. B. C. Wood, B.A.	C. Sampson, B.Sc.	C. J. W. Shep- erson, B.Sc.	C. A. Barber, M.A.	W. H. Harrison M.Sc.
Bombay . . .	F. Fletcher, M.A., B.Sc.	G. H. Hender- son, N.D.A., N.D.D.	H. H. Mann, P.Sc., Princi- pal, J. B. Knight, M.Sc., Professor of Agriculture.	G. A. Gammie, F.L.S.	H. H. Mann, D.Sc. (Chemist and Principal of College).
Bengal . . .	F. Smith, B.Sc.	(not provided)	H. H. Corbin, B.Sc.	W. R. Butten- shaw, M.A., B.Sc.	Vacant.
Eastern Bengal and Assam	Rai Bahadur B. C. Basu, M.B.A.C.	(to be filled locally in October)	(not provided)	(required in October 1907)	(1) A. A. Meggitt, B.Sc. (Agricultural Chemist).  (2) R. S. Finlow, B.Sc. (Fibre Ex- pert).
Burma . . .	A. MacKerral M.A., B.Sc.	(not provided)	M. E. Thomp- stone, B.Sc.	(vacant)	F. J. M.Sc.
United Provinces .	J. M. Hay- man, D.V.S.	(vacant)	A. W. Freman- tie, B.Sc.	H. M. Leake, M.A., F.L.S.	G. Clarke, F.I.C.
Punjab . . .	S. Milligan, M.A., B.Sc.	(not provided)	A. C. Dobbs, B.A.	(vacant)	J. H. Barnes, B.Sc., A.I.C., F.C.S.
Central Provinces .	D. Clouston, M.A., B.Sc.	(vacant)	G. Evans, B.A., B.Sc.	(vacant)	F. J. Plymen, A.C.G.I.
North-West Frontier Province.	(vacant)	(not provided)			

*Note.*—Postings made subsequent to June 1907 have not been included in this statement.

Eight of these officers have not yet arrived in India. The sanctioned posts will probably all be filled before the end of the financial year. The Mysore, Baroda and Kashmir States are developing their Agricultural Departments and have each done a great deal to improve Horticulture. The larger public gardens in India are doing much to improve our fruit orchards and are making other improvements. The Planters' Associations in Behar and Southern India have been active in advancing their industries. The Indian Tea Association and Indigo Planters' Association have each a staff of Agricultural Experts.

3. *Rules of Service.*—Uniform rules have been laid down for the appointment in the agricultural service. Local allowances for certain officers of the Imperial Department of Agriculture and Principals of Provincial Colleges have been sanctioned. Separate Departments of Agriculture, distinct from the Land Records Departments, have been formed in nearly all Provinces and are placed in charge of officers of the Indian Civil Service as Directors of Agriculture. The restriction limiting the total emoluments of the Directors of Agriculture to the pay of the Collectors of the highest grade as a maximum has been withdrawn. Definite orders have been issued by the Government of India regarding the authority which can be exercised by the Imperial Experts over Provincial work. This authority is purely advisory. The Imperial Experts can freely communicate direct with Provincial Experts regarding lines of work already sanctioned, and their advice is also very freely taken advantage of in executive duties.

4. *Tours.*—In 1905 Mr. Sly attended the Educational Conference held at Simla and read a paper on rural education. During the period under report the Inspector-General visited all the Provinces once or several times. The main objects of the tours were to inspect various Government Farms and to confer with the local officers regarding the work done on these Farms, and regarding the extension of experimental work of proved value into local districts and of good methods of cultivation or good varieties of crops into other parts of India. A visit was paid to Burma early in 1905 when a detailed scheme for the organisation of the Agricultural Department of the Province was framed in consultation with the Director. On this tour endeavours were made to ascertain the possibilities of cotton cultivation in the Province. These were not found to be particularly hopeful because the profitable cultivation of cotton requires much labour, and in Burma labour is both scarce and dear. In Madras the Provincial Agricultural Stations and the general agriculture of the Province were seen, and in more particular detail the sugarcane experiments at Samalkota, the Agave plantations at Hindupur and the system of rice irrigation under tanks supplemented by wells. This system can probably be adopted with advantage in many parts of Peninsular India and should be generally known. On



the same tour Mr. Tata's Silk Factory at Bangalore was inspected. Three visits were paid to the Bombay Presidency. The extensive work in the Bombay Agricultural Department was inspected and the possibilities for its extension in numerous directions discussed. The tree cotton experiments made by Mr. Tytler at Belgaum were seen, also the experiments with Egyptian cotton in Sind. The Chharodi Cattle Farm was inspected in company with the Inspector-General, Civil Veterinary Department, and the Bombay Director of Agriculture. It was decided to continue breeding operations on very definite lines and to breed from the very best cattle only. This Farm has been transferred to the Civil Veterinary Department. The Baroda State was visited, and the farms and sericulture experiments there were inspected. In the United Provinces the extensive work initiated by Mr. Moreland in wheat improvement by hybridization and selection was studied, also the general and very varied work of the Department, especially the storing and distribution of good varieties of seed. A conference was held regarding the extension of the Department. The North-West Frontier Province was visited. An area for an experimental farm was selected and general enquiries made as regards agricultural improvements in the Province. On the same tour the Lyallpur Farm and the agricultural conditions of the Chenab Colony in the Punjab were seen. In Bengal Mr. Sly advised regarding the site for the Provincial College and its Farm and also saw the experimental areas under tree cottons which are managed by Messrs. Shaw, Wallace & Co. helped by funds from the Government of India and the British Cotton Growing Association. The agricultural experiments and the general agriculture of the Central Provinces were kept well in review as the head-quarters of the Department are at Nagpur. In February 1906, Mr. Sly went to Eastern Bengal and Assam and conferred with His Honour the Lieutenant-Governor, the Director and Mr. Finlow on the organisation of the Agricultural Department and the cultivation of jute in the Province. He visited with Dr. H. H. Mann, Heeleeka, the principal experimental station of the Indian Tea Association, some tea plantations and the Sisal Hemp plantation at Daurachera.

5. *Board of Agriculture.*—The constitution of the Board of Agriculture, its duties and objects were described in the last Report of the Department. Since then, it has done most useful work in giving advice to Government in general agricultural experimental work and in other connected matters. The Board has now held three annual meetings attended respectively by 32, 35 and 48 members. The increased number of members indicates progress. The influence of these conferences greatly affects the advancement of agricultural science and practice in India. The second meeting of the Board was held at Pusa. It was attended by members from all Provinces except Burma, also by representatives from Mysore and Baroda. The subjects for general discussion

were (1) the programmes of work of the Imperial and Provincial Departments, (2) means of improving Indian wheat and tobacco, (3) the use of artificial fertilizers in India and control of the trade, (4) the provision of fodder for cattle in times of famine, (5) a syllabus for the principal branches of agricultural education. The Proceedings of the Board have been separately published. The proposals as regards the syllabus for scientific agricultural education may have to be modified before they can be accepted for general application. In fact the syllabus as framed for general agricultural education should only be taken as a guide for the agricultural course in any particular Provincial College. A sub-committee consisting of the Pusa staff and several other scientific experts proposed, in general terms, a scheme of experimental work for the Pusa Institute and the Farm. The scheme recommends that fundamental principles applicable to tropical and sub-tropical agriculture only should be dealt with at Pusa. Before we can, however, apply science to practice in the field a complete knowledge of ordinary field practices is required, and it is just as essential to study these practices at Pusa as at Provincial Research Stations. It was decided that the meeting of the Board should, in alternate years, be held at Pusa and in one or other of the Provinces. The third meeting of the Board was accordingly held at Cawnpore in February 1907. In addition to the ordinary members Sir Edward Buck, K.C.S.I., and Major Atkinson, R.E., were visitors, and made valuable contributions to the proceedings. The chief discussions referred to the programmes of work of the various Agricultural Departments, the Indian Sugar Industry, Cotton Improvement, Artificial Fertilizers and the Unification of Laboratory Methods employed by Agricultural Chemists. The question of legislation for the control of artificial fertilizers was again considered. The Board decided that such legislation though desirable is not ripe for introduction, but that trade developments should be closely watched. Sir Edward Buck introduced discussion on two very important subjects. The first was the utilization of river silt in India, the second was the employment of Agricultural Engineers in India. The discussion elicited many facts of general interest. The Board of Agriculture has grown unwieldy as regards the number of members. Its future constitution is being considered. It is proposed to reduce the number of members and to specially invite officers experienced in Agriculture.

6. *The Agricultural Research Institute, Pusa.*—The Director, Mr. B. Coventry, held charge until February 1907, when he proceeded on leave. Dr. J. W. Leather has been officiating for him. All branches of the Institute except Agricultural Bacteriology are now located at Pusa and consist of Agriculture, Chemistry, Mycology, Entomology, Bacteriology and Botany. The Imperial Bacteriologist, Mr. C. Bergthel, is still on deputation with the Government of Bengal. The general work in

each section is described by the head of that section, and the report of each is added hereto as an appendix. Some reports being lengthy had to be summarised.

The College and Research building are nearly complete and will be opened for work by the end of April 1908. All other buildings are complete ; they include eight bungalows for European officers, quarters for six European probationers, a rest-house, hospital, veterinary dispensary, a hostel for seventy students, quarters for thirteen teachers, the farm buildings, general office, temporary chemical, biological, entomological and botanical laboratories, an insectary and a potculture house. The whole estate has been practically cleared of jungle and put in order and the roads and avenues have been greatly improved. The compounds of bungalows and other buildings are in trim order except the compound of the College building which is not yet finished. The Pusa estate, like other parts of Behar, is liable to be suddenly flooded owing to heavy continuous rain. It has, therefore, been found necessary to form embankments to exclude from the experimental areas flooding in occasional years. It is impossible to make full arrangements for the equipment of the Institute until its construction is complete ; but nucleus collections for the library and for other sections are being gathered. The museums of economic products, mycology and entomology, will be filled by specimens which have been collected or will be collected in the near future. Until the Provincial Agricultural Colleges are all in working order, we propose to teach at Pusa specially selected agricultural students who will each get a scholarship of sufficient value for support during the course of instruction. The chief object of instruction is to prepare natives of the country for practical work in scientific agriculture. Experienced highly educated natives are not now easily obtainable to supervise field experiments in a reliable way because practically trained men are not available. Eventually Pusa, by giving a post-graduate course, will, it is hoped, produce native specialists in particular lines of agricultural work such as in Agricultural Chemistry, Entomology, Mycology and Agriculture.

7. *Agriculture*.—Mr. E. Shearer, the Imperial Agriculturist, had charge of the Farm and all cultivation experiments during the period under review. The Pusa property extends over 1,300 acres, and the greater portion is intended for work-a-day methods. The clearing, levelling and reclamation of good arable land from jungle is nearly complete and preparations are being made on a small section of the property for scientific experiments which will probably benefit large areas in India. In framing the lines of experiments, the testing of varieties of crops, indigenous methods, available manures and such like, on land similar to that reserved for experimental plots, is likely to lead to useful results and this has been undertaken. In order to prepare for permanent

experiments, the uniformity of particular areas on the farm is being determined. The chief crops grown experimentally were cotton, sugarcane, jute and flax. Exceptional floods damaged the whole estate in 1905 and 1906. Precautions have been taken to prevent this damage in future. A detailed account of jute and flax cultivation is given under separate headings.

8. *Cotton*.—Imported and acclimatised American, indigenous and Egyptian varieties and perennial tree cottons were tried on the farm. After three years' experience general results indicate that many other crops are much more profitable in Behar than any description of cotton. The exotic annual cottons and even the acclimatised perennial tree cottons are liable to severe damage by boll-worm and other pests which are difficult to control.

9. *Sugarcane*.—Twenty-five varieties of sugarcane were planted in 1905. The general results are shortly dealt with in part six of this report.

Green manuring with *Sunn* hemp gave good results on newly broken up poor land. Two pasture grasses, *Chloris virgata* and *Chloris gayana* which flourish in Australia and South Africa were tried and being promising will be tried on a larger scale next year. The pasture area of the Pusa estate is now laid out. Manurial and other experiments on grass and pasture land in England have yielded very valuable and definite results. It has been arranged to start similar experiments at Pusa and to determine whether our pasture land can be improved. Mr. Shearer has framed a scheme of manuring and other experiments which is fully described in the *Agricultural Journal of India*, Vol. 2, Part 3. Breeding herds of local and Montgomery cattle are kept on the farm, the former with the object of distributing good bulls throughout particular districts in Bengal, the latter chiefly with the object of testing the milking quality of the breed and of supplying the Pusa establishment with milk. Montgomery cattle are probably the best milk-breed in India and apparently can be acclimatised easily in almost any other Indian district. This herd is doing very well at Pusa. The Superintendent, Civil Veterinary Department, Bengal, gives advice and takes a keen interest regarding these breeding herds. The rejection and distribution of bulls for district work is practically left in his hands. We have begun poultry breeding and bee-keeping at Pusa from stocks imported from England, but indigenous stocks will not be neglected.

10. *Agricultural Chemistry*.—Dr. J. W. Leather held charge of the section except during three months' leave when Mr. R. S. Finlow acted for him. He has now a European Assistant. Numerous analyses of soils, waters, silts, manures, feeding stuffs, oil-seeds,

sugarcanes, etc., were made and several special problems were investigated. The miscellaneous work which Dr. Leather has hitherto undertaken will decrease as the posting of Chemists to each Province is completed. He will have more time for original research and for definite large investigations. Such large investigations are now essential because the work of the department has developed. During the period under report Indian commerce has been helped by the work of the Chemical Section. The value of rain and dew in adding manurial elements to the soil is under investigation. Pusa has a well-equipped potculture house which has already given practical results regarding the manures required for particular Indian soils. Dr. Leather has described the potculture house in Memoir No. 3 of 1907, Chemical Series. He is endeavouring to popularise his potculture results by practical application in the field among Behar Indigo Planters. Meteorological records are being kept. Four drain gauges have been constructed and the chemical and other effects of the passage of water through the soil are under investigation. Dr. Leather is determining the conditions under which Cyanogenetic Glucosides are formed in certain agricultural plants, but there are yet no definite results to report.

11. *Mycology*.—The head-quarters of the Imperial Mycologist were transferred to Pusa in November 1905. Dr. Butler's practical work will be greatly facilitated by a complete reference herbarium collection of fungus diseases which affect Indian agricultural crops. The specimens are gradually being collected. His work cannot easily be applied in practice until preliminary enquiries, which take time are worked out. He is single-handed and has more agricultural crop diseases to deal with than in any country in the world. He requires a European assistant in addition to the supernumerary who has been appointed but has not yet joined. Dr. Butler was absent in Europe on leave for three months and then enlisted the co-operation of scientific workers in Paris, Berlin, and Kew. For Mycological work, the training of native assistants has been undertaken at Pusa as far as possible for every Province and will be continued. At Pusa and Poona experiments were continued to study the groundnut leaf disease. The wheat rust problem was also continued. An account of the varieties and distribution of Indian rusts has been published in the Botanical Memoir, Vol. I, No. 2, July 1906. The wilts of pigeon-pea, cotton, gram, jute, sesamum and indigo have also been under study. The knowledge so far gained indicates that the United States Cotton Wilt Fungus (*Neocosmospora vasinfecta*) which is widely distributed in India, is the probable cause. A parasite (*Sclerospora graminicola*) causes the green-ear disease of *bajra*, *jowar*, Italian millets and other cereals. A published Scientific Memoir deals with this parasite (Vol.

II, No. 1 of 1907, Botanical series). In the mycological laboratory numerous specimens of affected agricultural crops, fruit trees, and other economic plants were examined and remedies likely to prove useful were suggested. Field experiments were made at Dehra Dun and Pusa to test the value of soil inoculation recommended by the United States Department of Agriculture. They resulted in no appreciable gains. These methods probably do not generally suit the soils in India because the system of rotation usually practised includes numerous leguminous crops and the bacilli which produce the nodules on the roots of these crops and which add nitrogen in an organic form to the soil are probably numerous in every field. The study of the fungi which help to decompose the organic matter in soil has been commenced. Dr. Butler is giving special attention to the diseases of palm trees, sugarcane and mangoes. The spread of palm-tree disease from the Godavari delta threatens the extinction of palmyra; Coconut and betelnut palms in many parts of Madras. Dr. Butler toured through infected areas in August 1905 and March 1907. A large campaign to stamp out this disease is guided by Dr. Butler's advice, and the executive part of the work is being carried out vigorously by the Madras Agricultural Department.

A detailed account of this disease is given in the *Agricultural Journal* of October 1906 and a technical description of the parasite in the *Scientific Memoir*, Vol. I, No. 5, Botanical Series.

At Pusa investigation of the "Red Rot," "Black Rot," "Smut" and the "Red Leaf Spot," some of the chief diseases of sugarcane has been made. A simple and efficient method of checking "Red Rot," the most serious of these, has been discovered. The treatment and check of other sugarcane diseases are under investigation.

Dr. Butler visited Malda (Bengal) in 1905 to investigate the disease which is destroying the valuable mango orchards of the district. This enquiry will probably require intricate investigation. Dr. Butler is preparing a text-book regarding the fungus diseases of Indian plants for the use of Indian students.

12. *Entomology*.—Mr. Lefroy held charge of his section during the period under report. A supernumerary Entomologist joined in December 1906. Mr. Howlett as Second Entomologist will take up his appointment in December 1907. He is now specialising in England in preparation for work in India. The work of this section has progressed on very definite lines. The practical results of Mr. Lefroy's enquiries have already been of immense value to India. The entomological work in each Province is carried out by Indian assistants who have been trained at Pusa and who work more or less under the guidance of the Imperial Entomologist. They meet annually at Pusa, discuss with Mr. Lefroy the year's work and compare notes.

These meetings are extremely useful. The time of the Entomologist is largely taken up in identifying insects, reporting on them, and in satisfying enquiries. Steady progress has been made in investigating the life histories of insects injurious to agriculture. Specialists in Europe and America have helped this work. Pusa has now a large reference collection of injurious and other insects. Insecticides fatal to destructive insects but not to domesticated animals have been discovered. The insecticide experiments have reached the stage of field trials. An enquiry has been started regarding the prevalence in India of biting flies and their effects as carriers of disease. This subject is important in medical and veterinary science. The cultivation of Eri silk has been taken up to determine whether the worms can survive the dry hot weather and are likely to be acclimatised to heat in various districts. Lac was also introduced at Pusa as there is a likely field for this industry on existing trees in Behar. A severe outbreak of cotton boll-worm in the Punjab was controlled to some extent by measures described under cotton. Mr. Lefroy and Dr. Butler jointly tested the method of destroying locusts by the fungus which was reported to have been tried with success in South Africa. Healthy specimens of Bombay, North-West migratory locusts and some species of grasshopper were inoculated with pure culture of fungus in various ways. No successful results were obtained presumably because it has been found that the true natural locust parasite in South Africa is a different fungus (*Empusa grylli*) from that which has been distributed from Africa under this name (*Mucor ekiteosus*). A book on Entomology entitled "Indian Insect Pests" has been published. This book gives a summary of the facts relating to insect and insect life, origin of insect pests, their preventives and remedies and refers to the chief pests of the staple crops of India. The book has been widely appreciated in India. Mr. Lefroy is also recording general information regarding the insects of the cultivated areas. This as a text-book will be published soon to help advanced agricultural students and for general information.

