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*Schedule of papers circulated to Members of the Advisory Board of the Imperial Council of Agricultural Research for its meeting, held at New Delhi on the 16th, 17th and 18th February 1933.*

Notes on Subjects 1 to 24 of Agenda.

( iii )

AGENDA FOR THE MEETING OF THE ADVISORY BOARD OF THE  
IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, HELD  
AT NEW DELHI ON THE 16TH—18TH FEBRUARY 1933.

1. Decisions of the Governing Body on the recommendations of the Advisory Board made at the latter's meetings in June 1931, January 1932 and July 1932.
2. Appointment of Committees.
3. Recommendations of the Locust Committee at its fourth meeting held in January 1933—Proposals for future research.
4. Application from Dr. G. S. Thapar, M.Sc., Ph.D., Reader in Zoology, Lucknow University, for a grant of Rs. 25,460 spread over a period of 5 years for an enquiry into the Helminthiasis of cattle, sheep and goats in the United Provinces.
5. Application from the Dacca University for the grant of Rs. 1,756 on account of apparatus, etc., for the year 1933-34 in connection with the scheme for agricultural research already sanctioned by the Council.
6. Application from the Government of the United Provinces for a grant of Rs. 1,01,970 (Rs. 14,200 non-recurring and Rs. 87,770 recurring) spread over 5 years for investigation into indigenous drug plants of the United Provinces and their effective expansion as agricultural crops.
7. Application from the Government of the United Provinces for a grant of Rs. 4,650 spread over a period of 3 years for investigation into malting and brewing tests of improved barley.
8. Application from the Central Provinces Government for a grant of Rs. 46,700 spread over a period of 3 years for investigation into vaccination of cattle against rinderpest.
9. Application from the Government of Mysore for a grant of Rs. 20,400 spread over a period of 3 years for the investigation of Johne's disease among cattle in Mysore.
10. Question of an inquiry about coconut products and coconut oil in India.
11. Linseed—action to be taken to take full advantage of the tariff preference on Indian linseed granted by the Ottawa Agreement.
12. Application from the Government of the Punjab for a non-recurring grant of Rs. 22,300 in connection with a scheme for the installation of wheat milling and baking laboratory at Lyallpur.
13. Application from the Government of Bombay for a grant of Rs. 84,580 spread over a period of 10 years for research in sheep breeding.

14. Application from the Government of Madras for a grant of Rs. 92,487 spread over a period of 3 years for a scheme of research for improving the fishing industry and developing the supply of fish manure.
15. Application from the Government of Madras for a grant of Rs. 63,632 spread over a period of 5 years for a scheme for research on rural pisciculture.
16. Application from the Director of Agriculture, Bombay Presidency, for a grant of Rs. 5,100 for the export of Alphonso mango fruits to Great Britain in 1933.
17. Report of the Committee appointed to examine the Bihar and Orissa scheme of research on the economics of irrigation from tube wells.
18. Report of the Committee appointed to consider the progress report on the scheme for the breeding experiments in connection with improvement of goats conducted by Dr. A. E. Slater.
19. Scheme for conducting research in Warble Flies at the Muktesar Research Institute, at a cost of Rs. 32,400 spread over a period of 5 years.
20. Extension of the research work on the effect of ions on the growth of plants, by Dr. S. S. Bhatnagar upto the end of May 1933 (cost involved Rs. 337-8-0).
21. Application from the Government of North-West Frontier Province for a grant of Rs. 44,940 spread over a period of 3 years for an entomological survey scheme in the North-West Frontier Province.
22. Scheme for establishing a fruit canning and pressing research laboratory at the Fruit Experimental Station at Quetta (cost involved Rs. 63,000 spread over 5 years).
23. Application from the Government of Bengal for a grant of Rs. 65,579 spread over a period of 7 years for research into the diseases of poultry in Bengal.
24. Application from the Director of Agriculture, Bombay Presidency, for a grant of Rs. 2,000 for a scheme for holding an all-India Mango Show in Bombay.

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PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF  
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH,  
HELD AT NEW DELHI ON THURSDAY, THE 16TH FEBRUARY  
1933.

The following were present :—

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|---|--------------------------------------|
| 1. Diwan Bahadur Sir T. VIJAYA-<br>RAGHAVACHARYA, <i>Chairman</i> . | 16. Dr. V. N. LIKHITE.               |
| 2. Dr. N. AHMAD.  | 17. Colonel A. OLVER.                |
| 3. Mr. R. G. ALLAN.   | 18. Mr. F. J. PLYMEN.                |
| 4. Mr. M. AZHAR ALI.  | 19. Mr. T. F. QUIRKE.                |
| 5. Mr. A. D. BLASCHECK.   | 20. Diwan Bahadur T. RAGHA-<br>VIAH. |
| 6. Dr. W. BURNS.  | 21. Mr. S. V. RAMAMURTY.             |
| 7. Mr. B. C. BURT. <i>CBE</i>                                       | 22. Major P. B. RILEY.               |
| 8. Mr. P. H. CARPENTER.   | 23. Nawabzada SAADATULLAH KHAN.      |
| 9. Mr. G. K. DEVADHAR.  | 24. Mr. P. T. SAUNDERS.              |
| 10. Dr. T. EKAMBARAM.   | 25. Mr. D. R. SETHI.                 |
| 11. Mr. E. S. FARBROTHER.   | 26. Mr. H. R. STEWART.               |
| 12. Professor J. C. GHOSH.  | 27. Major R. F. STIRLING.            |
| 13. Dr. G. P. HECTOR.   | 28. Mr. G. T. TAIT.                  |
| 14. Mr. NIZAMUDDIN HYDER.   | 29. Mr. F. WARE.                     |
| 15. Mr. P. J. KEER.   |                                      |

Rai Sahib Malik CHARAN DAS, *Secretary*.

The following attended as visitors :—

1. Mr. E. J. BRUEN.                      2. Mr. B. A. COLLINS.

2. The meeting lasted from 11 A.M. to 1-30 P.M. and adjourned till 11-30 A.M. on Friday, the 17th February, to allow the Committees appointed to consider the progress report on the breeding experiments for the improvement of goats conducted by Dr. Slater and the draft of a Bill for all-India legislation for the prevention and control of contagious diseases among animals, to meet in the afternoon.

3. The Chairman, in welcoming the members to the meeting of the Board, said that he was afraid that, owing to the late receipt of some schemes, it had not been found possible to circulate beforehand papers relating to some of the items on the Agenda; he was prepared to postpone consideration of such items till to-morrow to enable members to study the papers.

4. *Decisions of the Governing Body on the recommendations of the Advisory Board made at the latter's meetings in June 1931, January 1932 and July 1932. (Subject No. 1 of the Agenda). (Appendix I).*—The Chairman stated that of the schemes recommended by the Advisory Board all had been sanctioned by the Governing Body except two, viz., the Benares Hindu University scheme for research on plant physiology and the Punjab Government scheme for the establishment of an Agricultural Research Station at Risalewala for work on the water requirements of crops. One scheme which did not receive the support of the Advisory Board at its last meeting had been sanctioned by the Governing Body, viz., the scheme from the Government of Madras for a grant for research work on potatoes\*. He stated that if members desired, this subject could be discussed on a later date in the proceedings.