13. *Botany*.—Mr. Howard took charge of the office of the Imperial Economic Botanist in 1905. At first he toured to acquaint himself with the agricultural conditions of various parts of India and the Botanical work carried on in the Provinces. A supernumerary Botanist has been added to his staff during the current year. Mr. Howard has in his charge at Pusa a large area which is partly devoted to orchards of many varieties of fruit, and partly to a botanical garden which will be chiefly planted with economic plants. The rest is really a field laboratory in which varieties of imported Indian crops are tested in small plots from which botanical descriptions and other data are obtained. The crops which have been chiefly dealt

with are wheat, barley, flax, tobacco, and fibre plants. Mr. Howard has given special attention at Pusa and in the Punjab to wheat and, I believe, has separated type specimens of all or nearly all Indian varieties from the mixed crops usually grown. This is really the first step towards the improvement of varieties. Cross-breeding and selection, and distribution of seed absolutely true to variety will follow. The general results of Mr. Howard's work with wheat will appear in a monograph which he is preparing and which will be freely illustrated with type specimens of numerous varieties. The study of various kinds of tobacco grown in India was also undertaken. Seed of tobacco was obtained from various parts of India and grown at Pusa. Much of the preliminary classification is now complete, and seed has been collected for further study this year. We have not yet got beyond the field study of varieties of tobacco, but the way has been paved for experiments in curing and also for producing fine qualities of tobacco which may command high prices for export.

14. *Cotton—Survey of indigenous varieties.*—A botanical survey of the cultivated forms of Indian cottons has been practically completed by Professor Gammie, the Bombay Economic Botanist, who has been helped by the Reporter on Economic Products to the Government of India and by experts of the Agricultural Department in each Province. The results have been published in his "Note on Indian Cottons". The report deals with the species and varieties of cotton known in India, their distribution in particular areas, the degree to which hybridization naturally occurs, the quality of lint and other particulars. A revised illustrated classification by Professor Gammie of Indian annual cottons is now in the press and will shortly be issued as a Scientific Memoir of this Department. A provisional classification of perennial or tree cottons found in India has also been prepared by him, but it is not yet sufficiently complete for publication. The Provincial Departments of Agriculture are testing on Government farms the varieties most suited to each cotton tract.

15. *Selection of cotton seed.*—The distribution [of seed from selected fields of the varieties ordinarily grown received considerable attention in the Provinces ; but this line of work is difficult because every cotton field practically contains several varieties. In India, improvement of ordinary varieties should begin by separating types and can be continued by plant-to-plant selection of seed. This work has been seriously undertaken by the Provincial Agriculturists and Botanists, and will tend slowly but with certainty towards improvement. The only other methods of improvement are (a) cross breeding and subsequent selection, (b) the introduction of exotic varieties. These methods are being fairly and fully tried. The problem of cotton improvement in India is extremely difficult. Special trade



demands require special kinds of lint. The chief and most paying demand at present is for coarse cotton to mix with wool for the manufacture of cheap warm cloth. If this demand is likely to be permanent, we ought to endeavour to increase the outturn of our so-called "inferior" cottons which are ordinarily grown with profit and without risk. The cotton farms have been extended in almost all Provinces, where it is proposed to raise on a sufficiently large scale for distribution to ryots, seed of such varieties of cotton as have been tried and found successful. A large cotton farm has been started at Surat in the Bombay Presidency for the improvement of the indigenous variety by selection of seed. Attempts to improve the indigenous *Kumpta* variety of Bombay by selection alone appeared to promise well. The various varieties of the Khandesh mixture have been isolated in order to compare the yields and quality of the produce of each. Some 30 tons of seed of the *Lahio* variety selected by the Department of Agriculture, Bombay, were distributed in the Ahmedabad District with successful results. One farm has been started in the Central Provinces for the improvement by continuous seed selection of (1) the coarse *Jari* variety and (2) of the finer *Bani* variety. Efforts have also been made to extend the area of pure crop of the *Karanganni* variety in Madras by special offers of rewards to cultivators.

16. *Cotton Hybridization*.—Experiments are in progress at several centres to improve the superior indigenous varieties by hybridization. The best results have been obtained in Bombay, Central Provinces and Madras. Practical results have been obtained by the Bombay Department of Agriculture by producing three crosses of fixed type which are superior to local cotton and which are suitable for the Surat-Broach tract which hitherto has produced the best cotton exported from India. One of these crosses can, it is believed, be grown over the whole of the Surat-Broach tract and may add immensely to the value of outturn. The other two indigenous crosses with proper treatment are expected to improve considerably. A cross between Bourbon (tree) cotton and Egyptian is also very promising; but requires experimental trial for two or three years longer. In other Provinces cross breeding results are promising, but are not yet sufficiently definite to describe.

17. *Trial of exotic cotton*.—Exotic varieties are under trial on Government farms and in cultivators' fields. Acclimatised American varieties may possibly be successfully introduced on an extensive scale in the United Provinces and in the irrigated areas of the Punjab, but they may in time deteriorate. The seed of *Dharwar-American* was distributed to planters along with seed of *Allens Hybrid* (New American), *Yennovitch* (Egyptian), *Caravonica*, *Broach* and *Buri*.

The trials were unsuccessful, except in the cases of *Dharwar-American* and *Buri*, both of which gave in unfavourable seasons fairly promising results in many places. The latter variety is of American Upland type. It is a fairly prolific and long-stapled cotton and may possibly be found suitable in Singbhum and Sonthal Parganas (Bengal). It gave in the Central Provinces a large outturn of very good cotton, and it will be there tested on an extensive scale. In the United Provinces the acclimatised *Dharwar-American* variety was not particularly successful. The cotton produced was equal to the best Broach, but the outturns were not uniformly good. In order to encourage the cultivation of these exotics which should be sown in the North of India with irrigation before the rains, the canal rate for this crop has been reduced. The cultivation of *American-Dharwar* cotton has increased in the Punjab, in spite of the heavy damage done by boll-worm in 1905. The area under this variety rose considerably in 1906. Experiments with Egyptian cottons indicate that they are well worth further trial in the South-Western districts of the Punjab. A farm has been started in the Province chiefly to grow exotic cottons under irrigation. Egyptian cotton in Sind occupied over 5,000 acres in 1906. The cultivation will probably extend largely, but boll-worm has done much damage. This damage can probably be controlled. The extension of this cultivation is restricted by inferior tillage which will improve as labourers are attracted to these new Canal Colonies, where labour is at present scarce and very dear. In Madras, American, Egyptian and *Caravonica*, varieties were tried, but there were no useful results. In Eastern Bengal and Assam, Spence tree cotton, *Caravonica*, *Dharwar-American*, *King's Improved* and *Buri* have done well on an Upland private estate. *Caravonica* cotton may succeed as a field crop in Assam. The Burma experiments with tree cottons were fairly successful and should be persevered with. The general experimental results indicate that exotic varieties of cotton producing fine lint may be extensively introduced into the Indo-Gangetic plain and particularly into the new Canal Colonies of the Punjab and Sind, provided we can overcome the traditions of the people and the ravages of boll-worm. The latter are more virulent on exotics than on indigenous varieties.

18. *Tree Cottons*.—Experiments with tree cottons are in progress in various Provinces. The results are generally unfavourable. All known varieties previously grown in India have been collected and have been cultivated under various conditions of soil and climate. The numerous varieties, grown on the Poona farm in 1904, were classified by Professor Gammie. The experiments undertaken by a syndicate with Messrs. Shaw, Wallace & Co. as Managers are still in their experimental stage, but this stage has so far been unsuccessful.

I have nothing, therefore, very definite to report regarding perennial cottons, but I am strongly convinced that they will never enter into regular cultivation in India. The British Cotton Growing Association and the Government of India, however, each contributed Rs. 10,000 towards the losses incurred by floods and otherwise on these syndicate plantations. The firm of Messrs. Shaw, Wallace & Co., has transferred their operations to some extent to Mourbhanj, where it is proposed to plant out about 500 acres chiefly with a particular variety of clustered-seed perennial cotton. The best sample of lint of this cotton was valued at 9*d.* per pound. The syndicate have now got about 294 acres under cultivation in different places.

Mr. Tytler, who was assisted by Government in starting a tree cotton plantation at Belgaum had no particular success in his experimental trials (without irrigation). His experiments suffered from the bad season of 1905-06. He has since formed a syndicate for the cultivation of tree cottons on an extensive scale with irrigation at Belgaum. Experiments by Provincial Departments of Agriculture with tree cottons have given conflicting results. *Caravonica* cotton gave promising results in Assam. Experiments have recently been started under irrigation by Mr. Spence at Deesa (Bombay) with a tree cotton which yields superior lint. These trials are in their experimental stage as the trees are yet young. The greatest risk in growing tree cottons is that they are very susceptible to insect pests which once established are difficult to get rid of because the trees are perennial.

19. *Extension of Cotton cultivation.*—The possibility of extending cotton cultivation in India has received a good deal of attention. The area under cotton has considerably increased in recent years chiefly owing to higher prices. The extension of railway systems and particularly of branch lines has materially helped this increase. The British Cotton Growing Association have made a large grant of £10,000 to be spread over four years for the improvement of the quality of Indian cottons and for the introduction and extension of the finer varieties of cotton in India. This grant has been used chiefly in providing seed of good varieties, in safe-guarding cultivators against loss in experimental trials and in obtaining through dealers an adequate price for superior cotton grown by individual land-owners. A sum of Rs. 28,500 was paid as subsidy in 1906-07. Out of this Rs. 10,000 were paid to the Indian Long-stapled Cotton Growing Syndicate to compensate against loss by floods. From the remaining sum of Rs. 18,500, the Provincial Departments of Agriculture spent Rs. 4,025 only during 1906-07. Rs. 10,000 are allotted for expenditure during 1907-08. The Provincial Directors of Agriculture have been consulted regarding the utilization of the grant in future years. Our Agricultural experts in every Province are almost unanimously of opinion that the agricultural

prosperity of India will be benefited less by improving the quality of Indian cottons than by improving the outturn, cultivation and trade practices of the ordinary indigenous varieties. Cotton experiments are likely to greatly expand. A Cotton Expert will be very shortly appointed. He will tour through the Provinces, co-ordinate the cotton experimental work and give in each Province, advice based upon his wider experience gained throughout India.

20. *Tea*.—The Indian Tea Association in its scientific and practical investigations was assisted by a subsidy of Rs. 15,000 from the Imperial Government and with Rs. 13,500 jointly from the Governments of Bengal and Eastern Bengal and Assam. This Department was strengthened by the appointment of an Entomologist (Mr. C. B. Antram), whose head-quarters are at Cachar. He has been provided with a laboratory and insectary. A survey of the tea soils of North-East India has been completed. Experiments have been made to determine the flavour of tea by quantitative analysis. The results have been published as a pamphlet on "Factors determining the quality of Tea." The general characters of many kinds of tea have been studied. The use of green manures and of bones in various forms has been tested in a general way. The different systems of cultivation are under systematic observation. Experiments regarding pruning and plucking promised to give useful results and will be continued till definite issues are obtained. Fungal parasites have been dealt with in a practical way. The causes, the means of infection and of prevention of the disease known as "Blister Blight" of tea plants were ascertained; the results have been published as Bulletin No. 3 of 1906 (Blister Blight of Tea Plant). A Bulletin on the "Mosquito Blight" (Indian Tea Association, Scientific Series, 1905, No. 1), has been published. Other investigations indicate methods of eradicating various insect pests including the "Bark eating Borer," the "Looper," the "Sandwich" and the "Red Slug Caterpillars" and of preventing damage done by "green fly" and the "white ant."

21. *Indigo*.—Scientific investigations were continued and controlled by Mr. C. J. Bergtheil whose services were lent to the Bengal Government for the purpose. The work done is described in appendix A of this report. The improvement of indigo manufacture has received a good deal of attention from specialists and others for many years. Little has yet however been done to improve the plant by selection. The Behar Planters' Association have recently appointed an Economic Botanist. He will have great scope for useful work in systematic field selection and in watching the results of cross fertilization. The superiority of the Java variety under very varying conditions of soil and climate is now generally recognised. There is very little doubt that its cultivation could, with advantage, be greatly extended in India

Mr. Bergtheil in his report of the Indigo Research Station, Sirsiah, 1906-07, however, states that the Sumatrana plant can be grown in Behar on certain classes of soil which are unsuitable for the Java variety. The ordinary field crops grown from Sumatrana or Java seed produce plants of great variety of type. The first step towards real improvement is to isolate type specimens and subsequently determine the economic value of each. As the economic value of a pure type depends upon leaf percentage and indigotin content, it is clear that the field work of an Economic Botanist should be in close touch with chemical laboratory investigations. The importance of an enquiry of this sort and the value of ultimate results to the indigo growers cannot be questioned. Mr. Bergtheil states that a preliminary step has been taken by growing and examining sub-varieties which were identified in 1903. The work of the Economic Botanist will help Indigo Planters when type plants of superior merit are grown and when sufficient seed is available for demonstration areas. The Behar Indigo Planters' Association have established seed farms in Behar. A seed farm has also been opened at Dasna in the United Provinces. The first crop of Java seed was bought by planters at a very high price. Recently at Cawnpore, important tests were carried out to determine the relative dyeing values of synthetic and natural indigo. The results were in favour of the natural product, as regards depth of colour and in other ways. It is conjectured that the impurities in natural indigo have something to do with these results.

22. *Jute*.—Though the area under jute very considerably increased during the two years under review, the demand for the fibre exceeded the supply. Prices remained high. The increasing demand shows the necessity of extending its cultivation outside Bengal. Madras, Burma and parts of Assam appear to offer very favourable physical and climatic conditions for its cultivation. The extension of jute cultivation is being investigated, and preliminary results have been published in Bulletin No. 3 of 1906. Trials with jute were made at the Samalkota Experimental Station (Madras), Ganeshkhind Gardens (Bombay) and at Nagpur and Raipur (Central Provinces). The results at the first two stations were fairly promising. Indigo Planters in Behar took up the cultivation, and their example was successfully followed by their tenants. Extensive tracts in the Assam Valley were for the first time brought under jute and yielded very fine crops. The cultivation is rapidly extending in the plains of Assam, but the lack of labour prevents extensive development. On the Lyallpur Farm (Punjab), jute was also successfully grown this season, but in the Chenab or other Canal Colonies of this Province, scarcity of labour will make extensive cultivation impossible. It has been suggested that the extension of jute cultivation may reduce food supplies for men and cattle in the congested districts

in Bengal and perhaps elsewhere. The experiments on Burdwan and Cuttack Farms clearly indicate that a crop of jute and a good crop of winter paddy can be got from the same field in one year provided the land is sufficiently manured and properly dealt with. Great developments in the jute trade are likely to occur in Burma when the Agricultural Department of that Province gets into full working order which will happen shortly. The crop will also extend largely in Eastern Bengal and Assam and probably in the delta areas of Madras. The scientific enquiries which have been made are described fully in the Agricultural Journal of India, Volume II, Part 2. With the co-operation of Mr. Finlow, forty-four so-called varieties of jute were grown at Pusa with the object of determining their characteristics and to gain knowledge regarding the differences in quality of fibre produced in different districts. Definite results have not yet been arrived at, and the experiments will be continued. A very practical aspect of the jute enquiry relates to improvement of varieties, manuring and cultivation. This is being fully dealt with. In particular, type specimens of each of the numerous races have been separated, and we are now able to supply pure seed of such races as are considered by our Botanists to be distinct. Mr. Finlow and Messrs. Cross and Bevan of London are collaborating in a bacteriological investigation regarding the alleged deterioration of Indian jute, but at present there is no evidence that the plant or its fibre have in any way deteriorated. Deterioration in the fibre is unquestionably due to malpractices in the trade after the crops are grown and retted. The Governments of Bengal and the Eastern Bengal and Assam have declined to undertake legislation to prevent fraudulent adulteration of jute.

23. *Flax*.—The possibility of cultivating flax in India as a paying fibre crop was recently revived by Sir Lewis Hay and the Dundee Chamber of Commerce. The Board of Scientific Advice published a Report on experiments with flax. The subject was referred to in an article issued in Volume I, Part III, of the Agricultural Journal of India. The Dooriah Indigo Factory in Behar, in which Sir Lewis Hay has an interest, carried out experiments which gave promising results. In 1906-07, a quantity of Russian (Riga) seed was distributed through the Department of Agriculture, Bengal. At Pusa and Bankipore, the results were promising, elsewhere they were not. At Bankipore the outturn of green plant was  $2\frac{1}{4}$  tons per acre. The Pusa experiments indicated that fibre as well as seed might be profitably obtained in India by introducing the best kinds of Russian, Belgian and Irish seed. At Pusa we have arranged for fibre-extracting machinery suitable for flax. The Government of Bengal made a special grant to the Behar Indigo Planters' Association in 1906-07, to help them to procure the services of an expert from Europe and to instruct them in the methods of steeping, retting,

scutching and placing the fibre on the market. He has been appointed and has arrived. He is engaged in supervising experiments at Dooriah and in giving general advice. (*Vide* appendix B)

24. *Other Fibres.*—The cultivation of Sunn-hemp (*Crotolaria juncea*) and *Hibiscus cannabinus* largely increased during the period under report. Formerly they were produced chiefly for use in India, but they are now exported to some extent as substitutes for jute. An investigation regarding possible jute substitutes has been undertaken by Mr. Finlow.

25. *Tobacco.*—Tobacco is a specially important crop in Bengal, Madras and in parts of the Bombay Presidency. Experiments at Pusa and in the Provinces have been undertaken in testing indigenous and exotic varieties, in hybridization and in methods of cultivation. These experiments will gradually lead up to the testing of methods of fermentation and curing. Fairly complete arrangements for these lines of work have been made at Pusa, but I do not anticipate any very special advance in our work until a Tobacco Expert is appointed, as no one in the Department has a specific knowledge of the work which should be done. Some foreign varieties have given good results in growth and apparently also in texture of leaf. Some experiments were conducted by Messrs. Spencer & Co. of Dindigul (Madras) to determine whether Indian grown tobacco could produce a good wrapper leaf when properly cured. The results were not indefinite. The Peninsular Tobacco Company, Limited, have started manufactories at Monghyr and Karachi and are producing cigarettes which, I believe, are superior to those previously produced in India. The fungoid and insect pests of tobacco are under investigation by Dr. Butler and Mr. Lefroy, and a certain amount of advice has been given to Planters.

26. *Wheat.*—The improvement of Indian wheat was fully discussed at the second meeting of the Board of Agriculture. The Provincial experts described the experiments which were being carried out in their respective areas. This information was epitomised by Mr. Howard. Dr. Butler and Mr. Lefroy prepared notes on the fungus and insect enemies of the crop. The Board of Agriculture considered in detail the suggestions and made proposals. The improvement of the Indian wheat trade requires numerous investigations specially as regards facilities for transport and also notably in regard to the separation of varieties, their improvement by selection of seed and by cross-breeding, the provision to cultivators of pure seed of varieties which can be grown without risk and which are suitable for export. The best means of storage in India requires investigation, also the milling and baking qualities of particular varieties. In the Canal Colonies of the Punjab, wheat has been grown year after year on the same land, and this system will certainly become unprofitable in time, even on the highly fertile soil of

these Colonies. The Muzaffarnagar wheat which has been distributed in large quantities from the Cawnpore Farm seed-stores for many years, continues to increase in popularity. In Bengal, this variety has given encouraging results. Pure samples of wheat which are suitable for export are being distributed by Provincial Departments of Agriculture. Rust resistance experiments are in progress on several Government Farms and are everywhere of very great importance. An account of the Indian wheat rusts has been published by Dr. Butler and Mr. J. M. Hayman as a Botanical Memoir, Volume I, No. II of 1906.

27. *Groundnut*.—The most important centres of groundnut cultivation in India are Madras and Bombay. During recent years there has been a marked decline, particularly in the Bombay Presidency in groundnut cultivation and a consequent falling off in the export trade. The causes of the decrease in Bombay cannot be definitely stated but are partially due to a fungoid disease locally known as *Ticca* and also to recent seasons of deficient rainfall. The Imperial Mycologist has shown that this disease which is due both to infected seed and infected soil can be combated by spraying. The chief damage is done late in the monsoon, and therefore early ripening varieties are to some extent exempt. Many foreign varieties have been introduced, and some of these practically escape damage by disease on account of their short period of growth. The most successful introductions in this respect have been Spanish and Japanese groundnuts. The indigenous varieties, however, command a higher price than any one of the Foreign varieties, for reasons which at present are difficult to understand. In Madras, the disease has been so disastrous that a special Government farm has been recently started at Palur in South Arcot for groundnut. There has been a keen demand for sound seed from many parts of the Presidency. Elsewhere also Provincial Departments of Agriculture have distributed sound seed. The groundnut area is rapidly extending in Burma and is likely to expand in the Central Provinces and Bengal and in the irrigated areas of Sind.

28. *Artificial Fertilizers*.—This subject is beginning to attract the general attention of agriculturists in India. It was considered by the Boards of Agriculture and Scientific Advice, and it has been recommended that various Agricultural Departments should undertake experiments to test such manures of this class as are available. A series of experiments are in progress on cotton with various artificial manures, and similar experiments will be extended to wheat, sugarcane and other valuable crops. The Board of Scientific Advice recommended that special attention should be given to the trial of sulphate of ammonia in sugarcane cultivation. This fertilizer is very largely used for sugarcane in Java and Mauritius, both of which countries are importing into India an increasing amount of sugar. When the Tata Iron and Steel manufactur-



ing project is in operation, the output of Ammonia Sulphate will greatly increase and be cheaply available for use in this country. The new artificial manures of Basic Nitrate, Calcium Nitrate and Calcium Cyanamide are under trial and will be tested on several Government Farms, although their prime cost in India for experimental trial is much beyond their worth in practical agriculture. Messrs. Phirozsha B. Petit & Co., Bombay, have, however, proposed to establish a factory in Kashmir for the manufacture of Nitrate of Calcium. At the instance of the Madras Agricultural Department, the Inspector-General of Agriculture referred to the Board of Agriculture at its second meeting, the question whether it was advisable for the Agricultural Departments to undertake the inspection and control of commercial fertilizers in India. Suggestions for legislation on the lines of those adopted in the United States and other foreign countries were also considered. After very careful consideration it was decided that the time was not ripe for the introduction into India of legislation on commercial fertilizers, but the Board considered it desirable to keep special watch over the developments of the trade.

29. *Irrigation*.—This subject, in relation to the improvement of agriculture, was fully discussed by the Board of Agriculture at its first meeting in January 1905 (Items Nos. 23—27 of the Proceedings). In pursuance of the recommendations of the Indian Irrigation Commission, hydraulic experiments in the irrigation of crops have been undertaken in most of the Provinces. In Bengal, the Agricultural Department started hydraulic experiments at Burdwan, Dumraon and elsewhere. These experiments, for the present, have been stopped owing to difficulties connected with reliable supervision. Mr. N. N. Banerji was placed on special duty to enquire into the possibility of extending well-irrigation in Behar and in Chhota-Nagpur. The results of his enquiry have been published as a separate report. The United Provinces have continued the investigations regarding general well irrigation and percolation wells. Well boring experiments are now a permanent feature in the work of the Department of Agriculture of this Province. Government provides the tools and supervision. The land-owners provide labour. Well sinking is also encouraged by giving advances. It is established that perforated cylinders provide the best casing for percolation wells. The Agricultural Department is also making experiments to solve the problem of sinking wells in the rocky parts of the Province and to protect the tracts of deep water level by tube wells worked by a central plant. In the Punjab, hydraulic experiments for irrigating wheat were conducted with the object of (1) determining the least number of waterings required and (2) the quantity of water required in each watering. These experiments will have to be continued for a number of years before definite results can be expected. The local Department of Agri-

culture is considering the question of employing an expert staff to report and prepare maps showing the possibilities of irrigation in each district, to improve the water supply of existing wells, to make trial borings and to generally aid the small proprietors to improve the irrigation of their fields. Hydraulic experiments for irrigating crops have been in progress for some time in Bombay. An oil engine and a pump is at work at the Nadiad Farm in Guzarat. The wells in this tract are deep, and their supplies of water are not easily exhausted. The cost of irrigation by oil-engine and pump is about half the cost by bullock power. The Department has arranged to maintain in each division a small staff of well borers. Boring trials will indicate where wells can be sunk with advantage. It is proposed to place an officer of the Public Works Department on special duty to enquire into the extension of irrigation from rivers by means of oil engines and pumps and to advise and assist land-owners in the erection and management of such machinery. Experiments in boring wells on the Japanese system were carried out in 1905 in the Bhavnagar State, Kathiawar. In all, five borings were made. The Japanese expert well sinker had his implements made locally. The depth reached in one case was 110 feet. The boring implements stuck at a certain depth before water was found and the boring had to be abandoned in each trial. The failure is partly attributed to the difficulty of making the Japanese expert and the labourers understand each other. The total cost of these experiments amounted to Rs. 5,500. Probably better and cheaper results would have been obtained by ordinary boring appliances. Madras has made very useful experiments on an extensive scale in pumping water with oil engines and centrifugal pumps under the supervision of Mr. A. Chatterton, Director of Industrial and Technical Enquiries. His report for 1905-06 fully describes his results. It embodies information in regard to (1) the actual cost of raising water under different conditions ; (2) the amount of irrigation water required under varying conditions as regards crop, soil and rainfall ; (3) the advantage of employing small oil engines and pumps for the irrigation of intensive cultivation such as that of garden crops on small areas ; (4) the quantity of water available for lift irrigation throughout the year from various sources of supply ; (5) the distribution of underground water in various parts of the Presidency and practical means of making larger use of it than at present ; (6) the efficiency of different oil engines and centrifugal pumps, the practical methods and the precautions to be taken in using them ; (7) the general arrangement of installations. In various parts of India *intensive* cultivation is practised and sugarcane, tobacco, ginger, turmeric, and many other crops are grown with extraordinary success. For this *intensive* cultivation, expensive well irrigation by bullocks and ordinary leather bags is very commonly used. This irrigation costs not less than Rs. 100 per acre per annum. The experiments of the last three

years have conclusively proved that there is great economy in using oil engines and pumps if there is a sufficient water supply in the wells. Oil engines can be worked fairly satisfactorily by native drivers on wages of Rs. 10 to 15 per month. In the Central Provinces a series of irrigation experiments with wheat and rice are being conducted on the Government Farms with the object of discovering the duty of water in various classes of soil, the maximum intervals between waterings and the like. In 1906, these Provinces were helped by a grant of Rs. 3,500 from the Imperial Department for experiments with oil engines and pumps. The Burma Agricultural Department is arranging to carry on experiments at Mandalay with irrigated paddy and also with a number of crops grown in the dry zone.

30. *Sericulture*.—Experiments in sericulture are in progress in several Provinces. The Bengal Silk Committee, with the support of annual subsidies from the Governments of Bengal and Eastern Bengal and Assam, continued to do useful work. Several model-rearing houses have now been constructed by the Committee. Microscopes and disinfectants were distributed to rearers. The necessity for these is gradually being appreciated by rearers particularly in Birbhum. The principal firms interested in the silk industry made a representation to the Government of Bengal showing a marked decline in the industry. A small Committee was appointed to make inquiries, and certain remedial measures were suggested. The late Mr. N. G. Mukerji, known as a Silk Expert, was deputed to Kashmir and Bangalore to report on methods of rearing, reeling, etc. He returned with the belief that the Bengal system of reeling could not be much improved and that inferiority in quality of silk was due to inferior cocoons. He was also deputed to the Baroda State, where Mulberry silk experiments have recently been started. After enquiry in the Central Provinces he also made recommendations for the improvement of the Tussar silk industry in that province. Sericultural experiments in the rearing of Univoltine silk in Eastern Bengal and Assam have, for the last three years, been giving successful results. In Hoshiarpore (Punjab) there has been a small but successful experiment. The raw silk produced in Kashmir in 1905 yielded a very high profit of £28,139 or 58½ per cent. on invested capital. The profits of 1906 are expected to exceed those of the previous year. The Kashmir industry gives employment to nearly 70,000 persons. A great success has already been achieved in establishing the silk industry at Mustang in the Kalat State (Baluchistan). The silk produced is equal in quality to Kashmir silk. Experiments in rearing Eri silk were started by the Imperial Entomologist at Pusa. Between April and November, five broods aggregating 150,000 worms were fed on the leaves of castor plants. The silk produced was valued in Calcutta at Rs. 80 per maund.

31. *Agricultural Education*.—The scheme sanctioned by the Secretary of State for higher agricultural education provides for seven Provincial Agricultural Colleges. In each of the larger Provinces except Eastern Bengal and Assam a site has been selected, land for experiments acquired and considerable progress made in construction of buildings. In most Provinces, the Colleges will be in working order within the next two years. The Madras College will be established at Coimbatore and the Bombay College near Poona. The Agricultural Schools at Nagpur (Central Provinces) and Cawnpore (United Provinces) will be each raised to the status of an Agricultural College. The needs of the Punjab and the North-Western Frontier Province will be met by a new Agricultural College at Lyallpur. The Agricultural Branch of the Sibpur (Calcutta) Engineering College will be closed as soon as the new Agricultural College at Bhagalpur is ready. The Burma Agricultural College is being built at Mandalay. The provision of Provincial Agricultural Colleges has modified the original aim of the Pusa Agricultural College. It will provide a post graduate course extending over two years to qualify graduates of Provincial Colleges as Experts in specialized branches of Agricultural Research. Pending the completion of the provincial Colleges selected students have been sent to Cambridge and America to complete their higher training in Agriculture. Four Bombay students are specializing in Sciences connected with Agriculture at Cambridge. Similarly the Government of Bengal have sent six students to America to graduate in Agriculture and specialize in particular lines of Agricultural work. Twenty-two probationers from various Provinces were under training at Pusa. Some were found unfit and rejected. Thirteen completed their training and were qualified for Provincial service. Three were trained in general agriculture, two in Agricultural Chemistry, two in Mycology and six in Entomology. Two probationers are still under training in Agriculture and Mycology. Besides these, six men were trained for field work in Entomology and one in Entomological drawing. The most pressing requirements of Provincial Departments are thus met; but the real development of agricultural improvement hinges on the completion of the Provincial Agricultural Colleges and the Pusa Institute. When these are ready, arrangements will be made to give full agricultural training, and the necessity of sending students to foreign countries will cease. Questions relating to educational qualifications necessary for admission, scholarships, the curriculum of studies and the degree to be conferred on passed students have practically been settled.

32. *Distribution of seeds and implements*.—This branch of work engaged much attention during the past two years. The demand for pure and selected seed has increased, and a number of seed depôts have been started by the Provincial Departments of Agriculture. The distribution has not, however, been successful in all directions particularly in regard

to indigenous varieties of cotton. For distribution in the Central Provinces cotton seed was obtained from particularly selected fields of good crop, but this selection was really no selection at all, because every field in the Central Provinces grows a very mixed crop of cotton. We have to begin much more humbly, go slow and be quite sure that we are really distributing seed which is true to a particular type. This principle is the beginning of seed selection, and the sooner this is fully recognised in every Province in India, the better for the country. In some of the other Provinces, the cotton seed distributed was truer to kind. Besides cotton, seed of other crops such as wheat, ground-nut, jowar, jute, tobacco, indigo, mustard, etc., was distributed to Government Farms or private persons, the object being to introduce new and superior varieties. Mention may be made of the successful results obtained at the Dumraon Farm by the introduction in 1902 of Jubbulpore and Raipur mustard. These varieties have been found superior to the local variety not only in the quantity of yield but also in the quality of oil. The Provincial Agricultural Departments have mostly established seed farms on a sufficiently large scale to grow seed of such varieties of crops as have been tried and found successful. We have had numerous indents from foreign countries for seeds and plants, and we get an adequate return in kind. We have sent abroad, in small parcels, a total of nearly four tons of seed during the last two years.

The interchange between Provinces of superior indigenous implements was as satisfactory as in the previous years. The agricultural exhibitions and shows which are becoming important features of the Provincial activities have greatly helped this work. There has been a marked increase in the demand for iron ploughs in some of the Provinces; winnowers and fodder cutters are gaining favour among cultivators. The Poona sugar boiling apparatus and the plant used in Mr. Hadi's process of sugar making have become widely known to cultivators, and the demand for these is steadily increasing. The merits of new implements are fully tested on Government Farms, and demonstrations are made to show the advantages of those which suit local conditions. Owing to scarcity of labour in the Canal Colonies of the Punjab, bullock-power reapers and steam threshers are coming into use, because, the enormous irrigated wheat crop of these Colonies must be handled expeditiously.

33. *Publications.*—At the suggestion of the Board of Agriculture of 1905 (Item 43 of the Proceedings) the Annual Reports of the Experimental Farms and the Departments of Agriculture have been improved. These reports will be issued hereafter in uniform size and at uniform dates. The work of each experimental station will be described in the form of a continuous record which will include any positive action taken to make the station and its teachings known to agriculturists generally. Accounts of experiments which have yielded very definite

results in experimental plots and demonstration areas will be published in Bulletin form. These Bulletins will be translated in simple vernacular for the information of native cultivators.

The Imperial Department of Agriculture now issues two important publications (1) the Agricultural Journal of India—a quarterly Journal, intended for the use of educated Indian Agriculturists and general readers interested in agriculture, and (2) the Scientific Memoirs of the Department of Agriculture, which are papers of a scientific or technical nature and are published occasionally. These publications are widely distributed in India and to learned societies and interested individuals in all countries. The free distribution is more extensive than the sale list. An adequate return is, however, obtained in free copies of publications which are indispensable to the Department. Moreover, advertisement is essential for new publications. The Journal and Scientific Memoirs are liberally supported by contributed articles from the Imperial and Provincial Experts of the Department and also from other Government officials and private individuals. Articles on original work in India can be published quicker in the Memoirs than in any home journal. This is a matter of importance to scientific men working for the Indian Agricultural Departments and is fully appreciated. A good many Bulletins have been published during the year by the various Agricultural Departments. They deal with definite results of agricultural experiments. All the agricultural publications issued in India during the past two years are given in the list of publications (Appendix C).

34. *Expenditure.*—The expenditure incurred in the Imperial Department of Agriculture (apart from expenditure on buildings constructed by the Public Works Department) has been as follows :—

Section of Department.	1906-07.	1905-06.
	Rs.	Rs.
Inspector-General of Agriculture in India . . . . .	90,235	1,03,360
Director, Pusa . . . . .	1,06,300	60,665
Chemical Section . . . . .	28,268	28,694
Mycological Section . . . . .	25,382	24,055
Entomological Section . . . . .	28,588	32,056
Bacteriological Section . . . . .	2,500	900
Agricultural Section . . . . .	99,248	63,692
Botanical Section . . . . .	19,743	21,503
TOTAL . . . . .	4,00,264	3,34,925

The figures for 1905-06 include Rs. 99,572 for the initial expenditure under the following heads :—

	Rs.
Construction of Departmental Buildings and Machinery . . . . .	50,747
Equipment of the Pusa Library . . . . .	18,825
Laying out roads . . . . .	15,000
Irrigation . . . . .	15,000
TOTAL	99,572

Deducting this amount from Rs. 4,00,264 we get a net recurring expenditure of Rs. 3,00,692 for 1905-06. The expenditure of 1906-07 is larger than that of 1905-06. The increase in 1906-07 is due to the expansion of the Department. In addition to the ordinary budget provision, the Inspector-General of Agriculture in India receives an annual grant for expenditure upon special investigations, improvements and the like, which he may desire to introduce. The principal objects to which this grant has been devoted in the past two years are as follows :—

Particulars.	Amount.
1. Grants-in-aid of long stapled cotton experiments by Messrs. Shaw, Wallace & Co. . . . .	Rs. 40,000
2. Grants-in-aid of the Department of Agriculture, Bombay . . . . .	12,000
(1) For Mr. Tytler's cotton experiment at Belgaum . . . . .	5,000*
(2) For Sugarcane Power Crusher for Manjri Farm . . . . .	5,000
(3) For sugarcane experiments in Sind and for demonstration of improved Poona method of <i>gul</i> making at the Ahmedabad Exhibition . . . . .	1,200
(4) Contribution to the Nadiad Farm . . . . .	800
3. Grants-in-aid of the Department of Agriculture, Bengal, for distribution of seed of the <i>Aus</i> variety of Central Provinces paddy in the Chota Nagpur District . . . . .	350
4. Grants-in-aid of the Department of Agriculture, Central Provinces, for expenditure upon experiments with an oil engine and a pump in the Central Provinces . . . . .	8,200
5. Paid to the Secretary to the Chief Commissioner, Coorg, for agricultural improvements in Coorg and for experiments with Caravonia cotton . . . . .	3,000
6. Grants to the Indian Tea Association . . . . .	30,000
7. Purchase of seeds, implements and other requirements for agricultural experiments . . . . .	2,680†
8. Extension of Botanical Garden at Pusa . . . . .	4,000
TOTAL	1,00,230

\* Recovered from Mr. Tytler owing to his having formed a syndicate.