5. *Appointment of Committees. (Subject No. 2 of the Agenda).—(Appendix II).*—The Chairman stated that the Committees referred to in the papers circulated to the members of the Advisory Board on this subject were those in regard to which the Board had given him power to appoint the personnel. He suggested that the Committee to consider the progress report on the scheme of breeding experiments for the improvement of goats conducted by Dr. A. E. Slater, should meet at 3 P.M. and that the Committee appointed to examine the draft of all-India legislation for the prevention and control of contagious diseases among the animals should meet at 3-15 P.M. to-day. The Board agreed.

6. *Recommendations of the Locust Committee at its fourth meeting held in January 1933. Proposals for future research. (Subject No. 3 of the Agenda). (Appendix III).*—Mr. Burt, in introducing the subject, explained in detail the work which had been done and the lines on which the Locust Committee had recommended future work should proceed. The Committee's proposals were summarised in paragraph 3 of the note which had been circulated to members. In answer to Mr. Devadhar, the Chairman said that laboratory work at Lyallpur would be continued under Mr. Afzal Husain. It was proposed to provide for this by a grant to the Punjab Government in order to avoid any administrative difficulties. Mr. Afzal Husain's work would be controlled by the Director of Agriculture, Punjab, and the local Government. Rao Sahib Ramachandra Rao would be directly responsible to the Council for the rest of the work which might be described as survey and exploration work in Baluchistan, Sind, Rajputana, Khairpur and the adjoining portions of Central India.

At this stage, Mr. Carpenter moved that Mr. Afzal Husain be appointed a member of the Locust Committee. The proposal was seconded by Mr. G. K. Devadhar and agreed to by the Board.

In answer to a question by Dr. Burns, as regards the utility of oil cloth in locust control measures, Mr. Burt said that they had gone into the question with Mr. Richards who had carried out experiments in the United Provinces. Mr. Richards was satisfied that oil cloth was the best material for making barriers when dealing with locust hoppers by methods other than insecticides and that this and sodium fluosilicate were the most useful locust control material. As regards locust work conducted elsewhere in the Empire,

\* This scheme was approved by the Advisory Board in 1931.

Mr. Burt said that the Imperial Council of Agricultural Research was in touch with the Locust Committee of the Economic Advisory Council, London, and received reports on all locust movements in the Empire and any other part of the world. The Council also received locust Reports from Persia. In answer to Dr. Nazir Ahmad, the Chairman said that the Committee had given specific directions under each head of the programme. The Board then adopted the report of the Locust Sub-Committee and recommended the proposals made therein for the sanction of the Governing Body.

7. *Application from Dr. G. S. Thapar, M.Sc., Ph.D., Reader in Zoology, Lucknow University, for a grant of Rs. 25,460 spread over a period of five years for an enquiry into the Helminthiasis of cattle, sheep and goats in the United Provinces. (Subject No. 4 of the Agenda). (Appendix IV).*—Colonel Olver in introducing the subject referred to the question of overlapping between this scheme and the Punjab scheme regarding animal parasites recently sanctioned by the Council. He expressed the opinion that there were great differences between the irrigated areas in the Punjab and the dry areas likely to be met with in the United Provinces and that owing to this reason there was in his view ample scope for different work in different areas. Dr. Thapar was a very suitable man for the proposed work from which very valuable results were expected. The scheme was a modest one and included no buildings, etc. Mr. Allan considered the scheme a well considered one and involved no overlapping with the work which was being done by the Veterinary Department. Mr. Devadhar asked whether information was available as regards the mortality caused by this disease, to which Colonel Olver replied that he could not give definite figures but thought that the loss must be tremendous. A number of speakers emphasised the value of the scheme. A proposal that a Standing Committee on Helminthology should be established to secure the best possible co-ordination in such research was generally agreed to. After a good deal of discussion and in view of the fact that the recommendations of the Board at this meeting would not come before the Governing Body till sometime in September or October next the Board decided that this scheme should be referred to the Committee of Helminthologists to be appointed by the Chairman with instructions to report to the Advisory Board at its next meeting to be held sometime in July or August 1933.

8. *Application from the Dacca University for the grant of Rs. 1,756 on account of apparatus, etc., for the year 1933-34 in connection with the scheme for agricultural research already sanctioned by the Council. (Subject No. 5 of the Agenda). (Appendix V).*—After Dr. Hector had introduced the subject, Dr. Burns asked whether there was co-ordination of this work with the work that was being done by Professor Dastur in Bombay. Mr. Burt replied that there was no overlapping as regards the programme of work carried out at these two places. The nutrition of rice was a very wide subject and Professor Dastur had been working on a particular aspect of rice physiology. He felt that these two researches should go on parallel to each other. Dr. Burns said that the question of co-ordination was becoming more and more important and he would like this question to be taken up seriously at the next meeting of the Advisory Board by bringing this subject on the Agenda. Mr. Burt

pointed out that progress reports on both the schemes would be before the Advisory Board at the next meeting. In answer to Mr. Sethi, the Chairman said that when the scheme was sanctioned it was decided that each year's requirements for apparatus, etc., should be examined on their merits on receipt of details from the University. In the result, the Board recommended the application for sanction.

9. *Linseed—action to be taken to take full advantage of the tariff preference on Indian Linseed granted by the Ottawa Agreement. (Subject No. 11 of the Agenda). (Appendix VI).*—Mr. Burt, in introducing the subject, said that as a result of the Ottawa Agreement Indian linseed would, in future, receive a ten per cent. tariff preference in the United Kingdom market. This was one of the most valuable preferences on agricultural products obtained by the Ottawa Agreement. Prior to the Economic Conference linseed was on the free list under the original Import Duties Act. The United Kingdom imported 300,000 to 350,000 tons of linseed mainly from foreign sources, worth even at present prices some three million pounds sterling per annum. Linseed production in India and exports had fallen heavily largely through increasing competition from Argentine and other countries. We had, however, a much greater producing capacity. The area under linseed had increased by 16 per cent. this year in the Central Provinces. It was important to exploit the full advantages of this preference and to supply the English market with sufficient supplies of Indian linseed to prevent an unreasonable rise in price. Another important point was the question of quality. There, fortunately, India had almost everything in her favour. Indian linseed was more sought after than that of other countries in the United Kingdom market, but Argentine linseed was always underselling Indian linseed and the preference we had now obtained should be very valuable in restoring the linseed position. Indian linseed had a higher oil content than Argentine linseed. Indian linseed was also cleaner. It looked as if we had most of the cards in our hands and we found in actual point of fact the premium for Indian linseed had been well maintained but it was pointed by English importers that the premium was too big and this probably explained the shrinkage in purchases from India. It meant that people who must have high quality of oil had been willing to pay these higher prices but the constant growing competition of Argentine had induced people for whom it was not essential to have first class oil to buy Argentine seed. Mr. Plymen said that the area under linseed had gone up by 16 per cent. in the Central Provinces probably due to the fall in wheat prices. He agreed to steps being taken to increase the area under linseed and said that it was scarcely a matter which could be postponed. He, however, doubted whether it would be of any good to start a direct scheme of propaganda to get people to put more and more land under linseed. He suggested that the relative gross monetary return from linseed should be determined by the agricultural departments districts staff. He thought that the present prices of wheat would guide the cultivator himself and if he realised that linseed paid him more the area under it would be increased automatically. Mr. Allen drew attention to the need for more work on the experimental farms in the linseed-growing provinces, to the importance of introducing superior varieties. Mr. Collins asked for further information as to the course of prices.

The point was made by several speakers that direct advice to increase the area under linseed by the Departments of Agriculture was not desirable in as much as no guarantee of prices could be given. Mr. G. K. Devadhar urged the great need for suitable publicity of these results being arranged by the Council through the medium of the vernacular papers and magazines so that the poor agriculturists would attempt experiments to reap the fruit of the labours of the Council. Mr. Burt, in replying to the points raised, said that it was a constant criticism now-a-days that the agriculturist was being exploited by the trader and he suggested that they should do what they could through the medium of vernacular papers and other methods to place the cultivator in possession of better information regarding market conditions and prices of this article so that he might be a little less handicapped. He agreed that Agricultural Departments should not attempt direct propoganda but should try to put the cultivator in possession of facts. He agreed that they should study the economics of the linseed crop especially the gross monetary return per acre. The war period had started a fashion for increased wheat growing which possibly went beyond economic limits in some areas. He thought a great deal would be achieved if Mr. Plymen's suggestion was accepted. As regards the question asked by Mr. Kerr as to why there was this disparity between Indian prices and Argentine prices, Mr. Burt said that this was partly due to the superior quality of Indian linseed. As to what was the immediate effect of the Ottawa Agreement on the present prices and trade demand, he noticed that the first noticeable effect was a fall in the prices of Argentine linseed ; there had been no corresponding fall as far as he knew in the Indian linseed in London. He had received a recent report which showed that importers in London definitely stated that they attached very great importance to the ten per cent. preference and expected an increase of Indian linseed sales in London. He added that the qualities which were appreciated in the London market were first of all high oil content, secondly big seed (Bold) and thirdly a light coloured husk. At this stage, it was decided to include the various suggestions which had been made in the course of discussion in the form of a resolution. The following resolutions were carried unanimously :—

- “(1) That the Imperial Council of Agricultural Research be asked to furnish Provincial Agricultural Departments with weekly or fortnightly circulars giving the latest prices and trade information concerning linseed.
- (2) That the Advisory Board desires to emphasize the importance of increasing the supply of seed of improved varieties of linseed and of more attention to experimental work on linseed on the experimental farms in each of the principal linseed growing Provinces and States. It also suggests that an exchange of improved varieties between the different provinces and States and with the Imperial Institute of Agricultural Research, Pusa, would be an advantage.
- (3) The Board recommends that the information as to the extent and importance of the Ottawa preference on linseed should be made available to agriculturists in the various provinces and States



by suitable propaganda especially through Co-operative Societies and by the supply of information to vernacular papers and magazines."

10. The meeting then adjourned till 11-30 A.M. on Friday, the 17th February 1933.

CHARAN DAS,

*Secretary.*

*The 16th February 1933.*

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PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF  
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH,  
HELD AT NEW DELHI ON FRIDAY, THE 17TH FEBRUARY 1933.

The following were present :—

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|---|--|
| 1. Diwan Bahadur Sir T. VIJAYA-<br>RAGHAVACHARYA, <i>Chairman</i> . | 16. Mr. P. J. KERR.                      |
| 2. Dr. N. AHMAD.  | 17. Dr. V. N. LIKHITE.                   |
| 3. Mr. R. G. ALLAN.   | 18. Colonel A. OLVER.                    |
| 4. Mr. M. AZHAR ALI.  | 19. Mr. F. J. PLYMEN.                    |
| 5. Rao Bahadur BHIMBHAI<br>R. NAIK.                                 | 20. Mr. T. F. QUIRKE.                    |
| 6. Mr. A. D. BLASCHECK.   | 21. Diwan Bahadur T. RAGHAVIAH.          |
| 7. Dr. W. BURNS.  | 22. Captain Nawab RAIS JANG-<br>BAHADUR. |
| 8. Mr. B. C. BURT.  | 23. Mr. S. V. RAMAMURTY.                 |
| 9. Mr. P. H. CARPENTER.   | 24. Major P. B. RILEY.                   |
| 10. Mr. G. K. DEVADHAR.   | 25. Nawabzada SAADATULLAH KHAN.          |
| 11. Dr. T. EKAMBARAM.   | 26. Mr. P. T. SAUNDERS.                  |
| 12. Mr. E. S. FARBROTHER.   | 27. Mr. D. R. SETHI.                     |
| 13. Professor J. C. GHOSH.  | 28. Mr. H. R. STEWART.                   |
| 14. Dr. G. P. HECTOR.   | 29. Major R. F. STERLING.                |
| 15. Mr. NIZAMUDDEN HYDER.   | 30. Mr. F. WARE.                         |

Rai Sahib Malik CHARAN DAS, *Secretary*.

The following attended as visitors :—

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|------------------------------|-------------------------|
| 1. Dr. B. K. BADAMI.         | 3. Mr. B. A. COLLINS.   |
| 2. Mr. E. J. BRUEN.          | 4. Mr. J. H. G. JERROM. |
| 5. Mr. V. KRISHNAMURTY IYER. |                         |

2. The meeting lasted from 11-30 A.M. to 1-25 P. M. and adjourned till 10-30 A. M. on Saturday, the 18th February, to allow the Committees appointed to examine the scheme of research on the economics of irrigation from tube wells and the draft Bill for all-India legislation for the prevention and control of contagious diseases among animals, to meet in the afternoon.