†The main heads of expenditure under this item are (1) Supply of jute seed to the Colonial Office, London, for trial in West Africa; (2) Purchase of Arlington ploughs for trial in India; (3) Supply of Indian cotton gins to the Crown Agents for Colonies, Whitehall Gardens, London, for transmission to Lagos; (4) Purchase of sugar boiling pans, for trial in the Central Provinces; (5) Purchase of Hodgkinson's cotton hand-gins for trial; (6) cost of date palm off-sets and tree cotton seeds; (7) Sugarcane cuttings supplied to Samalkota Experimental Station.

35. *Provincial Departments of Agriculture.*—It is unnecessary to give details of work done in each Province because each Department publishes its own report. I may, however, give the following information.

36. *Bombay.*—The Department has five European Experts, a large staff of well-trained Indian assistants, an Agricultural College and

twelve experimental stations. The College is at present the only one that teaches up to a degree standard in Agriculture. It is at present located in a hired bungalow. The classes for the three years' course are large. The permanent building for teaching and research work is being built. One hundred and forty-three acres of land have been acquired for the College Farm. An Industrial and Agricultural Exhibition was held at Surat in 1906. The Department sent 723 exhibits. The Department holds annually an Agricultural Conference chiefly to obtain the views of practical business men regarding agricultural improvements. The Conference was held in Bombay in 1905, in Surat in 1906 and will be held at Ahmedabad in November 1907. Similar conferences if held regularly in other Provinces would also be of great value.

37. *Madras*.—The Expert European staff of the Department now consists of the Principal of the College, an Agricultural Chemist, Economic Botanist and two Deputy Directors of Agriculture. Mr. Chatterton, Director of Industrial and Technical Inquiries, helps the work of the Agricultural Department in many ways. His long experience in India is invaluable. There are now ten experimental stations in Madras which are devoted to general agricultural problems, also to particular enquiries regarding sugarcane, pepper, jute, groundnut, agaves, rice and cotton. Groundnut has received prominent attention, and there is a high demand for sound seed. The need is felt for practical Indian subordinates who can properly supervise field work. The new Agricultural College and the head-quarters of most of the expert staff will be at Coimbatore. Agricultural Shows and Associations are a marked feature in the useful work of the Department.

38. *United Provinces*.—The Director, Mr. W. H. Moreland, C.I.E., after a visit to Australia began the first work in wheat improvement by cross-breeding in India. This work continues to be a very important enquiry in his Department. His expert staff of European specialists is being gradually recruited, and the old Cawnpore School of Agriculture is advancing to the status of a college. Four agricultural stations are now at work, and the Province has been mapped out into four divisions, to each of which an all-round agricultural expert will be appointed. The methods adopted for storing and distributing good seed of particular crops could, with great advantage, be carried out in other Provinces. The method devised by the Assistant Director, Khan Bahadur H. M. Hadi, M.R.A.C., for refining sugar, has attracted much attention. Boring experiments for well water have been very successful. A superior method for constructing percolation wells has been devised.

39. *Bengal*.—The work of the Department of Agriculture was separated from that of Land Records towards the end of the year 1905-06. The expert staff sanctioned for this Province consists of Deputy Director of



Agriculture, Principal of the College, Economic Botanist and Agricultural Chemist. The last two places are still vacant. Indian assistants trained at Pusa have been appointed for such Entomological and Mycological work as can be done by them under the guidance of the Pusa staff. There are six agricultural stations at Dumraon, Burdwan, Sripur, Cuttack, Bankipore and Sabour near Bhagalpore. The first three stations are maintained at the cost of the Dumraon, Burdwan and Hathwa Rajas, respectively. The Bankipore (210 acres) and Sabour (340 acres) Agricultural Stations are being organised. A farm of 200 acres will be opened at Chinsura on the East Indian Railway line for the deltaic alluvium. The Department has opened a seed, implement and manure store which is increasing in usefulness. It is proposed to open such stores at each Agricultural Station. A Committee, with the Director as President, was appointed to enquire into the present decline of silk industry and to suggest remedial measures. The improvement of jute as regards agricultural and trade aspects has received much attention by the Department. The cultivation of imported varieties of flax is likely to lead to a new profitable fibre industry. The value of the *Rhea* industry which was boomed in Bengal some years ago, may now be discounted. The Bengal Government has continued to make an annual grant of Rs. 50,000 to the Behar Indigo Planters' Association for research work in indigo. The services of Mr. Bergtheil have been placed at the disposal of the Association. A very short summary of the research work done by him and his assistants at Sirsiah is given in Appendix A. The details of work done cannot be conveniently described here, but I consider that Mr. Bergtheil should continue his present investigations when he takes up his permanent appointment at Pusa and also as far as possible guide by advice the scientific work of the Behar Planters' Association. Pending the completion of the Provincial and Pusa Colleges, the Department has sent six passed students of the Sibpur College to America for higher agricultural training. The report of the progress of these students is satisfactory.

40. *Punjab*.—A separate Department of Agriculture has been formed in the Punjab as in other Provinces. The expert staff at present consists of the Principal of the Agricultural College and Research Institute, the Deputy Director of Agriculture and the Agricultural Chemist. An Economic Botanist will join shortly. The extraordinary fertility of the new Canal Colonies and the enterprise of the cultivators offer exceptional chances for agricultural improvement. The Punjab agricultural experts have thus unusual opportunities of improving the agriculture of the Province. The scarcity and dearness of labour in the Punjab will probably require the introduction of labour-saving machinery for the wheat crop. There are very large exports of wheat from the Punjab, and prompt harvesting and disposal of the crop is very important,

I suggest that it is extremely important that railway and other facilities for export should be improved.

41. *Central Provinces.*—The Department of Agriculture is now separated from that of Land Records and Settlements. Two Deputy Directors of Agriculture, an Agricultural Chemist, a Principal of the College and an Economic Botanist have been sanctioned. There are four experimental farms at Nagpur, Raipur, Hoshangabad and Akola. The Nagpur Farm deals chiefly with cotton, wheat and rotation experiments and the Raipur Farm with rice. The Hoshangabad Farm is specially intended for wheat experiments and the Akola Farm for experiments with cotton. The Department has particularly demonstrated in the districts the advantages of drilling particular crops and of using particular implements, specially winnowers, chaffcutters, iron-ploughs and sugar-making appliances. A good deal of useful work has been done in the sanitary disposal of sewage on cultivated fields on the Meagher System. The method of applying sulphate of copper to juar (*Sorghum vulgare*) seed to prevent smut has been extensively demonstrated. The distribution of selected seed was extended. The Nagpur Agricultural School has been raised to a College with a three years' course. The Agricultural Gazette which is published in vernacular has maintained its circulation. Several Agricultural Associations have been formed.

42. *Eastern Bengal and Assam.*—The expert staff of the Department consists of the Assistant Director and the Fibre Expert. The posts of Economic Botanist, Agricultural Chemist and the second Deputy Director of Agriculture have been sanctioned, but are not yet filled. The College and Laboratories are under construction at Dacca, and land has been acquired for a College Farm. The experimental stations are at Rangpur, Rajshahi, Jorhat, Upper Shillong and Wahjain, and land for a tobacco station at Burihat is being acquired. Important jute experiments are in progress. Bengali cultivators, to demonstrate the proper method of cultivation and of extracting the fibre, have been employed. The Rajshahi Sericultural School has been taken over by Government and remodelled on a popular basis.

43. *Burma.*—The Agricultural Department has now been fairly organised. The Land Records and Agricultural Departments have been separated. The expert staff consists of an all-round Agriculturist, as Principal of the College, Deputy Director of Agriculture, Agricultural Chemist and Botanist. Arrangements have been made to start three agricultural stations—one at Mandalay as College Farm, one at Hmawbi chiefly for the study of paddy and a third in the dry zone of Burma.

44. *Expansion of the Department.*—The general expansion of the Agricultural Departments in India outlined in the last report has progressed. The experimental stations and demonstration plots in each Province have increased in number. I have already referred to the strength-

ened staff of European Specialists. I am hopeful that the Indian staff will be improved by better rates of pay and prospects. The work of the Department will be much extended by the Provincial Agricultural Colleges, Agricultural Associations, Agricultural Shows and the establishment of cattle-breeding farms. Efforts are being made to provide improved seed, good manures and better implements. In the Provinces, the Departments of Agriculture have been separated from the Departments of Land Records in order to enable the Directors to devote undivided attention to the improvement of agriculture. There is, in fact, a general advance which need not be further particularised, but which is an advance for progress.

J. MOLLISON, M.R.A.C.,  
*Inspector-General of  
Agriculture in India.*

SIMLA, E.,

*The 17th October 1907.*

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## REPORT OF THE OFFICIATING DIRECTOR OF THE AGRICULTURAL RESEARCH INSTITUTE, PUSA

1. *Charge of Office.*—Mr. B. Coventry held charge of the office of Director until February 20th, 1907, when he proceeded on leave and I was appointed to act for him in addition to my own duties.

2. *General work of the Institute.*—The Institute consists of six sections, namely, Agriculture, Chemistry, Botany, Entomology, Mycology and Bacteriology. The agricultural, entomological and botanical sections have been located at Pusa during the whole two years; the chemical and mycological sections were transferred from Dehra Dun in 1905; whilst the bacteriological section remains to be opened. Excepting Agriculture, the sections which are already at Pusa are accommodated in temporary buildings pending the completion of the new laboratories. The nature of the work is fully explained by myself and my colleagues in the following sectional reports.

The extensive laboratories which have been under construction for three years will be ready for occupation by the end of April 1908.

3. *Buildings.*—Quarters for the European and native establishments, students' hostel, rest house, hospital and veterinary dispensary have been completed. The Farm buildings, Farm Office, Botanical and Entomological minor laboratories, Insectary, Fumigating House, and Potculture House were constructed departmentally.

4. *Roads, etc.*—The estate is liable to inundation from two sides and during the monsoon of 1905 and 1906 a large area of land was under water on this account. Three protective embankments became necessary, two of which have been completed and the third will be so shortly.

The roads of the estate have been made. The avenues have been thinned or new trees planted where necessary and generally improvements introduced. In some cases areas of jungle have been cleared for cultivation and pasture land.

Most of the compounds of the completed buildings have been laid out, but that of the large laboratories cannot be dealt with until the building is completed.

5. *Medical.*—A Military Assistant Surgeon was appointed in September 1906 but reverted almost immediately to military duty. He was succeeded by Mr. J. R. Foy in November 1906. The average number of cases in hospital has been 2·66 per day since the hospital was opened and the average number of out-door patients has been 13·11. In the

opinion of the European staff at Pusa the present medical arrangements are unsatisfactory.

6. *Training*.—Some students have undergone periods of training in special subjects. The courses of instruction will be much amplified when the Institute laboratories are complete.

7. *Library*.—The Library of the Institute consists of about 4,000 volumes, many of which are very valuable. It has been arranged to lend books to officers of the provincial departments under certain conditions. The catalogue is about to be issued.

8. *Publications*.—The publications of the Institute comprise (1) The Agricultural Journal of India, published quarterly, (2) Scientific Memoirs of the Department of Agriculture in India, (3) Bulletins which deal with matter in process of investigation, (4) Leaflets in English or the vernacular are issued at intervals.

The Inspector-General of Agriculture in India is the Editor and is assisted by advice from the staff. The grant is Rs. 25,000 per annum.

The preparation of these publications takes up much time. The Artist's work is supervised by Mr. Lefroy and the Photography is in my charge. These duties are by no means nominal and absorb much time. An Assistant Editor is urgently required.

9. *Accounts*.—The whole of the accounts pass through the Director's office. The total current cost of the Institute may be summarised as follows :—

	1905-06.	1906-07.
	Rs.	Rs.
Pay and travelling allowances . . . . .	1,16,500	1,31,900
Publications . . . . .	15,000	25,000
Farm expenditure and Scientific apparatus buildings, sanitation, etc., and contingencies . . . . .	1,78,500	74,700
<b>TOTAL</b> . . . . .	<b>3,10,000</b>	<b>2,31,600</b>

J. WALTER LEATHER,

*Officiating Director, Agricultural  
Research Institute, Pusa.*

**REPORT OF THE IMPERIAL AGRICULTURAL CHEMIST  
FOR THE YEARS 1905-06 AND 1906-07.**

1. *Charge of Office*.—I held charge of this branch of the Institute until April 11th, 1906, when I proceeded on privilege leave until July

2nd and Mr. R. S. Finlow officiated for me ; I again held charge throughout the following 12 months.

2. *Laboratory*.—The laboratory was transferred from Dehra Dun to Pusa in November 1905 where it has been accommodated in a temporary building pending the completion of the permanent laboratory.

3. *General analytical work*.—In past years a large part of the energies of the establishment have been absorbed by the examination of specimens sent by provincial departments. With the appointment of provincial chemists a material change has been effected in the character of the work undertaken, and investigations of a more special nature have been taken up.

The following statement shows the number of samples analysed in each of the two years :—

	1905-06.	1906-07.
Soils . . . . .	244	255
River water and silt . . . . .	..	82
Waters . . . . .	65	65
Manures . . . . .	229	124
Feeding stuffs and oil-seeds . . . . .	63	51
Sugars and surgarcane . . . . .	46	132
Plants examined for glucoside . . . . .	..	40
Rubbers . . . . .	9	..
Gum . . . . .	1	..
TOTAL . . . . .	657	749

4. *Potculture House*.—A very well-equipped house for experiment on plants and soils by potculture methods has been erected at Pusa and a description of it published as Memoir No. 3 of the Chemical Series. The nature of the work carried on here is explained in paragraphs dealing with plant food in soils and cyanogenetic glucosides.

5. *Available plant food in soils*.—For several years a good deal of attention has been given to a study of available plant food in soils. The earlier work consisted in comparative tests of the validity of Dyer's method for the estimation of a soil's requirements in phosphates or potash and the principal results obtained have been published as Memoir No. 4, Chemical Series. As a practical adjunct to this work, a series of field experiments on the value of superphosphate in Behar, where the soil seems to be generally, within certain geological limits, deficient in available phosphate, has been commenced.

The investigation on available plant food in soils has more recently been directed to a more exact knowledge of the precise state in which

these compounds exist, in the hope that more accurate methods of soil examination may be evolved.

6. *Pusa soils*.—In 1906 samples of the surface and sub-soils of all the fields within the arable area at Pusa were taken ; they were subsequently analysed and, in addition, specimens of each were stored for possible future examination.

7. *Meteorology*.—The usual meteorological records are maintained and the Institute is a reporting station of the meteorological department.

8. *Rain and Dew*.—A record of the amount of Nitrogen compounds in rain and dew was maintained last year at Pusa to provide a confirmation of that which was obtained by the examination of rain water and dew at Cawnpore and Dehra Dun (Memoir No. 1, Chemical Series) and the newer data agree with these in demonstrating the smallness of the total amount of these compounds in the annual rain and dew.

9. *Drain gauges*.—During the hot weather of 1906 four gauges were constructed at this Institute for observing the nature of percolation during wet weather. They are similar to those at Rothamsted in England and at Cawnpore and each consists of a block of earth 1—1000 acre in area which has been isolated in the undisturbed state. In two, the earth is three feet deep, and in the other two it is 6 feet deep. Rain water falling on them may either soak into the soil, or if the fall is very heavy it may also overflow. Arrangements are made for measuring the amount of water which percolates, the velocity of percolation, the chemical characteristics of the drainage water, and for measuring any water which overflows at 2", 3" or 4" above the ground level, as may be desired. The construction was carried out by Mr. M. H. Arnott, Superintending Engineer, Public Works Department, to whom we are much indebted for the care and interest that he devoted to this work. We shall thus have two records in India regarding the nature and quantity of percolation. Of those at Pusa it is proposed to keep one six-foot and one three-foot gauge entirely bare fallow, and on the other two vegetation, either grass or other plants, throughout the year, in order to determine the difference between the amount of drainage in the two cases.

10. *Loss of water from soil*.—Information as to the rate at which water is lost from soil during periods of dry weather and the amount of movement through the soil naturally forms the counterpart to a knowledge of drainage conditions, and records have been kept, in the first instance in bare fallow land, for this purpose. The first year's results have been considered of sufficient interest to merit publication and will appear shortly.

It will be evident that information regarding the movement of water through the soil during wet and dry weather respectively in India, important as it is when considered alone, is enhanced by the fact that it at the same time assists the formation of an opinion as to possible movements of plant food through the soil.

11. *Saltpetre*.—A reference was made in my last report to the saltpetre industry. Experiments were made to ascertain the manner in which the salts are removed from the nitre-earth during the percolating process so universally employed, and these demonstrated that the nitrates and chlorides pass out first, the major part of the sulphate remaining, in the ordinary course of the work, in the soil ; and that the effect of the ashes which are so commonly added is to convert some of the nitrates of soda and lime into the potash salt. It was also ascertained that the common belief in the formation of nitrate in the refinery earths has no foundation in fact.

12. *Sugarcane*.—An assistant of this laboratory was again deputed during 1906 to analyse sugarcane in the Balaghat district.

The composition of the juice of the varieties of sugarcane at Pusa has been ascertained each year, and latterly this has been done periodically during the whole ripening period in order to ascertain what changes occur at this time.

13. *Cyanogenetic glucosides*.—Various plants, jowar, linseed, have been grown under varying conditions in order to try to determine the conditions under which their peculiar cyanogenetic glucosides are formed in large amount. It has been found that this is not a feature of the variety, for instances of the same variety forming much glucoside, or none at all respectively, have been met with. It is hoped that by carefully controlling the conditions of growth, the cause of formation may be isolated, and the work has met with a certain measure of success.

14. *Establishment*.—Mr. H. E. Annett, Supernumerary Chemist, arrived in May 1907. Mr. W. Roberts, Supernumerary Agriculturist, has been detailed to this section for experimental work on Behar soils. Four of the Indian assistants, who have served for some years in this section, are doing good work. Four of the provincial chemists spent some months at Pusa in order to acquaint themselves with the general work which is in progress.

In December 1905 three probationers, one each from Bengal, Madras, and the Central Provinces, were sent to this Institute for a period of training in the chemical section. Of these one resigned : the other two



remained until March 1907 and then returned to appointments in their respective provinces. The sanctioned scale of pay is insufficient to secure the best men, and only attracts probationers possessed of very limited qualifications. Much more than this is required if any particular progress is to be made in Agricultural Chemistry in India.

J. WALTER LEATHER,  
*Imperial Agricultural Chemist.*

PUSA.

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## PART IV.

## REPORT OF THE IMPERIAL MYCOLOGIST.

1. I held charge of my section during the period under review, with the exception of three months from the 9th of August 1906, when I took privilege leave and Mr. S. K. Basu, Senior Assistant, took charge.

My laboratory was transferred from Dehra Dun to Pusa, in November 1905. It now occupies a temporary building. Considerable difficulties have been caused by damp and dust. Though these will be largely obviated when the main building is ready for occupation, still the experience of the past two seasons has shown that certain classes of work will always be carried on at a disadvantage in the warm, moist climate of Pusa.

My section will have two distinct functions to fulfil. One, common to all similar sections of Agricultural Departments everywhere, is the investigation of plant diseases and the study of fungi concerned in them, or otherwise agriculturally important. The other, usually separated or, indeed, in the older departments often unnecessary, is the accumulation of a representative collection of fungi for consultation. A large general fungus herbarium is not usually considered a necessary part of the equipment of an agricultural mycologist's laboratory. Such a collection is generally available elsewhere and in cases of difficulty the services of competent systematists near at hand can be obtained for the identification of species. As a matter of fact, however, in Europe at least and in a measure in the United States, cases of difficulty rarely arise. The fungus flora of these areas is well known and the identity of the species parasitic on particular plants can be determined with considerable ease. In India circumstances are different. It is probably the least known, excepting China, of any large area in the civilised world as regards the fungus flora. Almost the only important group of parasitic fungi which has been studied in India is the "rusts". Hence, though many of the commoner crop diseases of Northern India are known and have been studied in Europe, cases constantly occur of diseases which have not been previously investigated. In order to deal with these it is necessary to have the means of identifying the parasites concerned. The co-operation of other workers is not always available, and though I have to acknowledge generous assistance from outside India it is essential that the Mycological section at Pusa should eventually reach a position in which it will be able to deal with work of this nature. Further, one of the important duties at Pusa will be to assist

other Mycologists in India in determining their species and for this purpose good consulting collections are necessary.

Much time has been given to organising the sectional library and collections for ready reference to meet this demand. Card indices of the collections both parasites and host plants, and of all fungi hitherto described from India, have been prepared.

When on leave in Europe, I visited Kew, Paris and Berlin to secure assistance in naming and describing my collections of Indian fungi. I was fortunate enough to obtain the co-operation of Messrs. H. and P. Sydow of Berlin, and technical descriptions of Indian fungi will appear from time to time in their Journal, the "Annales Mycologici", one of the chief organs of systematic Mycology.

During the period under review, I collected specimens in Central Bengal, Behar, Godaveri, Belgaum, Bassein, Kumaon and Lyallpur. A very useful collection was made by Mr. S. N. Mitra, 3rd Assistant, in parts of the Bombay Presidency. Munshi Inayat Khan collected in Bundelkhand and Kumaon. Specimens have been presented by Mr. I. H. Burkill, Mr. J. M. Hayman, Mr. C. A. Barber, Professor Gammie, Mr. Sundararaman, Mr. R. S. Hole, Mr. R. S. Troup, in India and by Dr. Walter Busse, Berlin, Mr. E. W. Holway, University of Minnesota, Mr. C. G. Lloyd of Cincinnati, Professor Jakob Eriksson, Stockholm, and Herr H. Sydow, Berlin, to all of whom I am much indebted.

The main lines of research work which it is proposed to follow at Pusa, were submitted to the Committee of the Board of Agriculture appointed to advise on the scientific work of the Institute at the second meeting of the Board held in January 1906, and were approved of.

2. *Investigations of Plant Diseases.*—Palm diseases. A serious disease of cultivated palms has broken out within the past few years in the Godaveri Delta. It is spreading slowly in a continuous area. Palmyra palms are chiefly attacked, but coconut and probably betelnut palms are also destroyed. In many villages over eighty per cent. of the palms have been killed. I visited the diseased area in August 1905 and March 1907. Proposals were made for an organised campaign to endeavour to stamp it out before the very valuable coconut forests further south were infected. A sum of Rs. 5,000 was sanctioned by the Madras Government, in 1906, for experimental measures for its control in a small area. This was increased by Rs. 26,000 in 1907, for the treatment of the whole area affected. The present operations are under the control of an Assistant Collector with a supervising staff from the Madras Department of Agriculture and two assistants from Pusa. The working parties are composed of palm climbers, (toddy drawers) under several Revenue Inspectors. The cause of the disease is a fungus which chiefly attacks the leaf sheaths, and spreads gradually through

successive sheaths until the central bud is reached and the tree is killed. An account of it was given in the Agricultural Journal for October 1906, and a technical description of the parasite in the Memoirs, Volume I, No. 5, February 1907.

3. *Sugarcane diseases*.—The chief sugarcane diseases studied were red rot, smut, black rot and red leaf spot. Experiments with the former extending over two seasons show that the chief mode of conveyance is by the use of cuttings already containing the fungus. As this view is not in accord with the ideas prevailing in other countries where the disease has been a cause of loss, it required very full testing. The result has been to leave no doubt as to its substantial correctness in the more severe forms of the disease. Two distinct types of disease, however, occur and have been the cause of the misconception. In the milder first type air-borne spores gain access to the standing cane, being assisted by anything which tends to weaken the latter, such as the attacks of borers or leaf-hoppers. Individual canes become diseased, but the whole stool is not as a rule affected. The use of such infected canes as cuttings for seed leads to the second and (in Northern India) much the more severe type. The living fungus is planted out inside the cuttings and the resulting stool is attacked from below and eventually killed. The first form was active in the Pusa crop in the season of 1906-07, following on an epidemic of leaf-hopper. By carefully excluding all canes with recognisable symptoms of infection in selecting seed cane, the more serious type of disease can be, as a rule, eliminated. The practical conclusions to be drawn are that while it is impossible to avoid completely the first type of disease, it may probably be much diminished by checking pests and is not in any case likely to lead to very severe loss. Most of the loss caused by this disease is due to the use of infected seed and this loss can be avoided by discarding such seed in planting, without great difficulty. "Ratooning" varieties subject to the disease (as most of the thick canes) is liable to result in loss, which may be entire or almost entire if the ratooned crop had any large proportion of diseased canes the previous year. Further experiments are in progress to determine how far the fungus can exist in a cane without causing discoloration, whether soil infection ever occurs, the co-existence of other fungi in red rot, its connection with borers and some other points. Experiments with smut have been commenced this season. Black rot is primarily a disease of cuttings and is not at present a serious disease, though a near ally, the "pine apple" disease, is a cause of much loss in other countries. The latter was detected in newly imported cane and the consignment was destroyed. Accounts of these and other diseases of cane were published in the Memoirs, Volume I, No. 3, July 1906, and in a paper on the selection of sugarcane cuttings in the Agricultural Journal in April 1907.

4. *Cereal rusts*.—Experiments have been carried on in conjunction with Mr. J. M. Hayman, Deputy Director of Agriculture, United Provinces at Cawnpore in growing wheat in rust proof cases to test the validity of the “hereditary” theory of the disease. About 180 plants have been thus grown and two pustules of rust occurred in two cases this year. On the whole the evidence is against this being a frequent occurrence and it is possible that accidental contamination took place. A preliminary enquiry into the degree of resistance and susceptibility to rust was carried out at Lyallpur and Pusa, but it has been considered advisable to postpone taking this up in detail until pure races of Indian varieties have been separated. An account of the experiments and of the varieties, distribution, etc., of Indian rusts was published in conjunction with Mr. J. M. Hayman in the Memoirs, Volume I, No. 2, July 1906.

5. *Ground-nut leaf disease*.—Failure to establish this disease at Pusa has led to the abandonment of local experiments in its treatment. At Poona, steeping and spraying experiments are in progress, without as yet, any definite results.

6. *Wilt diseases*.—An area was reserved on the Poona Farm for an attempt to produce a resistant strain of pigeon pea by selection. Last year's results were promising. A similar experiment commenced at Pusa was destroyed by floods. Biological work with wilt-producing fungi absorbed much time but the conditions of infection are not yet determined. Wilts of cotton, gram, Bimlipatam-jute (*Hibiscus cannabinus*), sesamum and indigo have also been under study and it is probable that the majority of these diseases are caused by the United States cotton-wilt fungus (*Neocosmospora vasinfecta*) which was discovered to be widely distributed in India this year. A paper describing the pigeon pea wilt was published in the Journal in January 1906.

7. *Green-ear disease of cereals*.—Bajra, jowar, Italian millet and *Euchlæna luxurians* are all attacked in India by a parasite, *Sclerospora graminicola*, previously known on Italian millet and wild grasses only. An account of its life history and effects was published in the Memoirs, Volume II, No. 1, March 1907. This should enable practical methods of treatment to be employed in localities where it causes loss.

8. *Mango diseases*.—I visited Malda in August 1905, at the request of the Bengal Agricultural Department, to enquire into a disease which was reported to be damaging the valuable mango orchards of the district. The cause was found to be an alga already known as the cause of “red rust” of tea, one of the worst blights of this crop. The features of the disease correspond closely with those observed on tea and, like the latter, serious loss appears to be confined to certain districts, though the alga is widely distributed all over India. The conditions determining viru-

lence are not clearly known but they are evidently local, and prolonged investigation on the spot would be necessary before any suggestion for treatment could be made. This is not possible at present. Other minor diseases of the mango have also been studied.

9. *Other diseases.*—A large number of other diseases of plants, including most of the cultivated crops of the plains and several fruit and economic plants, were examined. A proportion of these are specimens sent in by Superintendents of Farms and other persons interested in agriculture, and reports are issued giving such recommendations for prevention or remedy as are likely to prove most useful. Others are collected by the establishment. Information regarding these is steadily accumulated, cultures obtained, the life histories studied and inoculations tried as opportunity permits. When necessary, a personal visit is made to the locality reporting the disease, or an assistant is deputed for local investigation. It will be years before we have anything like a comprehensive knowledge of Indian plant parasites and every occasion is utilised towards this end. This may be taken as the routine work of the Laboratory at present. It is essential to acquire information regarding the characters, distribution and effects of the diseases of important crops in India as rapidly as possible. A few only can be selected for further investigation at any one time. Such are, at present, the cereal rusts, sugarcane diseases, wilts of Leguminosæ, and Malvaceæ, and palm diseases. In some cases simple preventive or remedial measures suggest themselves at once, and detailed study can be left over. A commencement has been made in expanding work through the medium of trained native assistants in the Provincial Departments. These men will be able to inculcate simple measures of improved sanitation, the selection of disease-free seed, the destruction of infective matter and the like; they will also assist largely in the crop disease survey. Larger measures of dealing with severe outbreaks of disease must be, as far as can be judged at present, left to Government agency. Government can also take an active part in checking imports of disease and in providing disease-free seed through seed farms. Further progress in the general control of plant diseases depends on the education of the cultivators.

10. *Soil inoculation for legumes.*—Field experiments with cultures of the bacilli obtained from pigeon pea, grown and applied after the methods recommended by the United States Department of Agriculture were carried out at Dehra Dun and Pusa. The Dehra Dun experiments, which alone were satisfactory, showed that no appreciable gain resulted from the application. The probable explanation is that bacilli, capable of forming nodules on this commonly grown pulse, must have been present in the field even though the crop itself had not recently been grown there.

11. *Fungus diseases of injurious insects.*—A joint investigation of the possibilities of this method of destroying locusts was carried out with the Imperial Entomologist. The locust fungus is a parasite which is capable of causing epidemic disease in certain locusts. Healthy specimens of the Bombay and North-West Migratory locusts and some species of grasshoppers were inoculated with pure cultures of the fungus, in various ways. Everything was done to increase the chances of infection. The results showed that for the species tested, the method is not likely to be of the slightest use. A Bulletin (No. 5 of 1907) giving details of the experiments and results is now printed. A supposed parasite of the green coffee bug was imported by the United Planters' Association of Southern India and forwarded to Pusa for cultivation. Repeated attempts were made to obtain a strong growth, but it failed to thrive and reports from South India indicate that no cases of infection occurred even with the freshly imported material, so that nothing is to be expected from this method of fighting the pest. These results are in harmony with the general experience of other countries, where the claims of those who advocate this line of work have not as a rule borne full enquiry.

12. *Soil fungi.*—A commencement has been made in the study of the soil fungi which assist in the decomposition of organic matter and help to render it available for plant food. The necessary preliminary to this is a knowledge of the species which are most constantly present in a given soil. This work has been in the hands of Mr. S. K. Basu, M.A., 1st Assistant, who has isolated and determined a number of the commoner soil forms at Pusa.

13. *Systematic Mycology.*—A monograph of the genus *Pythium*, an imperfectly known group of lower fungi to which the "damping off" and palm rot parasites belong, was published in the Memoirs, Volume I, No. 5, February 1907. To this was added a description of its parasites and some allied fungi. The first part of a systematic account of the fungi in the Herbarium at Pusa, entitled "Fungi Indiæ Orientalis", was published in conjunction with Messrs. H. and P. Sydow in the *Annales Mycologici* for October 1906. A second part is in preparation. Part of the collections of fungi, chiefly the larger woody forms, was sent to Kew, and descriptions of the new species published by Mr. G. Masee in the Kew Bulletin.

14. *Text-book.*—Some progress has been made in the preparation of a text-book of Indian diseases of plants. It is hoped to complete this during the coming year. Nothing of the sort is available for students of tropical and sub-tropical plant diseases.

15. *Training.*—The training of probationary assistants for the Central Provinces and Bengal was completed in April 1907. A pro-

bationer for the United Provinces has been under training since the 4th March 1907.

16. *Establishment.*—The staff has been strengthened by the recent appointment in England of Mr. W. McRae, M.A., B.Sc., as Supernumerary Mycologist. This officer has not yet, however, joined in India. Mr. J. H. Mitter, B.Sc., was appointed 2nd Assistant in July 1906. Babu R. R. Sen was appointed 3rd fieldman in August 1905, and N. C. S. Gupta, 4th fieldman, in December 1905, but transferred on deputation to the office of the Director, Pusa, in June 1906. All have worked satisfactorily, particularly Mr. S. K. Basu, Senior Assistant, Munshi Inayat Khan, 1st fieldman, and Babu Rameshwar Dayal, Clerk.

E. J. BUTLER,  
*Imperial Mycologist.*

PUSA.

*The 18th August 1907.*



## PART V.

### REPORT OF THE IMPERIAL ENTOMOLOGIST.

1. *Training*.—Entomological Assistants were given a full course of training for the Agricultural Departments of Bombay, Bengal, United Provinces, Madras and Assam. A short course of training was given to the Entomological Lecturer, Poona Agricultural College, to a Farm Overseer undergoing a general Agricultural training for Bengal, and to six Agricultural Assistants who had completed their agricultural course at the Cawnpore Agricultural College for the Punjab Agricultural Department.

2. *Establishment*.—The Supernumerary Entomologist, Mr. C. W. Mason, arrived in December 1906. In anticipation of the appointment of the Second Entomologist, the staff allotted to this officer was appointed. The post of First Assistant to the Imperial Entomologist was held by C. S. Misra who is directly engaged in training the probationers sent to Pusa. The second Assistant, C. C. Ghosh, has had charge of the insectary. One Assistant, T. V. R. Aiyar, was transferred to Madras as Entomological Assistant. P. G. Patel has been specially employed to work at biting flies. The other assistants are now being trained. The artist staff appointed for the Institute and for the Journal worked under my guidance.

3. *Buildings*.—The insectary was occupied in July 1905; the insecticide godown has been used as a laboratory since June 1906 and a large part of the staff still work in the old barn. Lack of light and of working accommodation have caused great difficulties in carrying out Laboratory work. The full work of my section can only be entered into when the permanent Laboratory is complete.

4. *Provincial work*.—Trained Assistants are now employed in each Province and, in most cases, the Imperial Entomologist suggests and guides the year's programme of work. Progress has been made in the general study of injurious insects. In the Punjab, the severe outbreak of boll-worm required special measures which are reported to have given good results. The three principal measures were:—

- (1) Removal and burning of the old plants in January.
- (2) The cultivation of *bhinda* (*Hibiscus esculentus*) as a trap crop.
- (3) The reintroduction of the parasite of the boll-worm.

The first did good generally, but the second was a general failure except in such localities as depended on well irrigation and where

the people understood how to grow the plant. The third measure was an apparent success. Damage estimated in 1905 at two to three crores of rupees was very greatly reduced in 1906 by these measures and in 1907 the crop is reported to be normal, the parasite being abundant generally. In Sind, the loss in 1906 was as bad as in 1907, but the parasite was reintroduced in April-May 1907 from Pusa and is now re-established there. The Bombay Entomological Assistant has given special attention to the outbreak of Potato Moth, an imported pest. In the Central Provinces, good progress has been made in investigating the general pests and a good course of practical entomology is being framed for the college. In Madras and Bengal good progress has also been made in general investigation regarding injurious insects.

The Provincial Entomological Assistants meet at Pusa in January of each year to discuss the year's programme, see the progress made at Pusa and compare notes. Real progress regarding Entomological enquiries is being made in the various Provinces and useful information about the injurious crop pests can without difficulty be diffused.

5. *Correspondence*.—Reports of injury to crops with specimens of the insects are received from the District officials and when possible a report is sent back at once. These district reports show when insects are doing injury and would be extremely valuable if more frequently sent; damage by insects is constantly reported in the weekly crop reports, but no report with specimens is sent to Pusa. I receive numerous enquiries from Farm Superintendents, Superintendents of the State Gardens, and from other official sources; from commercial firms, planters, zemindars and other private individuals. These enquiries cover a wide range and I have to devote much attention to answering them. A considerable part of my work is devoted to acquire the information necessary to answer such enquiries.