3. At the outset, the Chairman recalled the promise he had made to Mr. Devadhar on the previous day that he would bring up Subject No. 1 (Appendix I) again to enable members to make any further comments thereon if they wished to do so (*vide* paragraph 4 of the proceedings of the meeting held on the 16th February 1933). Mr. Kerr drew attention to the fact that in the case of the Madras potato-research scheme the Governing Body had sanctioned a scheme which had been turned down by the Advisory Board and enquired whether the Governing Body was in order in passing the scheme in the

circumstances? He did not mind the Governing Body rejecting a scheme recommended by the Advisory Board, but the position was different when the Governing Body passed a scheme which had been turned down by the Board. Mr. Carpenter considered that there was need for some well-defined principle to govern such cases. Instead of sanctioning a scheme which had not been recommended by the Advisory Board he thought that in such cases it would be better if the Governing Body referred the scheme back to the Advisory Board with its views. Mr. Burt said that he was at a disadvantage as he was not present at the last two meetings of the Governing Body or the meeting of the Advisory Board when the Madras scheme was last considered. But he would point out that, far from flouting any decision of the Advisory Board, the Governing Body had in the present case only restored the Advisory Board's original recommendation in favour of the scheme. While he desired to see the Advisory Board's recommendations scrupulously respected he was of the opinion that the Madras scheme was not a good case on which they should raise the general question. In this connection he referred to the fact that one of the elected representatives of the Advisory Board on the Governing Body did not support the potato scheme which had been recommended by the Advisory Board but opposed it in the Governing Body in May 1931. If he had supported it, probably the scheme would have been approved by the Governing Body in 1931. The Chairman said that the issues raised were—

- (i) Was it open to the Governing Body to sanction a scheme which was not recommended by the Advisory Board?
- (ii) Did the elected representatives of the Advisory Board on the Governing Body have freedom to express only their own views on the schemes under consideration at the meetings of the Governing Body if they were contrary to the recommendation of the Advisory Board on them?

Mr. Devadhar agreed that the usual procedure should be for the Governing Body to refer the matter back to the Advisory Board though the latter body is fully alive to the advisory character of its decisions or recommendations before it sanctioned any scheme which had not been recommended by the Board. Dr. Burns emphasised that the Board should not restrict the liberty of conscience of its representatives. The Governing Body had the abstract of the proceedings of the Advisory Board in the printed papers. He thoroughly agreed with the proposed procedure in respect of rejected schemes. Nawabzada Saadatullah Khan and Messrs. Saunders and Azhar Ali also spoke on the subject. Mr. Burt said that in respect of both the questions under consideration there was general unanimity of opinion in the Board. In his opinion a convention might be established that the Governing Body would refer back to the Advisory Board any scheme not recommended by the Board in regard to which the Governing Body did not see their way to accept the Board's view. No action, however, appeared to be necessary at the present time. As regards the other point, the Board agreed that its representatives on the Governing Body should state the views of the Board on schemes coming up before the Governing Body but after they had done that they were at liberty to express their own personal views also even though they might conflict with the recommendations of the Board.

4. *Application from the Government of the United Provinces for a grant of Rs. 1,01,970 (Rs. 14,200 non-recurring and Rs. 87,770 recurring) spread over 5 years for investigation into indigenous drug plants of the United Provinces and their effective expansion as agricultural crops (Subject No. 6 of the Agenda). (Appendix VII).*—Mr. Allan, in introducing the scheme, referred to the amount of preliminary work which had been done in the United Provinces. Their original scheme was of a much wider character. In view, however, of the fact that the Imperial Council of Agricultural Research had already approved schemes which dealt largely with the chemical and pharmacological aspects of the problem, the Provincial Agricultural Research Committee had revised the United Provinces scheme suitably so as to restrict it to the agricultural aspect of medicinal plants and drug research. The scheme, if sanctioned, would be of great help to the small agriculturists. Mr. Stewart said that it was proposed to have two farms but there was no budget provision made for either the purchase or the rent of the required land. Was he right in assuming that the United Provinces Department of Agriculture had the land available or would meet the cost on this account from its departmental budget? Mr. Allan replied that he hoped to arrange to get the necessary land free of charge from the Forest Department. Mr. Devadhar enquired whether there was any overlapping between this scheme and that of Colonel Chopra to which Mr. Allan replied in the negative. Dr. Ghosh pointed out that only recently Colonel Chopra's scheme and the Madras scheme on Toxicology were sanctioned by the Council at a cost of about Rs. 1,50,000. Should the Council's resources be further diverted in this direction? Should not the question be left over for private enterprise? Some Calcutta firms had their own farms and ran them at a profit. The proposed work perhaps fell more properly within the scope of the Indian Research Fund Association. Mr. Sethi referred to the promise of facilities given at the last meeting by himself and Mr. Allan to Colonel Chopra in connection with the latter's scheme and considered that the present scheme was purely provincial and should be financed by the United Provinces Government. Mr. Burt was of the opinion that the present scheme was the logical sequence of Colonel Chopra's and Mr. Saunders' scheme; but required very careful consideration for the scheme as it stood might not achieve the results which Mr. Allan had in mind. Though he desired that the Council should do every thing possible to secure the collaboration of Indian Universities in all possible ways, he was not satisfied that the Benares Hindu University had the necessary facilities for the particular work which proposed for it in the present scheme. The programme of work was also not satisfactory. In his opinion the University portion of the scheme required entire reconsideration as to what was possible and what was desirable in view of the schemes already sanctioned. He supported the Hill portion of the scheme which according to him would fit in very well with the schemes already sanctioned, but suggested that the matter be referred to a Committee for full examination between now and the next meeting of the Advisory Board. Dr. Burns said the scheme was vague and unsatisfactory, and attempted far too much. Mr. Ramamurty stated that Bengal and Malabar were important from the point of view of indigenous drug plants and the Committee should keep this in mind and suggest the place or places where the plants should be grown. Mr. Plymen wanted the Committee to examine what drugs were in demand and were likely

to be obtained. Dr. Hector considered the present scheme too ambitious. Mr. Kerr said that the scheme required very careful scrutiny. Dr. Burns moved that the scheme be referred back to the United Provinces Agricultural Research Committee for revision in the light of the criticisms of the Board. The Chairman put Dr. Burns' motion to vote which was lost by the casting vote of the Chairman. The Board then agreed to refer the scheme to a Committee of the Council to consider the criticisms made thereon and submit its report to the next meeting of the Board. The personnel of the Committee was left to be fixed by the Chairman.

5. *Application from the Government of the United Provinces for a grant of Rs. 4,650 spread over a period of 3 years for investigation into malting and brewing tests of improved barley. (Subject No. 7 of the Agenda). (Appendix VIII).*— Mr. Allan introduced the scheme. Mr. Stewart wanted to clear a possible misapprehension with reference to the statement made in the United Provinces Government's application to the effect that co-operation with the adjoining provinces was not possible. There was, he said, no question of the Punjab not wishing co-operation in regard to malting and brewing tests of barley. If there was a hope of this line of investigation being encouraged by the Council, the Punjab would gladly send a scheme costing about Rs. 5,000. As regards the details of cost of the United Provinces scheme, there was a provision of Rs. 100 per year for manurial experiments which, being small, might in his opinion suitably be met by the local Government, the scheme being confined to sending samples of barley for malting and brewing tests. Mr. Devadhar asked for information from Mr. Allan as to how he had tried to meet the criticism of Sir Joseph Kay, at the close of Annexure No. III to Appendix VIII on page 70 of the proceedings. Mr. Sethi supported the scheme and said that he would also like to submit similar proposals for the consideration of the Council. Mr. Burt said that an application of this kind should be treated with sympathy. Not long ago the Advisory Board agreed that all applications for the testing of agricultural products in the United Kingdom should go through the Council and there was undoubted advantage in such a procedure. The barley question had become important in view of the ten per cent. tariff preference under the Import Duties Act and the time was opportune. The United Provinces Department had done a great deal of work on barley. He explained the present methods of testing malting barleys. He, however, said that if the present scheme was recommended full facilities should also be given to the Punjab and Bihar and Orissa to send samples for testing. He thought that Rs. 10,000 per annum would cover the testing for all provinces. Mr. Plymen supported the scheme, but enquired whether the barley would reach the United Kingdom in good condition. Mr. Burt replied that it would do so if shipped from Karachi at the right season. In the end the Board supported this scheme and suggested that proposals be submitted from the Punjab and Bihar and Orissa and that when these were received the requirements of all 3 provinces should be considered together at the next meeting of the Board.