6. *Research*.—Progress has been steadily made in the investigation of the life histories and habits of injurious insects. A detailed study has been made or is being made of the most important insects, but for numerous destructive insects a full enquiry must wait until we have more time. For each injurious insect all observations are recorded and will in time be worked up. Every stage of the insect's life is recorded pictorially by an artist and the "plate" to illustrate each insect is brought to completion. When particular insects begin to do damage to crops, methods of treatment are experimented with. In co-operation with Mr. R. S. Finlow, a special investigation into insecticides was made, in the hope of finding a substance poisonous to insects but not poisonous to cattle, which could be applied profitably in the field. This investigation has reached the stage of field trials. Other subjects under enquiry, as time allows, are the

nfluence of climatic phenomena on insects, the utilisation of beneficial insects and the value of trap crops in Indian Agriculture. In collaboration with the Imperial Mycologist an enquiry was made into locust fungus and its value.

The cultivation of "Eri" silk was taken up to determine whether the worms will survive the dry hot weather or can be acclimatised to it. Lac was also introduced under cultivation, as there is a large field for lac culture on existing trees in Behar.

7. *Insect survey*.—In addition to work of a purely economic nature, provision has to be made for teaching, both in the shape of a collection of the common insects of India and of facts concerning them. The general collection of insects at Pusa has accordingly been made as large as possible. The insects collected are, when necessary, sent to specialists in Europe or America for identification and are then classified. Large collections have been sent to England for the use of authors of prospective volumes of the Fauna of India; I have received the greatest help from the Editor of the Fauna, Colonel Bingham, and our collection owes much to the generous help of Mr. H. E. Andrewes, in sending named specimens of beetles.

It has also been necessary to gather together all the recorded information about insects as the basis of teaching and to supplement this by observation and research. This has been done and the text of a volume on the insects of the cultivated areas of India has been prepared. This will serve as a basis for teaching or, if published, will be an advanced student's text-book and a manual for all workers in Entomology in India. No such work exists at present and its preparation has taken much time. Mr. F. M. Howlett, who will take up the work of the Second Imperial Entomologist in November has collaborated. He has been working at Indian Diptera in England.

8. *Summary*.—The chief work of the past two years has been a continuation of the preliminary work commenced in 1903, the chief object being the study of the injurious insects of this country with a view to recommend measures to check them or at least to give reliable information about them. The publication of this information is important to the agricultural classes. Practical instruction in entomology can be more effectively carried out when the Provincial Agricultural Colleges and the permanent Laboratories at Pusa are opened.

9. *Publications*.—"Indian Insect Pests" is the most important item and its publication and wide circulation in India has already produced marked effects. The publication of the Journal and Memoirs has given me heavy work. I have had to supervise the preparation of illustrations for all sections of the Institute including the reproduction of the plates and illustrations of the Journal and Memoirs. I have acquired technical knowledge of printing processes, under some

difficulties. The publishers have introduced the "Three Colour Process," and other improvements and illustration work in India is being vastly improved. Although the work of Messrs. Thacker, Spink & Co. is excellent, we have great need for an Assistant Editor skilled in printing processes and who can bring the work of illustrating to the highest possible level without increased cost. I consider that an Assistant Editor for our publications is urgently required.

H. MAXWELL-LEFROY,

*Imperial Entomologist.*

PUSA ;

*The 12th August 1907.*

## PART VI.

## SUMMARY OF THE REPORT OF THE IMPERIAL AGRICULTURIST.

1. *Staff*.—Mr. E. Shearer was in charge of the section for the whole period. Mr. R. W. B. C. Wood joined as supernumerary in October 1905. In May 1906, he was appointed Deputy Director of Agriculture in Madras. Mr. A. G. Birt and Mr. W. Roberts joined each as a supernumerary in October 1906, and Mr. G. Garrad, in December 1906. Mr. Garrad was deputed to Bombay in May 1907 and Mr. Roberts to the Imperial Agricultural Chemist, each for special agricultural work which will probably give them some experience necessary for Provincial appointments.

2. *Historical*.—The Pusa estate of over 1,300 acres was largely occupied by jungle when first taken in charge by the Agricultural Department and the work of clearing the good land for arable cultivation has been extensive and costly. The work is not complete and apart from agriculture the amenities of the estate in this section still require considerable improvement.

3. *Training*.—Two probationers from Bengal completed two years' training in April 1906, and were respectively appointed overseers on the Bankipur and Sabour Farms. A probationer from the Central Provinces completed eighteen months' training in March 1907, and was appointed overseer on the Akola Farm. A probationer from Bengal was, after six months' training, appointed in December 1906, Travelling Inspector of Agriculture in the Orissa Division of Bengal. Another from Eastern Bengal and Assam continues under training.

4. *Cropping*.—The crops on particular selected fields were grown with the intention to determine how far the fields are uniform in character so that they may be eventually devoted to permanent experiments. The produce from each acre of these fields has been weighed separately. Information regarding the suitability of particular areas for particular experiments is required and a decision on this point will be come to shortly. So far, the indications are that, while large areas are not uniform, considerable blocks will be suitable for accurate experimental work.

5. *Cotton*.—Extensive trials began in 1904 and included the following :—

- (a) Selected indigenous (annual and tree varieties).
- (b) Newly imported American.
- (c) Acclimatised American.
- (d) Egyptian.

The general results have been unsatisfactory. It has been therefore decided that other crops are more profitable in Behar. In consultation with the Inspector-General of Agriculture, it has been further decided that these experiments should be abandoned. The varieties of tree cotton have given particularly unsatisfactory results at Pusa.

6. *Sugarcane*.—Twenty-five varieties were tested as regards methods of cultivation, manuring, irrigation, susceptibility to disease, outturn, etc. Damage was done particularly to thick soft varieties by white ants, borers, leaf hoppers, jackals and pigs. Fungus diseases caused considerable damage. Dr. Butler deals with the last-named troubles and Mr. Lefroy with insect attacks.

7. *Jute*.—Forty-four varieties of jute were grown in 1906, forty-two of *C. capsularis* and two of *C. olitorius*. The results are described in a general way by the Fibre Expert.

8. *Flax*.—Experiments with this crop have been carried on since 1904 for seed and fibre but chiefly for the production of fibre. The various varieties imported from Russia, Belgium and Ireland grew very well. An estimate of their value for fibre does not belong to my Department.

9. *Mangel wurzels*.—Mangel wurzels, as well as turnips, are grown to a limited extent in Northern India. The former was grown at Pusa in the rabi season of 1906 on well manured irrigated land and yielded just under 20 tons per acre. This crop will probably supply in part very suitable food for our cattle and sheep in the hot weather.

10. *Green manuring*.—The advantage of green manuring with San-hemp was tested and, in newly broken land, proved very profitable.

11. *Trial of new pasture grasses*.—The seeds of *Chloris virgata* (known in South Africa as "Rhodes grass") and *Chloris gayana* were received from New South Wales. They grew well and will be tried again on a larger scale.

12. *Breeding herds*.—Montgomery cattle continued to do well. The best of them give eight to nine sers\* of milk a day when in full profit but this yield is less than in their own country. These cattle have remained healthy.

A herd of local cattle was started with the object of distributing bulls to improve Bengal cattle and the management is practically supervised by the Bengal Civil Veterinary Department. This breed is kept at Pusa to supply Provincial requirements but under present circumstances could possibly be more correctly controlled on a farm managed by officers of the Bengal Government.

13. *Establishment*.—The staff have worked well especially the two Farm Overseers, Mr. Gulabbhai Desai and Mr. Mohammed Ikram-uddin, and Mr. Judah Hyam, the Veterinary Overseer, who is in charge of the breeding herds.

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\* Ser—2 lbs.

## PART VII.

## SUMMARY OF THE REPORT OF THE IMPERIAL ECONOMIC BOTANIST.

1. Mr. A. Howard took up appointment in India in May 1905. During the first three months he saw a good deal of the work carried on by the Agricultural Departments in various Provinces. The area under his charge at Pusa contains a fruit orchard and also a Botanical Garden which is in part devoted to such crops as he is studying. The area is securely fenced and laid out conveniently with paths and in plots. The Botanical Garden of Economic plants is only now being laid out as funds were not available until this year. The want of a laboratory and apparatus greatly impeded his work at Pusa during the first year. Convenient buildings have since been erected. One building is provided with north light and is quite suitable for laboratory work.

Extensive orchards have been planted and these comprise plots of peaches, figs, mangoes, litchis, guavas, loquats, plums and citrus fruits. The experimental scheme refers to pruning, cultivation, irrigation, manuring, planting and the influence of stocks on the scion. The whole is commanded by irrigation from the river and drainage has been arranged for. An account of this work has been published as Bulletin No. 4 of the Agricultural Research Institute, Pusa. The fruit trees are yet all young. They have, however, grown well and all are likely to succeed as they were selected as suitable for the soil and climate of Pusa. Some trees have already fruited. The fruit from the peach trees was notably perfect.

2. *Wheat investigation.*—In 1905, Mr. Howard collected many samples of seed in the wheat-growing districts. These samples mostly contained mixed seed. The different varieties had to be sorted out and their botanical characters and agricultural values studied. He has obtained a representative collection of Indian wheats through the Agricultural Departments, the Reporter on Economic Products, the Superintendent, Botanical Survey of India, and from other sources. He has undertaken a detailed study of the Punjab wheats at the request of the Punjab Director of Agriculture. A preliminary classification was made in 1906. By extensive field studies a classification of all wheats grown in the various Provinces has been nearly finished. He started cross-breeding wheat experiments in the Punjab and at Pusa. On account of favourable climatic conditions the former are

likely to be the most productive. The cross-breeding wheat experiments in the United Provinces and in Bombay have been conducted by local officers for a number of years. Mr. Howard is preparing a book of reference regarding Indian wheats. The work has been more laborious than he expected. He hopes to finish it soon.

3. *Tobacco*.—The study of the numerous varieties grown in India has been commenced. Exotic varieties likely to grow well in India have been collected. A classification of various types is a necessary preliminary to work on improvement. This classification has been undertaken.

4. *Barleys*.—A survey of the barleys grown in India is being made with the aim of improving this crop by cross-breeding and selection of seed. Many varieties were grown at Pusa in 1906-07.

5. *Ganja (Cannabis sativa)*.—The attention of the Imperial Economic Botanist has been drawn to the need of a biological study of the *ganja* plant, but at present he is fully employed on other and more important work and a general enquiry must wait. He has, however, started minor enquiries regarding this crop at Pusa.

6. *Library Catalogue*.—A complete revision of the Library catalogue was found necessary and was undertaken in 1907.

7. *Tours*.—Mr. Howard toured extensively to become acquainted with the agricultural conditions of various parts of India, to see the general agricultural and experimental work which is being carried out in the Provinces, and to gain special information regarding his work on wheat.

8. *Staff*.—Mr. R. J. D. Graham, M.A., B.Sc., has been appointed Supernumerary Economic Botanist, and arrived in May 1907. Mr. Howard has found difficulty in obtaining a sufficient staff, because neither pay nor prospects are at present attractive.



## APPENDIX A.

A SHORT ACCOUNT OF RECENT WORK IN BEHAR IN  
INDIGO RESEARCH.

In continuation of the far more extensive work of the previous years experiments in manufacture have been carried out at Pusa and at the Bengal Research Station (Sirseah), but chiefly at the latter place.

The Java and Sumatrana varieties yielded the largest outturns of dye by steeping in water at a temperature of 104° F. for 7 hours. These results require confirmation. Extra expense is incurred by using water at a high temperature but water which is too low in temperature is frequently employed with loss on cold and wet days at the beginning and at the end of the manufacturing season. The value of the plant at various stages of growth has been investigated and the study of the fermentation process has been further extended. It is recommended that the conditions of time and temperature mentioned above should be rigidly adhered to. There are inevitable losses of indigotin in the seed water and also in boiling, straining and pressing; but it is believed that an increase of outturn can be usually obtained between the oxidizing process and the finished product. This is under investigation. Attention has been directed to drying indigo in the form of powder as indigo cakes have to be reduced to powder for dyeing purposes. The agricultural and laboratory tests have clearly proved the superiority of the Java plant over the old Sumatrana variety. The difficulties connected with the poor germination of Java seed have been overcome. Treatment with sulphuric acid is effective. The idea was suggested by Dr. Butler and the treatment is successful because the outer tough coat of the seed is weakened and germination in the ordinary moisture of Indian soils is thereby facilitated. The Java plant is a perennial. It should be sown in October-November and cut back in the spring in order to multiply branches and increase leaf growth. There are divided opinions regarding the effect of pruning in subsequent years and the question requires further investigation. As regards manual experiments no very definite results can yet be reported. The inoculation of Indian soils with a culture of the appropriate nodule bacteria has produced no advantageous results in Behar, presumably because the soils of this district are already sufficiently stocked with such bacteria. Considerable advance has been made in supplying good seed of both Java and Sumatrana varieties to Indigo Planters from established seed farms.

The Behar Indigo Planters' Association have appointed a Botanist and further advancement in indigo research in India will greatly depend upon his work. Nothing has yet been done to separate the best types of plants of any particular variety. The indigo industry is by no means yet dead in India and may yet become again very prosperous by seed selection on rational lines and by other agricultural improvements which are quite feasible. Much less attention has been given to the agricultural improvement of the crop than to chemical and other enquiries regarding the best means of extracting the dye.

Samples of known indigotin content sent to various analysts for examination showed considerable discrepancy in their results. A uniform method of trade analysis for indicating the true indigotin content of the samples dealt with has, therefore, been attained and its use by the leading analysts of Calcutta and England secured. The relative dyeing values of synthetic and natural indigo have been tested by Mr. Bergthell and very interesting results were obtained. Further trials are probably necessary, but as far as the tests at Cawnpore go natural indigo gave a better depth of colour than synthetic indigo and was pronounced a better dye for ordinary Indian cloths. Mr. Bergthell is, at present, on leave in England. When he returns from leave his research work regarding indigo will be continued at Pusa where complete arrangements have been made for manufacture and research. We may thus help European Planters in Behar, but we are still more likely to help the backward methods of manufacture in the United Provinces and Madras where cultivation has recently extended.

## APPENDIX B.

## A SHORT ACCOUNT OF EXPERIMENTS WITH JUTE AND OTHER FIBRES.

## JUTE.

For several years the jute trade has been in a critical condition but it has been generally profitable to Indian cultivators and dealers. There has been a large expansion in its cultivation. The demand for the fibre increased so rapidly that supplies began to run short during 1905, with the result that prices had doubled. In 1906 and 1907 the areas under this crop expanded considerably with the result that in 1907 prices have fallen steadily and in time will probably become more normal.

*Jute Extension.*—Mr. Finlow, the Fibre Expert, has published a full report (Agricultural Research Institute Bulletin No. 3 of 1906) which deals with the possibilities of extending jute cultivation in various Provinces. This report has been supplemented by the report of Mr. F. Smith, published in the *Agricultural Journal of India*, Vol. II, Part 2, April 1907, which refers particularly to the results of the experiment in Bengal. Outside Bengal, Madras appears to offer more favourable opportunities for jute cultivation than any other part of India. The climate of the Malabar Coast is distinctly similar to that of Bengal, although the hilly nature of some parts indicates unsuitability at first sight. Trials with jute have been conducted in the Godavari delta, at the Samalkota Experimental Station, since 1905, by Mr. Barber, the Madras Government Botanist. The results of the experiments in 1905 were not successful, but in 1906, owing to better experience regarding the necessary agricultural conditions, they were much more satisfactory. These experiments have been continued at the Samalkota Farm in 1907 and seed has been distributed to a number of cultivators in the district, who have received advice from the Agricultural Department regarding the proper method of cultivation. In 1907, jute experiments are also being carried out in other parts of Madras, notably at Tanjore in the Godavari delta on the Malabar Coast. In Bombay, trials were carried out in 1906 at the Ganeshkhind Gardens, Poona, by Professor Gammie on manured land but without irrigation. A yield of over  $7\frac{1}{2}$  maunds of fibre per acre was obtained, the value in Calcutta being Rs. 10-4-0 per maund. A larger area has been put down this year. Experiments at the Poona and Manjri Farms—at the latter with irrigation—are also being continued. Conditions in the rice districts of Bombay are not so favourable as in Madras owing to the want of early rains. The Central Provinces commenced trials with jute in 1905 at Nagpur and at Raipur, which were continued in 1906; the results were not satisfactory, chiefly because there are usually no premonsoon showers and the seed cannot, therefore, be sown early enough under favourable circumstances. This season (1907), however, sowings were made at Raipur on manured land in April with well irrigation and the results are reported to be much more promising. Well irrigation early in the season is very expensive and it is extremely doubtful whether it will pay even with a valuable crop like jute in the Chhattisgarh district where rice is practically the only crop at present. Behar and the Assam Valley, where jute had not hitherto been cultivated to any large extent, will probably produce very fine crops as experience is gained by cultivators. In 1904, Behar Indigo Planters began to get interested in jute and their tenants are now growing the crop to a considerable extent. In this tract, about 8,500 acres are under cultivation in the Mozafferpore and Champaran Districts this season (1907). Jute cultivation will probably extend largely into the plains of Assam because physical and climatic conditions are suitable. During the months of March, April and May of the present year, Mr. Finlow made a prolonged tour through the districts north and south of the Brahmaputra, including Cachar. The land near the river on both banks of Brahmaputra is in some places subject to deep inundation in the rainy season, but in others the banks are

practically, if not entirely, above flood level. Away from the river, there are large areas of rich land, much of it virgin and covered with dense reed jungle which, when brought under cultivation, may yield large crops of jute. The cultivation of jute is extending rapidly in the western end of Assam Valley where the acreage is estimated at 60,000 acres this year (1907) as against 33,700 acres in 1906. Many tea planters are interested, but the lack of labour will prevent rapid development. Forty-four varieties of jute were grown at Pusa in 1906, with two objects—(a) to commence plant to plant selection of seed, (b) to study the botanical characteristics of the different races and their agricultural values. Our observations tend to show that the Bengal jutes can be generally classified into (a) green stemmed races, (b) red stemmed races, (c) early maturing races, and (d) late maturing races. Different districts do produce fibre of different qualities and we are enquiring into the reasons. A full report on the experiments made at the Burdwan and Cuttack Farms has been published by Mr. F. Smith in *Agricultural Journal*, Vol. II, Part 2, April 1907.

*Seed Distribution.*—The Bengal Agricultural Department in 1906 distributed about 300 maunds of seed of jute from crops grown specially for the purpose. The Eastern Bengal Department of Agriculture also distributed 75 maunds of seed grown at the Rajshahi Farm, a considerable proportion of the latter was distributed in small quantities free of charge to intending cultivators chiefly in Assam. Part of the seed was also used for experimental purposes in other parts of India.

*Jute substitutes.*—The question of utilizing the various fibre plants which are possible substitutes for jute is assuming increasing importance. Both San-hemp (*Crotalaria juncea*) and *Hibiscus cannabinus* are grown throughout India chiefly for home use but to a considerable extent for export. Madras had nearly 70,000 acres of *Hibiscus cannabinus* in 1906 (the acreage for 1905 was probably less than 45,000) grown for export, or for gunny bags made in the mills at Bimlipatam. Seventy thousand acres of San-hemp were grown in the plateau districts of the Central Provinces in 1905. The crop is also fairly important in Madras, the Punjab, Bombay and Bengal.

While these and other fibres have not all the peculiar properties of jute, they are superior to it in some respects and can be used for purposes for which jute is not suitable.

*Other jute investigations.*—Mr. Finlow has made arrangements with Messrs. Cross and Bevan of London, the well-known authorities on cellulose, to collaborate with them in certain scientific investigations regarding fibres. The first of these investigations is an attempt to find out the cause of the alleged deterioration which has occurred in jute during recent years. It is hoped that the Calcutta Baled Jute Association will co-operate in the enquiry which will, in the first instance, be chiefly bacteriological.

*Diseases.*—During the present season the crops of jute over a large part of Bengal have been attacked by insects; but serious damage has not been done except in a few instances. The Imperial Entomologist is dealing with these pests.

*Fraudulent watering of jute* is a common practice among small dealers and leads to much damage to baled jute during transport to Europe. Repressive legislation which was regarded as essential by a considerable section of the commercial community was declined by the Governments of Bengal and Eastern Bengal and Assam on various grounds.

*Scientific work.*—A temporary laboratory has been equipped at Pusa and work has been carried on during the last three months. At present the investigations are devoted chiefly to a chemical and microscopical examination of numbers of samples of fibre with the object of establishing data to assist the selection experiments in the field. Other problems will be taken up as opportunity offers.

#### FLAX.

Experiments in cultivating flax in India as a fibre crop began as early as 1840 but no definite results were obtained. Experiments have again recently been started chiefly by Sir Lewis Hay, Bart., who, together with his manager Mr. Cameron, has

commenced operations on a large scale at Dooriah, Behar. The results of these experiments were considered by the Government of Bengal to justify assistance and an expert flax cultivator, M. Vandekerkhove, from Belgium, was appointed in February 1907. He will have to gain experience of Indian conditions of cultivation before he can give reliable advice on all points regarding the prospects of the crop. He states, however, that the weight of the rippled straw at present obtained in India is only about half of the yield obtained in Europe. He considers that this return would not be sufficiently remunerative to induce cultivators to take up flax ; but he is quite sanguine that better results can be obtained by increasing the yield of straw per acre and by more expert manipulation in the extraction of the fibre. The retting process should be carried out in the fair season not in the rains. The hot weather is too dry for the breaking and scutching processes. Six varieties of imported flax were grown at Pusa during the rabi season of 1906-07 ; both for fibre and for seed. The yields of straw rippled (threshed), unrippled and seed were fairly satisfactory. Unfortunately, part of the machinery obtained from Europe for extracting the fibre arrived in broken condition so that it is impossible to give yields of fibre at present. The best plots gave about 25 maunds of rippled straw per acre. The European yield is from 40 to 50 maunds per acre. The cultivation expenses in Europe are higher than in India and acclimatization of seed may tend to increase the yield in India. The experiments will be continued until definite issues are obtained and a note will be published regarding results as soon as full experience on the prospects of the crop has been gained. In considering the value of a flax crop account must be taken of the seed, as the straw need not be cut for fibre until the seed is approaching ripeness. The average yield of seed from each of four plots at Pusa was worth about Ra. 17 per acre.

Mr. Finlow hopes in time to show, as regards Bengal and Eastern Bengal and Assam, (a) the best varieties of fibre plants to grow, (b) the best methods of cultivation, (c) the best means to produce the best fibre for the market, (d) the best means of getting full value for good fibre, and (e) the best way of growing seed on a large scale for distribution. He also hopes to be able to show to which areas jute cultivation can be profitably extended, where jute substitutes can be profitably grown and in which parts other profitable fibre plants can be introduced.

## APPENDIX C

### *List of Agricultural Publications in India during 1905-06 and 1906-07.*

No.	Title.	Author.	Where published.
<i>General Agriculture.</i>			
1	Annual Report of the Imperial Department of Agriculture for the year 1904-1905. Price 12 annas.	Inspector-General of Agriculture in India, Nagpur, Central Provinces.	Government Printing, India, Calcutta.
2	Proceedings of the Board of Agriculture in India, 1906. Price 12 annas.	Ditto                      ditto	Ditto.
3	Proceedings of the Board of Agriculture in India, 1907. Price Re. 1-2.	Ditto                      ditto	Ditto.
4	Annual Report of the Board of Scientific Advice for the year 1904-05. Price Re. 1.	Secretary, Board of Scientific Advice, Calcutta	Government Central Press, Calcutta.
5	Annual Report of the Board of Scientific Advice for the year 1905-06. Price Re. 1-2.	Ditto                      ditto	Ditto.
6	Agricultural Statistics of British India, 1904-05. Price Rs. 3.	Director General of Statistics	Government Printing, India, Calcutta.
7	Agricultural Statistics of Native States, 1904-05. Price Rs. 3.		
8	Area and yield of certain crops in India, 1905-06. Price 5 annas.	Department of Commerce and Industry	Ditto.
9	Agricultural Journal of India, Vol. I, Parts 1-4. Price Rs. 6.	Agricultural Research Institute, Pusa	Messrs. Thacker, Spink & Co., Calcutta.

*List of Agricultural Publications in India during 1905-06 and 1906-07—contd.*

No.	Title.	Author.	Where published.
		<i>General Agriculture—contd.</i>	
10	Agricultural Journal of India, Vol. II, Parts I to IV. Price Rs. 6.	Agricultural Research Institute, Pusa . . .	Messrs. Thacker, Spink & Co., Calcutta.
11	The Extension of Jute Cultivation in India. Bulletin No. 3, 1906, of the Agricultural Research Institute, Pusa. Price 12 annas.	R. S. Finlow, B.Sc., F.C.S., Fibre Expert to the Government of Eastern Bengal and Assam.	Government Printing, India, Calcutta.
12	Note on the Oudh Seed Depôts . . .	W. H. Moreland, C.I.E., I.C.S., Director of Agriculture, United Provinces of Agra and Oudh.	Ditto.
13	Report on the Control and Utilization of Rivers and Drainage for the fertilization of Land and mitigation of Malaria.	Sir Edward Buck, K.C.S.I., LL.D. . . . .	Government of India, Revenue and Agricultural Department.
14	Sorghum Vulgare. Pers. (Andropogon Sorghum, Brot). The great millet or Juar in India. Agriculture Ledger No. 6 of 1905. Price 6 annas.	Sir George Watt, Kt., C.I.E. . . . .	Government Printing, India, Calcutta.
15	Phoenix Dactylifera Linn. (The Date Palm). Part I. Notes on Date Palm cultivation in countries other than India. Agriculture Ledger No. 1 of 1906. Price 3 annas.	F. Fletcher, M.A., B.Sc., Deputy Director of Agriculture, Bombay Presidency.	Ditto <sup>1</sup>
16	Psophocarpus Tetragonolobus (Goa Bean) Goa Beans in India. Agriculture Ledger No. 4 of 1906. Price 3 annas.	L. H. Burkill, M.A., Reporter on Economic Products to the Government of India.	Ditto.

17	Report of the Agricultural Department, Bengal, for the period of 15 months from 1st April 1905 to 30th June 1906. Price 8 annas.	Department of Agriculture . . . . .	The Bengal Secretariat Book Depôt, Calcutta.
18	Report on the Administration of the Department of Agriculture of the United Provinces of Agra and Oudh for the year ending 30th June 1906. Price 8 annas.	Ditto . . . . .	United Provinces Government Press, Allahabad.
19	Report on the operations of the Department of Land Records and Agriculture, Punjab, for the year ending 30th September 1905. Price 5 annas.	Ditto . . . . .	Civil and Military Gazette Press, Lahore.
20	Report on the operations of the Department of Agriculture, Punjab, for the year ending 30th June 1906. Price 4 annas.	Ditto . . . . .	Ditto.
21	Annual Report of the Department of Agriculture, Bombay Presidency, for the year 1905-06.	Ditto . . . . .	Government Central Press, Bombay.
22	Report on the working of the Department of Agriculture of the Central Provinces, during the year ending 31st March 1906. Price Re. 1.	Ditto . . . . .	Secretariat Press, Nagpur.
23	Report on the operations of the Department of Agriculture, Madras Presidency, for the official year 1905-06. Price 6 annas.	Ditto . . . . .	Government Press, Madras.
24	Burma Land Records Administration Report for the year ending 30th June 1906. Price Re. 1.	Ditto . . . . .	Government Printing, Burma, Rangoon.

*List of Agricultural Publications in India during 1905-06 and 1906-07—contd.*

No.	Title.	Author.	Where published.
<i>General Agriculture—contd.</i>			
25	Report of the Agricultural Branch of the Department of Land Records and Agriculture, Eastern Bengal and Assam, for the year 1905-06.	Department of Agriculture . . . . .	Eastern Bengal and Assam Secretariat Press, Shillong.
26	Annual Report of the Burdwan Experiment Station for the year 1905-06. Price 4 annas.	Ditto . . . . .	The Bengal Secretariat Book Depot, Calcutta.
27	Annual Report of the Dumraon Experiment Station for the year 1905-06. Price 2 annas.	Ditto . . . . .	Ditto ditto.
28	Annual Report of the Mripur Experiment Station for the year 1905-06. Price 2 annas.	Ditto . . . . .	Ditto ditto.
29	Annual Report of the Cuttack Experiment Station for the year 1905-06. Price 2 annas.	Ditto . . . . .	Ditto ditto.
30	Report on the Cawnpore Agricultural Station in the United Provinces for the year ending 30th June 1906. Price Rs. 1.	Ditto . . . . .	United Provinces Government Press, Allahabad.
31	Report on the Agricultural Station, Orai, Jalaun, of the United Provinces of Agra and Oudh, for the year ending 30th June 1906. Price 8 annas.	Ditto . . . . .	Ditto ditto.
32	Annual Report of the Government Experiment Farm, Lyallpur (Punjab), for the Kharif and Rabi Seasons, 1904-05. Price 5 annas.	Ditto . . . . .	Civil and Military Gazette Press, Lahore.



33	Annual Report of the Government Experiment Farm, Lyallpur (Punjab), for the Kharif and Rabi Seasons, 1905-06.	Ditto . . . . .	Ditto	Ditto.
34	Annual Report of the Agricultural and Botanical Stations in the Bombay Presidency for the year 1905-06. Price Re. 1-2.	Ditto . . . . .	Government Central Press, Bombay.	
35	Report on the Agricultural Stations in the Central Provinces for the year ending 30th June 1906.	Ditto . . . . .	Secretariat Press, Nagpur.	
36	Annual Report on the Agricultural Stations in Eastern Bengal and Assam for the year ending 30th June 1906.	Ditto . . . . .	Eastern Bengal and Assam Secretariat Press, Shillong.	
37	Annual Report of the Tropical Plantation at Wahjain for the year ending 30th June 1906. Price 2 annas.	Ditto . . . . .	Ditto	ditto.
38	Annual Report of the Jorhat Agricultural Station for the year ending 30th June 1906. Price 2 annas.	Ditto . . . . .	Ditto	ditto.
39	Annual Report of the Rangpur Agricultural Station for the year ending 30th June 1906. Price 2 annas.	Ditto . . . . .	Ditto	ditto.
40	Annual Report of the Rajshahi Agricultural Station for the year ending 30th June 1906. Price 2 annas.	Ditto . . . . .	Ditto	ditto.
41	Annual Report of the Shillong Fruit Gardens for the year ending 30th June 1906. Price 2 annas.	Ditto . . . . .	Ditto	ditto.
42	Scientific Report of the Attur Agricultural Station for the official year 1905-06.	Ditto . . . . .	Government Press, Madras.	

*List of Agricultural Publications in India during 1905-06 and 1906-07—contd.*

No.	Title.	Author.	Where published.
<i>General Agriculture—contd.</i>			
43	Scientific Report of the Hagari Agricultural Station for the official year 1905-06.	Department of Agriculture . . . . .	Government Press, Madras.
44	Scientific Report of the Bellary Agricultural Station for the official year 1905-06.	Ditto . . . . .	Ditto.
45	Scientific Report of the Palur Agricultural Station for the official year 1905-06.	Ditto . . . . .	Ditto.
46	Scientific Report of the Koilpatti Agricultural Station for the official year 1905-06.	Ditto . . . . .	Ditto.
47	Report of the Indigo Research Station, Sirsiah, for the year 1905-06.	C. J. Bergtheil, Imperial Bacteriologist . . . . .	Behar Planters' Association, Mozufferpore.
48	Report of the Indigo Research Station, Sirsiah, for the year 1906-07.	[ Ditto ditto . . . . .	Ditto.
49	Ficus Elastica. Its natural growth and Artificial propagation. Forest Bulletin No. 4.	E. M. Coventry, Deputy Conservator of Forests . . . . .	Government Printing, India, Calcutta
50	The cultivation of Ficus Elastica. Price Re. 1-6-0.	Claud Bald . . . . .	Messrs. Thacker, Spink & Co.
51	The Objects and Plan of the Heeleaka Experimental Station.	Harold H. Mann, D.Sc., Scientific Officer to the Indian Tea Association; and C. M. Hutchinson, Assistant Scientific Officer to the Indian Tea Association.	Indian Tea Association, Calcutta.
52	Green Manuring in Tea Culture in India . . . . .	Ditto ditto.	Ditto.

53	Factors determining the Quality of Tea . . .	Ditto	ditto	Ditto.
54	Experiments in Heavy Pruning . . .	Ditto	ditto	Ditto.
55	Report on the Heeleaka Experiments . . .	Ditto	ditto	Ditto.
56	Report on Sugar Mill at Benipur Factory .	Percy Jones . . . . .		Behar Planters' Association, Mozufferpore.
57	A note on the results obtained with Java Indigo.	C. J. Bergtheil, Imperial Bacteriologist . . .		Ditto.
58	A note on Testing the germinating capacity of Seeds.	Ditto . . . . .		Ditto.
59	A note on Harvesting Java Indigo Seed . .	Ditto . . . . .		Ditto.
60	A note on the Treatment of Java Indigo Seed with Sulphuric Acid to promote germination.	Ditto . . . . .		Ditto.
61	A note on Pruning Java Indigo . . . . .	Ditto . . . . .		Ditto.
62	Jute in rotation with Paddy in the same year. Leaflet No. 1 of 1907.	F. Smith, B.Sc., Deputy Director of Agriculture, Bengal.		Department of Agriculture, Bengal.
63	Groundnut. Leaflet No. 2 of 1907 . . . . .	Ditto	ditto	Ditto.
64	Winter Rice. Leaflet No. 3 of 1907 . . . . .	Ditto	ditto	Ditto.
65	Potatoes at Burdwan. Leaflet No. 4 of 1907	Ditto	ditto	Ditto.
66	Potatoes in rotation with Jute. Leaflet No. 5 of 1907.	Ditto	ditto	Ditto.
67	Variety Experiment on Mustard at Dumraon Agricultural Station. Leaflet No. 6 of 1907.	Ditto	ditto	Ditto.
68	Suggestions on the improvement of Silk reeling in Bengal. Price Re. 1-8-0.	N. G. Mukerji, M.A., M.R.A.C., F.H.A.S., Assistant Director of Agriculture, Bengal,		Bengal Secretariat Book Depôt, Calcutta.

*List of Agricultural Publications in India during 1905-06 and 1906-07—contd.*

No.	Title.	Author.	Where published.
<i>General Agriculture—contd.</i>			
69	A Report on Sericulture in Baroda . . .	N. G. Mukerji, M.A., M.R.A.C., F.H.A.S., Assistant Director of Agriculture, Bengal.	Government Press, Baroda.
70	A Report on Kashmir Silk Industry . . .	Raojibhai B. Patel, M.R.A.C., M.R.A.S., Director of Agriculture and Industries, Baroda.	Ditto.
71	Monograph on the Cattle and Buffaloes of Burma.	Major G. H. Evans, F.L.S., I.C.V.D. . . .	Government Printing, India, Calcutta.
72	Notes on indigenous breeds of Cattle in the Punjab.	Major H. T. Pease, I.C.V.D. . . . .	Ditto.
73	Manual of Irrigation Wells. Bulletin No. 22 of 1907. Department of Agriculture, United Provinces. Price 12 annas.	E. A. Molony, I.C.S. . . . .	United Provinces Government Press, Allahabad.
74	Conditions determining the area sown with crop in the United Provinces, Part I. Bulletin No. 23 of 1907. Department of Agriculture, United Provinces. Price 2 annas.	W. H. Moreland, C.I.E., I.C.S., Director, Department of Land Records and Agriculture, United Provinces.	Ditto ditto.
75	Note on Sugarcane. Bulletin No. 25 of 1905. Department of Agriculture, Bombay.	J. B. Knight, M.Sc., Professor of Agriculture, Bombay.	Government Central, Press, Bombay.
76	Cattle in the Bombay Presidency. Bulletin No. 26 of 1905. Department of Agriculture, Bombay. Price Rs. 8-4.	Major F. Joslen, Superintendent, Civil Veterinary Department, Bombay.	Ditto.
77	Date Palm. Bulletin No. 28 of 1906. Department of Agriculture, Bombay.	F. Fletcher, M.A., B.Sc., Deputy Director of Agriculture, Bombay.	Ditto.