6. *Application from the Government of the Central Provinces for a grant of Rs. 46,700 spread over a period of 3 years in connection with a scheme for further investigation into vaccination of cattle against Rinderpest. (Subject No. 8 of the*

*Agenda*). (*Appendix IX*).—Major Stirling introduced the scheme and offered to answer any questions that members might wish to ask. Mr. Kerr, in supporting the scheme, was of the opinion that it should be worked in collaboration with the Imperial Institute of Veterinary Research, Muktesar, and that the scheme should be put under the Veterinary Investigation Officer appointed for the Central Provinces. In that case the senior officer on Rs. 140 per mensem included in the scheme would be unnecessary, and should be omitted. Major Riley said that experiments made in Bihar and Orissa had shown encouraging results and supported the scheme but said that staff was on an extravagant scale. Colonel Olver stated that he had gone into this scheme very carefully, which, in his opinion, was very necessary being on the eve of the big advance in control measures. As regards the point that if the scheme was placed under the Veterinary Investigation Officer, it would mean the neglect of some part of his own duties he did not agree. In his opinion, he would be in a better position to look after the working of the scheme. On the whole he supported this idea and suggested that the staff could be reduced to some extent. He also pointed out that the cost of the scheme could be reduced on account of the price of serum having been reduced. In his opinion, the Veterinary Investigation Officer if put in charge of the work should work under the general control of the Director of Veterinary Services and should keep the Council informed of the progress of work. Major Stirling, in replying to the points raised, said that he had no objection to the scheme being worked under the Veterinary Investigation Officer provided a senior officer who had been particularly trained by him was employed on it. As regards collaboration with the Central Institute, he expressed the opinion that it was unnecessary to do so but added that question (1), namely, the best method of obtaining virus, will have to be done by collaboration with Muktesar as in the Central Provinces they had not one variety of Rinderpest virus but a number of varieties. In regard to the item relating to the employment of 11 peons (coolies) for controlling animals to which Major Riley had objected, he said that they were essential. They could not employ casual labour as such labour was always objected to by the Accountant-General. Mr. Farbrother supported the retention of the entire staff proposed in the scheme. Major Riley would not put the work under the Veterinary Investigation Officer. Colonel Olver said that it was necessary to keep exact records of the results of the work and for this purpose work must be done under the control of the Veterinary Investigation Officer. The scheme was then put to vote and carried with the full staff asked for but with the proviso that it should be worked under the Veterinary Investigation Officer, Central Provinces, appointed by the Imperial Council of Agricultural Research.

7. The meeting then adjourned till 10-30 A.M. on Saturday, the 18th February 1933.

CHARAN DAS,

*The 17th February 1933.*

*Secretary.*

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF  
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, HELD  
AT NEW DELHI ON SATURDAY, THE 18TH FEBRUARY 1933.

The following were present :—

- |  |                                    |
|--|------------------------------------|
| 1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, <i>Chairman</i> . |                                    |
| 2. Dr. N. AHMAD.   |                                    |
| 3. Mr. R. G. ALLAN.  | 17. Mr. P. J. KERR.                |
| 4. Mr. M. AZHAR ALLI.  | 18. Dr. V. N. LIKHITE.             |
| 5. Rao Bahadur BHIMBHAI R. NAIK.                               | 19. Colonel A. OLVER.              |
| 6. Mr. A. D. BALSCHHECK.                                       | 20. Mr. F. J. PLYMEN.              |
| 7. Dr. W. BURNS.   | 21. Mr. T. F. QUIRKE.              |
| 8. Mr. B. C. BURT.   | 22. Diwan Bahadur T. RAGHAVIAH.    |
| 9. Mr. P. H. CARPENTER.  | 23. Mr. S. V. RAMAMURTHY.          |
| 10. Mr. G. K. DEVADHAR.  | 24. Major P. B. RAILEY.            |
| 11. Dr. T. EKAMBARAM.  | 25. Nawabzada SAADATULLAH<br>KHAN. |
| 12. Mr. E. S. FARBROTHER.                                      | 26. Mr. P. T. SAUNDERS.            |
| 13. Professor J. C. GHOSH.                                     | 27. Mr. D. R. SETHI.               |
| 14. Dr. G. P. HECTOR.  | 28. Mr. H. R. STEWART.             |
| 15. Dr. L. K. HYDER.   | 29. Major R. F. STIRLING.          |
| 16. Mr. NIZAMUDDIN HYDER.                                      | 30. Mr. F. WARE.                   |

Rai Sahib Malik Charan Das, *Secretary*.

The following attended as visitors :—

- |                       |                              |
|-----------------------|------------------------------|
| 1. Mr. B. K. BADAMI.  | 4. Mr. J. H. G. JERROM.      |
| 2. Mr. E. J. BRUEN.   | 5. Mr. V. KRISHNAMURTY IYER. |
| 3. Mr. B. A. COLLINS. | 6. Dr. SUNDAR RAJ.           |

2. The meeting lasted from 10-30 A.M. to 1-30 P.M. when it terminated having disposed of all the items on the Agenda.

3. *Application from the Government of Mysore for a grant of Rs. 20,400 spread over a period of 3 years for the investigation of Johne's disease among cattle in Mysore (Subject No. 9 of the Agenda). (Appendix X).*—In the absence of a representative from Mysore, Colonel Olver introduced the scheme. He stated that the proposed investigation was very important from the point of view of the Dairying Industry for the whole of India and should be of considerable value. Mr. Kerr, in supporting the scheme, observed that as a scheme from an Indian State on such a problem as that of Johne's disease, it deserved support. There was no doubt that the disease was widely prevalent in India, though from its very nature, it was not possible to estimate its extent. Mr. Quirke enquired whether Mr. Rao, whose name

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was mentioned in the scheme, was considered suitable for doing the proposed work. Mr. Ware was of the opinion that the programme of work could be carried out in Mysore. His feeling, however, was that the scheme should not be started till after the Central Investigation Officer had been appointed at Muktesar. In the end, the Board considered that some more points required to be cleared and accordingly postponed the consideration of the subject to the summer meeting of the Board when it was hoped that the Mysore representative would be present.

4. *Question of enquiry about cocoanut products and cocoanut oil in India (Subject No. 10 of the Agenda). (Appendix XI).*—Mr. Burt, in introducing the scheme said that India was at present importing large quantities of cocoanut oil which was a raw material for the vegetable fat industry and also for the soap industry and it was also used for domestic consumption in important quantities. The very great increase in imports, both of cocoanut oil and *copra*, which had taken place during the last 12 months seemed to indicate a shortage in the supply of cocoanut and cocoanut products in India. On the other hand, he had heard definite complaints that the prices of cocoanut products in South India were also unduly low. He thought that this was a matter on which they should have first hand information. He, therefore, suggested that, as in the case of Sann Hemp, they should employ an officer for a short period to go round and find out the facts. He did not think that an enquiry lasting for more than 3 months would be needed. An Agricultural Officer would be required for the purpose and the areas concerned would be Travancore State, Madras, Mysore State and Cochin as also some parts of Bombay and Bihar and Orissa in which cocoanut was grown as a commercial crop. In his opinion the cost of the enquiry should not exceed Rs. 6,000. Mr. Devadhar without being parochial would not like Bombay to be excluded from the sphere of the contemplated enquiry for the production of cocoanut owing to four or five of its coastal districts having comparatively no mean area under the cocoanut crop which supplies bulk of the people's need for domestic purposes. Mr. Ramamurthy referred to the fact that cocoanut from Ceylon was underselling Malabar cocoanut and suggested that the proposed special officer should also visit Ceylon in order to ascertain reasons which enabled Ceylon to import her cocoanut products into India at a profit and consider why Indian cocoanut should not be able to hold its own. Mr. Ramamurthy also stated that the Government of Ceylon had provided special facilities such as grants, loans, etc., to cocoanut growers while Indian cocoanut was not getting any such facilities. He, therefore, welcomed the proposed appointment of a special officer so that we might create some kind of organisation for research and the marketing of cocoanut produce in India in the same way as Ceylon, which was our main competitor, had done. In this connection, he suggested the levy of a cess on imports of cocoanuts and cocoanut produce and asked the Advisory Board to express its opinion on the suggestion. Mr. Collins, in supporting the proposal, said that Hyderabad was importing 24 lakhs worth of cocoanut every year and would like to consider the possibility of growing it. After some other members had spoken the Board agreed to the proposed appointment of a special officer including his visit to Ceylon and decided that the suggestion regarding the levy of a cess on cocoanut and cocoanut products should first be placed before the Indian Oil Crushing Industry Committee for consideration.



5. *Application from the Government of the Punjab for a grant of Rs. 22,300 in connection with a scheme for the installation of wheat milling and baking laboratory at Lyallpur (Subject No. 12 of the Agenda). (Appendix XII).*—Mr. Stewart, in introducing the scheme, said that in the evolution of new wheats one of the important points in view was that these wheats should possess good milling and baking qualities. The only sure method of judging quality was by means of milling and baking tests but there were no facilities in India for carrying out tests on a small scale. In the North-West of India there were certain large wheat milling factories where it was possible to get milling and baking tests made but that was a matter of considerable difficulty. These mills were commercial units. They worked on a large scale and did not want to be bothered with carrying out small scale tests. The greatest drawback to testing new wheats in such mills, however, is the relatively large quantity of each particular sample required. To produce the requisite quantity required time, labour and considerable expense and then at the end the results might show that the wheat was not desirable enough to be put on the market. In order to get over this difficulty the present application was being made for a grant for the installation of a wheat milling and baking laboratory at Lyallpur. The proposed plant would be available for testing wheats from other provinces as well. Mr. Quirke supported the scheme. Mr. Devadhar was of opinion that the proposed plant should be under the control of the Council as a central institution and samples from other provinces should be tested here as well. Dr. Burns said that the plant had better be under the control of the territorial Director where it was located. It would be useful to Bombay, particularly to Sind. Mr. Stewart replied that apart from the fact that the laboratories and staff of the Research Institute, Lyallpur, would be available to carry out all the work connected with the tests, there was also at Lyallpur a very large commercial flour mill with experts and his Department had already secured a promise from the managing agents of that mill of advice and assistance in the running of this small set and in the training of the necessary staff. In view of the fact that the market for wheat was not only in India but also in Great Britain, Mr. Plymen was not sure whether a test report from a well recognised institution in Great Britain would not carry greater weight than a test report from an institution located in India. Mr. Burt, in supporting the proposal, said that the time had come when there should be such a testing plant in India. The tests at Lyallpur would not be a substitute for the final tests to be made in England, or other importing countries, where an export wheat was concerned. Tests of the nature referred to by Mr. Plymen would still be desirable but must obviously be limited in number. As to the testing of wheat for other provinces, he said that the Government of the Punjab might consider the question of charging no fees or nominal fees. If fees were to be charged at all they must not be prohibitive. He also wanted an assurance from Mr. Stewart that every sample of wheat tested at Lyallpur would, in actual point of fact, be chemically examined by the Agricultural Chemist's section so that the results of milling and baking tests could be correlated with composition. Mr. Stewart readily gave the latter assurance and said that special chemical staff for this work was included in the scheme. In the matter of fees, he said that the local Government had decided that this question need not be raised at present. In reply to Mr. Carpenter, Mr. Stewart stated that four-pound

samples would be required. Mr. Carpenter thought that that was a very small sample, and supported the scheme. On a vote being taken the scheme was recommended for sanction.

6. *Application from the Government of Bombay for a grant of Rs. 84,580 spread over a period of 10 years for research in sheep breeding (Subject No. 13 of the Agenda). (Appendix XIII).*—Mr. Bruen introduced the scheme which was supported by Dr. Burns, Rao Bahadur Naik and Mr. Devadhar also supported the proposal but the latter referred to the item relating to buildings included in the scheme and suggested that a sum of Rs. 6,000 or Rs. 7,000 representing the cost thereof should be excluded from the scheme as it was contrary to the principle adopted by the Council to govern such cases. Colonel Olver said that the cost of the scheme was not high but that it would be better if a special committee were to go into the whole question of the systematic investigation which was required in regard to the improvement of sheep in India. It would be worse than useless to start any more sheep breeding schemes unless continuity in the work could be insured and it was necessary to ascertain if the results obtained in the area suggested would be of value for the rest of India. Mr. Collins said that Hyderabad was interested in sheep breeding and that it was proposed to ask the Imperial Council of Agricultural Research for a grant. He hoped that the Committee, if appointed to examine this scheme, would consider the best place where this work should be carried on. He added that he would like to be appointed on the Committee. So far as spinning test was concerned, he said that they would be prepared to carry out any spinning test that was required. Mr. Carpenter referred to the 5-year time limit for a scheme and said that 10 years was a very long period of time for the Council to commit itself in regard to its expenditure. According to him the scheme was purely a provincial one. He could not see how this scheme was going to be of benefit to the whole of India. He, therefore, supported the suggestion of Colonel Olver that this matter should be thoroughly thrashed out in a Committee. Dr. Burns expressed the opinion that the scheme should be started at once instead of being referred to a Committee. Mr. Bruen endorsed the suggestion of Colonel Olver that it was a big scheme and that some continuity of policy was required to make it beneficial to the country. He had no objection whatsoever to the scheme being referred to a Committee but at the present moment he wanted the assurance that the scheme would be sanctioned, so that the land required be earmarked for the purpose. In this connection he explained that if the scheme was delayed he might lose a very good opportunity of getting very suitable land from the Forest Department. Mr. Kerr also supported Colonel Olver's suggestion to refer the scheme to a special Committee. In the result, the suggestion to refer the scheme to a Committee was carried: the personnel of the Committee being left to the Chairman to decide.