78	The Bombay Cottons. Bulletin No. 29 of 1906. Department of Agriculture, Bombay. Price 10 annas.	Ditto	ditto	Ditto.
79	The Statistical Atlas of the Bombay Presidency. Price 14 annas.	Department of Agriculture, Bombay	.	Ditto.
80	The Elements of Agriculture of the Bombay Presidency. Price Re. 1-4.	P. R. Mehta, M.R.A.C.	.	Government Central Book Depôt, Bombay.
81	Cultivation of Bersim or Egyptian Clover (intended for cultivation in Sind only).	F. Fletcher, M.A., B.Sc., Deputy Director of Agriculture, Bombay.		Department of Agriculture, Bombay.
82	Instructions for the sowing and after cultivation of Egyptian cotton (without ridging).	Ditto	ditto	Ditto.
83	First Book of Agriculture. Price 12 annas.	C. Benson, M.R.A.C., Deputy Director of Agriculture, Madras.		MacMillan & Co., Ltd., London.
84	Lift Irrigation. Price Rs. 2 . . . .	Alfred Chatterton, Professor of Engineering, Madras.		G. A. Nateson & Co., Madras.
85	Report on Experiments in pumping with Oil Engines and Centrifugal Pumps in 1905-06.	Alfred Chatterton, Director of Industrial and Technical Enquiries in Madras.		Government Press, Madras.
86	Progress Report on the work of the Samalkota Farm during 1903-04, Bulletin No. 51.			
87	The Agathi Plant. Its growth in connection with the cultivation of the Betel vine which is trained thereon. Bulletin No. 52 of 1905. Madras Department of Agriculture. Price 9 pies.	Department of Agriculture, Madras	.	Ditto.

*List of Agricultural Publications in India during 1905-06 and 1906-07—contd.*

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APPENDIX TO REPORT OF THE IMPERIAL DEPARTMENT

No.	Title.	Author.	Where published.
<i>General Agriculture—contd.</i>			
88	The cultivation and curing of Tobacco as followed near Dindigul, Madura District. Bulletin No. 53 of 1905. Madras Department of Agriculture. Price 3 annas.	Department of Agriculture, Madras . . . .	Government Press, Madras.
89	Note on Irrigation by pumping from a well at Melrosapuram. Bulletin No. 54 of 1905. Madras Department of Agriculture. Price 3 annas.	Alfred Chatterton, Professor of Engineering, Madras	Ditto.
90	The Great Millet or Sorghum in Madras. Bulletin No. 55 of 1906. Madras Department of Agriculture. Price 3 annas.	C. Benson, M.R.A.C., Deputy Director of Agriculture, Madras, and C. K. Subba Rao, B.A., Sub-Assistant Director of Agriculture, Madras.	Ditto.
91	The Sunflower. Price 1 anna 6 pies . . . .	Department of Agriculture, Madras . . . .	Ditto.
92	Some suggestions for Madras Ryots. Bulletin No. 3 of 1906. Price 2 annas 9 pies.	The Central Agricultural Committee, Madras . .	Ditto.
93	The use of Prickly Pear as fodder. Bulletin No. 4 of 1906. Price 3 pies.	Ditto ditto . . . .	Ditto.
94	Squash. Bulletin No. 15 of 1906. Department of Agriculture, Eastern Bengal and Assam.	Department of Agriculture, Eastern Bengal and Assam.	Secretariat Press, Shillong.
95	Proceedings of the Agri-Horticultural Society of Madras (Quarterly, 1906).	Ditto ditto . . . .	Higginbotham & Co., Madras.

98	Journal of the Agri-Horticultural Society of Western India (Quarterly, 1906).	Honorary Secretaries, Poona . . . . .	Scottish Mission Industries Company, Ltd., Poona.
97	Experiments with Aman Paddy. Bulletin No. 1 of 1907.	F. Smith, B.Sc., Deputy Director of Agriculture, Bengal.	Bengal Secretariat Press.
98	List of the Principal Economic Plants grown in Bengal. Price 7 annas.	Department of Agriculture, Bengal . . . . .	Bengal Secretariat Book Depôt.
99	Manual of Arboriculture . . . . .	Ditto . . . . .	Bengal Secretariat Press.
100	Report on the Sugarcane Industry of Bengal.	Ditto . . . . .	Ditto.
101	Report on the possibility of extending well irrigation in Behar and Chota Nagpur. Price 12 annas.	N. N. Banerjea, B.A., M.R.A.C., F.H.A.S., M.R., A. S.I., Department of Agriculture, Bengal.	Bengal Secretariat Book Depôt.
102	Note on the Production of Coffee in India in the year 1906. Price 4 annas.	Office of the Director General of Commercial Intelligence.	Superintendent, Government Printing, India, Calcutta.
103	Production of Tea in India, 1906. Price 8 annas.	Ditto ditto . . . . .	Ditto ditto.
104	Note on the cotton failure on account of boll-worm in the Central and South-West Punjab in 1905 and on the results of the measures taken to prevent a recurrence in 1906. Bulletin No. 1 of 1907. Price 2 annas.	W. Renouf, C.S., Director of Agriculture, Punjab.	Civil and Military Gazette Press, Lahore.
105	Jute. Leaflet No. 1 of 1906 . . . . .	Department of Agriculture, Bengal . . . . .	Bengal Secretariat Press, Calcutta.
106	Note on Agricultural Experiments suitable for the Bhagalpur Division. Leaflet No. 2 of 1906.	C. A. Oldham, I.C.S., Director of Agriculture, Bengal.	Ditto.
107	Suggestions on the Cultivation of Cotton. Leaflet No. 3 of 1906.	N. G. Mukerji, M.A., M.R.A.C., Assistant Director of Agriculture, Bengal.	Ditto.

*List of Agricultural Publications in India during 1905-06 and 1906-07—contd.*

No.	Title.	Author.	Where published.
		<i>General Agriculture—conold.</i>	
108	A Short Note on Jute for Cultivators. Leaflet No. 4 of 1906.	Department of Agriculture, Bengal . . . . .	Bengal Secretariat Press, Calcutta.
109	Short Note on Cotton for the use of Cultivators. Leaflet No. 6 of 1906.	Ditto . . . . .	Ditto.
110	Simple instructions for the destruction of Insects attacking Jute. Leaflet No. 7 of 1906.	Ditto . . . . .	Ditto.
111	Instructions in regard to Cotton Picking. Leaflet No. 8 of 1906.	Ditto . . . . .	Ditto.
112	Short Note on Potato Cultivation for cultivators. Leaflet No. 9 of 1906.	Ditto . . . . .	Ditto.
113	Teaching of Experiment work at the Burdwan Station. Leaflet No. 10 of 1906.	Ditto . . . . .	Ditto.
114	A simple method of destroying the Red Cotton Bug which is now found in large quantities on the Cotton near Jamtara. Leaflet No. 11 of 1906.	Ditto . . . . .	Ditto.
115	Jute Experiment, Cuttack, 1906 . . . . .	F. Smith, B.Sc., Deputy Director of Agriculture, Bengal . . . . .	Ditto.
116	Jute Experiment, Burdwan, 1906. Leaflet No. 12 of 1906.	Ditto . . . . . ditto . . . . .	Ditto.



<i>Agricultural Chemistry.</i>			
1	Annual Report of the Agricultural Chemist to the Government of Mysore for the year 1904-05.	A. Lehmann, M.A., B.S.A., Ph.D., Agricultural Chemist to the Government of Mysore.	Mysore Government Central Press, Bangalore.
2	Annual Report of the Agricultural Chemist to the Government of Mysore for the year 1905-06.	Ditto                      ditto                      .                      .	Ditto                      ditto.
3	<i>Phaseolus Lunatus</i> (Lima or Duffin Bean). A Report on the Chemical examination of Beans. Agricultural Ledger No. 2 of 1905. Price 2 annas.	Wyndham R. Dunstan, F.R.S., Director of Imperial Institute, London.	Government Printing, India, Calcutta.
4	Saltpetre. A Report on the Manufacture of Indian saltpetre. Agricultural Ledger No. 3 of 1906. Price 6 annas.	D. Hooper, F.I.C., F.C.S., Superintendent, Industrial Section, Indian Museum, Calcutta.	Ditto.
5	The Fermentation of Tea, Part I . . . .	Harold H. Mann, D.Sc., Scientific Officer to the Indian Tea Association.	Indian Tea Association, Calcutta.
6	The rate of Hydrolysis in the Septic Tank .	J. W. Leather, Ph.D., F.I.C., F.C.S., Imperial Agricultural Chemist, Pusa.	Paper read at the 6th International Conference of applied Chemistry, Rome, 1906.
7	The Agricultural Research Institut, Pusa .	Ditto                      ditto                      .                      .	Ditto                      ditto.
8	The supply of nitrate to the surface soil from the underground water. Price 5s.	Ditto                      ditto                      .                      .	The Journal of Agricultural Science, Cambridge, Vol. I, Part 4.
9	Some preliminary notes on the physical properties of the soil of the Ganges Valley, more especially in their relation to soil moisture.	H. M. Leake, M.A., F.L.S., Economic Botanist to the Government of the United Provinces of Agra and Oudh.	Ditto                      ditto.
10	The fermentation of the Indigo Plant . .	C. J. Bergtheil, Imperial Bacteriologist . . .	Transactions of the Chemical Society, 1904, Vol. 85.

*List of Agricultural Publications in India during 1905-06 and 1906-07—contd.*

No.	Title.	Author.	Where published.
<i>Agricultural Chemistry—contd.</i>			
11	The Determination of the Indigotin in Commercial Indigo yielding plant.	C. J. Bergtheil, Imperial Bacteriologist . . .	Journal of Society of Chemical Industry. Vol. XXV, page 729.
12	The Composition of Indian Rain and Dew. Price Re. 1.	J. W. Leather, Ph.D., F.I.C., F.C.S., Imperial Agricultural Chemist.	Memoirs of the Department of Agriculture in India, Vol. 4, No. 1. Messrs. Thacker, Spink & Co., Calcutta.
13	The Composition of Oil Seeds. Price Re. 1	Ditto ditto . . .	Memoirs of the Department of Agriculture in India, Vol. I, No. 2. Messrs. Thacker, Spink & Co., Calcutta.
14	The Potculture House at the Agricultural Research Institute, Pusa, Part I. Price Rs. 3.	Ditto ditto . . .	Memoirs of the Department of Agriculture in India, Vol. 1, No. 3. Messrs. Thacker, Spink & Co., Calcutta.
15	Experiments on the availability of Phosphates and Potash in soils, Part I. Price Re. 1-8.	Ditto ditto . . .	Memoirs of the Department of Agriculture in India, Vol. I, No. 4. Messrs. Thacker, Spink & Co., Calcutta.
<i>Botany.</i>			
1	Bearing of Mendelism on the susceptibility of wheat to rust. Price 5s.	E. J. Butler, M.B., F.L.S., Imperial Mycologist .	Journal of Agricultural Science, Cambridge, Vol. I, Part III.
2	The Blister Blight of Tea . . . .	Harold H. Mann, D.Sc., Scientific Officer to the Indian Tea Association.	Indian Tea Association, Calcutta.
3	Agave and Furcraea, spp Agricultural Ledger No. 7 of 1906. Price Re. 1-8.	J. R. Drummond and D. Prain . . . .	Office of the Superintendent, Government Printing, India, Calcutta.

4	The varieties of cultivated pepper. Bulletin No. 56, Vol. III of 1906. Madras Department of Agriculture. Price 3 annas.	C. A. Barber, M.A., F.L.S., Government Botanist, Madras.	Government Press, Madras.
5	Some results of acclimatization work at Saharanpur Botanical Gardens. Bulletin No. 21 of 1906. Department of Agriculture, United Provinces. Price 2 annas.	W. Gollan, Superintendent of Gardens, Saharanpur.	Government Press, Allahabad.
6	First Report on the Fruit Experiments at Pusa. Bulletin No. 4 of the Agricultural Research Institute, Pusa. Price 6 annas.	Albert Howard, M.A. (Cantab.), A.R.C.S. (Lond.), F.C.S., F.L.S., Imperial Economic Botanist.	Government Printing, India, Calcutta.
7	The Haustorium of Santalum Album I. Early stages, up to Penetration. Price Re. 1.	C. A. Barber, M.A., F.L.S., Government Botanist, Madras.	Memoirs of the Department of Agriculture in India, Vol. I, No. 1. Messrs. Thacker, Spink & Co., Calcutta.
8	Indian Wheat Rusts. Price Rs. 3 . . .	E. J. Butler, M.B., F.L.S., Imperial Mycologist, and J. M. Hayman, Deputy Director of Agriculture, United Provinces.	Memoirs of the Department of Agriculture in India, Vol. I, No. 2. Messrs. Thacker, Spink & Co., Calcutta.
9	Fungus Diseases of Sugarcane in Bengal. Price Rs. 3.	E. J. Butler, M.B., F.L.S., Imperial Mycologist . . .	Memoirs of the Department of Agriculture in India, Vol. I, No. 3. Messrs. Thacker, Spink & Co., Calcutta.
10	Gossypium Obtusifolium, Roxburgh. Price Re. 1.	I. H. Burkill, M.A., Reporter on Economic Products to the Government of India.	Memoirs of the Department of Agriculture in India, Vol. I, No. 4. Messrs. Thacker, Spink & Co., Calcutta.
11	An account of the Genus Pythium and some Chytridiaceæ. Price Rs. 4-8.	E. J. Butler, M.B., F.L.S., Imperial Mycologist . . .	Memoirs of the Department of Agriculture in India, Vol. I, No. 5. Messrs. Thacker, Spink & Co., Calcutta.
12	Cephaluros Virescens, Kunze: The Red Rust of Tea. Price Rs. 4.	Harold H. Mann, D.Sc., Scientific Officer to the Indian Tea Association, and C. M. Hutcheson, Assistant Scientific Officer to the Indian Tea Association.	Memoirs of the Department of Agriculture in India, Vol. I, No. 6. Messrs. Thacker, Spink & Co., Calcutta.

*List of Agricultural Publications in India during 1905-06 and 1906-07—contd.*

No.	Title.	Author.	Where published.
<i>Bolany—contd.</i>			
13	Some Diseases of Cereals caused by <i>Sclerospora Graminicola</i> . Price Re. 1-8-0.	E. J. Butler, M.B., F.L.S., Imperial Mycologist .	Memoirs of the Department of Agriculture in India, Vol. II, No. 1. Messrs. Thacker, Spink & Co., Calcutta.
14	Studies in Root Parasitism. The Haustorium of <i>Santalum Album</i> . Part 2.—The structure of the mature Haustorium and the inter-relations between Host and Parasite. Price Rs. 3.	C. A. Barber, M.A., F.L.S., Government Botanist, Madras.	Memoirs of the Department of Agriculture in India, Vol. I, No. 1, Part II. Messrs. Thacker, Spink & Co., Calcutta.
15	Notes on Agave and Furcraea in India. Bulletin No. 8. Agricultural Series No. 7. Price Re. 1.	J. R. Drummond and D. Prain . . . . .	Bengal Secretariat Book Depôt, Calcutta.
10	Report on trials of the South African Locust Fungus in India. Bulletin No. 5 of 1907. Agricultural Research Institute, Pusa. Price 2 annas.	E. J. Butler, M.B., F.L.S., Imperial Mycologist, and H. M. Lefroy, M.A., F.E.S., F.Z.S., Imperial Entomologist.	Government Printing, India, Calcutta.
<i>Entomology.</i>			
1	An outbreak of Cotton Pests in the Punjab, 1905. Bulletin No. 2 of the Agricultural Research Institute, Pusa.	H. M. Lefroy, M.A., F.E.S., F.Z.S., Imperial Entomologist.	Ditto .
2	The Indian Insect Pests. Price Re. 1-8 .	Ditto	ditto . .
3	The Bombay Locust. Price Rs. 2-8 .	Ditto	ditto . .
			Memoirs of the Department of Agriculture in India, Vol. I, No. 1. Messrs. Thacker, Spink & Co., Calcutta.

	The more important Insects injurious to Indian Agriculture. Price Rs. 3.	Ditto	ditto . . . .	Memoirs of the Department of Agriculture in India, Vol I, No. 2. Messrs. Thacker, Spink & Co., Calcutta.
5	The Indian Surface Caterpillars of the Genus Agrotis. Price Re. 1-8.	Ditto	ditto and	Memoirs of the Department of Agriculture in India, Vol I, No. 3. Messrs. Thacker, Spink & Co., Calcutta.
		C. C. Ghosh, B.A., Assistant to the Imperial Entomologist.		
6	Individual and seasonal varieties in Helopeltis Theivora, Waterhouse, with description of a new species of Helopelties. Price Re. 1-8.	Harold H. Mann, D.Sc., Scientific Officer to the Indian Tea Association.		Memoirs of the Department of Agriculture in India, Vol I, No. 4. Messrs. Thacker, Spink & Co., Calcutta.
7	The Coccidæ attacking the Tea Plant in India and Ceylon. Price Re. 1.	E. E. Green, F.E.S., Government Entomologist, Ceylon, and Harold H. Mann, D. Sc., Scientific Officer to the Indian Tea Association.		Memoirs of the Department of Agriculture in India, Vol I, No. 5. Messrs. Thacker, Spink & Co., Calcutta.
8	Rice Grasshopper. Bulletin No. 27 of 1906. Bombay Department of Agriculture.	J. B. Knight, M.Sc., Professor of Agriculture, Bombay, Poona, and R. M. Dixon, B.A., Entomological Assistant, Bombay.		Government Central Press, Bombay.
9	Red Slug Caterpillar (a serious Pest of the Tea Plant).	Harold H. Mann, D.Sc., Scientific Officer to the Indian Tea Association.		Indian Tea Association, Calcutta.
10	The Mosquito Blight of Tea, Part III . . . .	Ditto	ditto . . . .	Ditto.
11	Notes on Entomology. Bulletin No. 1 of Mysore Department of Agriculture.	A. Lehmann, M.A., B.S.A., Ph.D., Agricultural Chemist to the Government of Mysore.		Mysore Government Central Press, Bangalore.
12	Destruction of Fleas by Insecticides. Leaflet. Agricultural Research Institute, Pusa.	H. Maxwell-Lefroy, M.A., F.E.S., F.Z.S., Imperial Entomologist.		Government Printing Press, Calcutta.
13	Useful Insects. (Leaflet.) Agricultural Research Institute, Pusa.	Ditto	ditto . . . .	Ditto.
14	Household Insects. (Leaflet.) Agricultural Research Institute, Pusa.	Ditto	ditto . . . .	Ditto.

*List of Agricultural Publications in India during 1905-06 and 1906-07—concl.*

No.	Title.	Author.	Where published.
15	Direction for sending Insect specimens. (Leaflet.) Agricultural Research Institute, Pusa.	<p style="text-align: center;"><i>Entomology—contd.</i></p> H. Maxwell-Lefroy, M.A., F.E.S., F.Z.S., Imperial, Entomologist.	Government Printing Press, Calcutta.
1	A note on the Inoculation of the soil for leguminous crop. Bulletin No. 1.	<p style="text-align: center;"><i>Bacteriology.</i></p> C. J. Bergtheil, Imperial Bacteriologist	Indigo Research Station, Sirsiah, Mozufferpore.

G. I. C. P. O.—No. 21 I. G. Agrl.—0-4-08—1-500.—J. E. J.