7. *Application from the Government of Madras for a grant of Rs. 92,487 spread over a period of three years for a scheme of research for improving the fishing industry and developing the supply of fish manure (Subject No. 14 of the Agenda) (Appendix XIV).*—Dr. Sundar Raj, in explaining the scheme, said that there was a certain amount of fish manure that was now produced in the country but nothing like as much as could be produced. The Madras Fisheries Department had substituted a simple plant for extracting the oil and crushing the resi-

due into a decent fish manure for the oil crude form of beach drying but technological research and the application of modern methods was called for. Mr. Ramamurthy said that the scheme had been carefully considered by the Provincial Research Committee. It had been suggested that, instead of appointing an American Expert on Rs. 1,200 p. m. as proposed in the scheme, a capable Honours Graduate might be selected in India and sent to the United States or Norway where he would be trained for a couple of years and then take up the work on his return. The cost of such a scheme would have been Rs. 58,000 as against Rs. 80,000 so that there would have been a saving of over Rs. 20,000. But then there was the objection that we should be wasting a couple of years. If a capable Bio-chemist could be obtained immediately he would be able to carry on the work during the next two years also and by having an Assistant working under him in the first year who would be sent to the United States in the second year and come back in the third year. A well-trained Indian would be secured who would be able to continue the work after the expert had left. The Provincial Research Committee therefore thought that it would be better even with an additional expenditure of about Rs. 20,000 to have a Bio-chemist straightaway. But if on the ground of expense the Advisory Board felt that it was desirable to postpone the scheme till a suitable Indian had been trained the Madras Government would not be unwilling to consider this point. They however felt that it was much better to start the scheme immediately, in order to get results of economic value. Considering the great value of manure in the improvement of produce from poor land in Malabar and the comparative poverty of its people the addition of this industry would be directly beneficial to the fishermen and indirectly to the agriculturists in that province. In this way Mr. Devadhar justified the expenditure incurred in launching the scheme. Mr. Plymen was of the opinion that the scheme was an expensive one and did not involve fundamental research. He was also not convinced of the need for the importation of a man from outside. In answer to Dr. Nazir Ahmad, as to the crops for which fish manure was used and the resulting increase in yield, Mr. Ramamurthy said that fish manure was largely used on the West Coast and was probably as good as super-phosphate. He also stated that the work could not be done at Bangalore, as suggested by Mr. Plymen, for the reason that Bangalore was situated inland, whereas the material required for this research could only be had at the sea coast. Dr. Ghosh said that the subject was no doubt important specially the better extraction of fish oils and it should be tackled immediately. He suggested that the work could be done at a much less cost by collaborating with the University of Madras. Mr. Carpenter referred to a resolution proposed by Dr. Hyder at the last meeting of the Advisory Board limiting the amount of money that a scheme should cost and pointed out that this scheme exceeded that amount. He, therefore, felt that the Board would need very good reasons for supporting the scheme. Another matter that needed consideration was whether the scheme was of an all-India importance. Mr. Stewart pointed out that it was proposed in the scheme to recruit a Graduate in Chemistry who would be paid Rs. 200 per mensem while in India but when he went to America he would draw over Rs. 700. He thought that if the man was given a scholarship of £250 a year that would reduce expenditure automatically by about Rs. 5,000. Mr. Burt was not satisfied with the all-India aspect of the scheme and for that reason he suggested that the scheme

with the discussion at the present meeting be referred to the Fertilizers Committee for examination and report to the Advisory Board. It was just the kind of scheme which that Committee should consider. The Board then decided to refer the scheme to the Fertilizer's Committee for examination and report.

8. *Application from the Government of Madras for a grant of Rs. 63,632 spread over a period of five years for a scheme for a research on rural pisciculture (Subject No. 15 of the Agenda). (Appendix XV).*—The scheme was introduced by Dr. Sundar Raj. Mr. Burt suggested that the scheme be referred to a Committee for examination with reference to its all-India aspect as also with reference to the principles Nos. (ii) and (v) of the principles laid down by the Governing Body to govern grants from its funds. The suggestion was adopted by the Advisory Board and the personnel of the Committee was left to the Chairman to decide.

9. *Application from the Director of Agriculture, Bombay Presidency, for a grant of Rs. 5,100 for the export of Alphonso mango fruits to Great Britain in 1933 (Subject No. 16 of the Agenda). (Appendix XVI).*—Dr. Burns explained the scheme. Mr. Burt informed the Board that the last year's experiments had cost the Council nothing as the receipts covered the expenditure. The Board recommended the scheme for sanction.

10. *Report of the Committee appointed to examine the Bihar and Orissa scheme of research on the economics of irrigation from tube wells (Subject No. 17 of the Agenda). (Appendix XVII).*—Mr. Sethi explained the scheme, and introduced the Committee's report. Mr. Burt, in supporting the scheme, said that they were extremely obliged to Mr. Brownlie for his assistance in the examination of the scheme. Mr. Brownlie's special knowledge and wide experience had enabled the Committee to put the scheme right in some important particulars. As now proposed, the scheme was cheaper by Rs. 5,000 than the original proposal. The Board recommended the scheme as amended by the Committee for sanction.

11. *Report of the Committee appointed to consider the progress report on the scheme for the breeding experiments in connection with improvement of goats, conducted by Dr. A. E. Slater (Subject No. 18 of the Agenda). (Appendix XVIII).*—The Chairman explained to the members that the Report of the Committee was for information and indicated that valuable work was being done and good progress made.

12. *Scheme for conducting research in Warble Flies at the Muktesar Institute at a cost of Rs. 32,400 spread over a period of 5 years (Subject No. 19 of the Agenda). (Appendix XIX).*—Mr. Ware introduced the scheme and Messrs. Kerr and Quirke supported it. The Board recommended the scheme for sanction.

13. *Extension of the research work on the effect of ions on the growth of plants, by Dr. S. S. Bhatnagar upto the end of May 1933 (cost involved Rs. 337-8-0) (Subject No. 20 of the Agenda). (Appendix XX).*—Mr. Stewart introduced the proposal. Mr. Burt said that it was necessary to continue the scheme on its present scale up to the end of May 1933 so as to complete the experiments that were now in progress. Dr. Bhatnagar wished to carry on a little subsidiary

work until next year to finally round the work in progress but that would not involve the retention of Dr. Singh, the research worker, for the remaining part of the year. Mr. Burt also informed the Board that when he visited Lahore during February he was exceedingly pleased with the way in which the work was carried and several points which had been raised during the discussion at the last July meeting of the Board had also been given effect to. Dr. Nazir Ahmad said that he had also an opportunity of seeing the experiments last December and was very interested in them. The experiments have now emerged from the laboratory stage and it is necessary that they should be tried in the field as Dr. Bhatnagar proposes to do. He supported the scheme. The Board recommended the scheme for sanction.

14. *Application from the Government of N. W. F. P. for a grant of Rs. 41,940 spread over a period of three years for an entomological survey scheme in the North-West Frontier Province (Subject No. 21 of the Agenda). (Appendix XXI).*—Nawabzada Saadatullah Khan explained the scheme, and in reply to Mr. Devadhar, said that the Province was running its Department of Agriculture for the last 20 years and they had now extended it. Mr. Carpenter expressed doubts as to whether the scheme was of an all-India importance. He therefore proposed that it should be referred to a Committee to examine it from that point of view. On a vote being taken the Board decided to refer the scheme to a Committee for examination and report. The personnel of the Committee to be settled by the Chairman.

15. *Scheme for establishing a fruit canning and pressing research laboratory at the Fruit Experiment Station at Quetta (cost involved Rs. 63,000 spread over five years) (Subject No. 22 of the Agenda). (Appendix XXII).*—In the absence of a representative from Baluchistan Nawabzada Saadatullah Khan introduced the scheme and said that a good deal of canned fruit was being imported from various foreign countries and that the scheme was necessary in order to foster the improvement and expansion of the fruit industry of Baluchistan. Mr. Burt, in supporting the scheme, said that it had a definite all-India aspect. Mr. Sethi suggested that the scheme should first be considered by the Committee of the Council which had examined other fruit growing schemes. This suggestion was carried, the personnel of the Committee to be decided by the Chairman.

16. *Application from the Government of Bengal for a grant of Rs. 65,579 spread over a period of seven years for research into diseases of poultry in Bengal (Subject No. 23 of the Agenda). (Appendix XXIII).*—Mr. Kerr, in introducing the scheme, referred to a similar scheme prepared by Colonel Olver which had been turned down by the Governing Body at its last meeting. The present scheme had been prepared on the same lines as the earlier one but its cost was much less so that one objection taken against Colonel Olver's scheme that it was expensive had been met. He also referred to the fact that the scheme was to last for a period of seven years as against the usual period of five years and explained that this was necessary in order to get a scholar trained in the United Kingdom in the disease of poultry before he could be employed to carry out researches on the subject. In reply to Mr. Azhar Ali, the Chairman explained that the scheme would be conducted outside Bengal. Dr. Burns considered

the scheme as very important and supported it. Mr. Ramamurty suggested that all diseases of poultry should be investigated by a comprehensive scheme which might be formulated by a special committee. Colonel Olver, in supporting the scheme, said that the results likely to be obtained from the scheme were well worth the cost. In the end the scheme was carried.

17. *Application from the Director of Agriculture, Bombay Presidency, for a grant of Rs. 2,000 for a scheme for holding an All-India Mango Show in Bombay (Subject No. 24 of the Agenda). (Appendix XXIV).*—Dr. Burns introduced the scheme. Mr. Azhar Ali pointed out that the time proposed for the Show did not suit the United Provinces. Mr. Sethi said that for mangoes from Bihar and Orissa they would have to wait till the middle of June. Mr. Ramamurty said that the proposed time for the Show would suit Madras. Further discussion showed that one show for India was not sufficient. What was perhaps required was one for the North of India and one for the South. Mr. Stewart agreed with Mr. Ramamurty. Mr. Plymen pointed out that the scheme had not come to the Council in the usual prescribed way, namely, through the Provincial Agricultural Research Committee and the local Government. Rao Bahadur Naik supported the scheme. Mr. Allan stated that a show of this kind in mango in Bombay was purely local and would have no all-India effect. Mr. Burt, in opposing the scheme, stated that the various provinces had run agricultural shows of all kinds for the last twenty years and had financed them provincially. For the first time the Council was asked to finance what was essentially a Bombay Presidency Mango Show. The Council funds were limited and he did not think that the precedent of grants to provincial agricultural shows should be created. If it was contended that the scheme was of all-India importance, then, it was premature, as they should await the results of the Bombay Cold Storage Research scheme already sanctioned by the Council. In the end the scheme was rejected.

18. With a vote of thanks to the Chair, moved by Mr. Devadhar on behalf of all, the meeting terminated.

CHARAN DAS,

Secretary.

The 20th February 1933.



APPENDIX I.  
SUBJECT NO. 1.

DECISION OF THE GOVERNING BODY ON THE RECOMMENDATIONS OF THE  
ADVISORY BOARD MADE AT THE LATTER'S MEETINGS HELD IN JUNE  
1931 AND JANUARY AND JULY 1932.

1. *Application from the Dacca University for a grant of Rs. 2,000 on account of apparatus, etc., for the year 1932-33 in connection with the scheme for agricultural research already sanctioned by the Council.*

Sanctioned.

2. *Application from the Dacca University for a further grant for the appointment of a Laboratory Assistant in connection with the scheme for agricultural research already sanctioned by the Council. (Approximate cost Rs. 2,000.)*

Sanctioned.

3. *Application from Professor J. C. Ghosh, D.Sc., Chemistry Department, Dacca University, Dacca, for a grant of Rs. 11,200 spread over a period of five years for the investigation of the organic constituents of Indian soils.*

Sanctioned.

4. *Application from Dr. B. K. Singh, Professor of Chemistry, Ravenshaw College, Cuttack, for a grant of Rs. 8,260 spread over three years for research work on the nature of organic compounds present in the rice soils of India and the factors influencing their decomposition with special reference to Bihar and Orissa soils.*

The recommendation of the Advisory Board that the scheme should be postponed pending results of work on Professor Ghosh's schemes was accepted by the Governing Body.

5. *Application from the Madras University for a grant of Rs. 25,830 spread over three years for a scheme of research in the cytological study of Indian crop plants.*

Sanctioned.

6. *Application from the Benares Hindu University for a grant for research on plant physiology (Estimated cost Rs. 1,33,340 spread over five years).*

Rejected.

7. Four schemes from the Indian Institute of Science, Bangalore :—

A. *Scheme for the preparation of cheap synthetic manure from town refuse and waste materials. (Estimated cost Rs. 4,950 spread over two years).*

Sanctioned.

B. *Scheme for the continuation of studies on electro-culture.*

The Advisory Board's recommendation was accepted and the scheme rejected.

C. *Scheme for the extension of sewage-farm investigations with special reference to Papaya and Plantain cultivation. (Rs. 13,340 spread over three years.)*

Sanctioned.

D. *Scheme for the extension of work on "quality" in crops. (Rs. 5,400 spread over two years.)*

Sanctioned.

8. *Scheme for the development of methodology in rural research submitted by the Vishwa Bharati Institute of Rural Reconstruction, Santiniketan. (Rs. 18,750 spread over three years to be borne by the Imperial Council of Agricultural Research as recommended by the Advisory Board.)*

Sanctioned.

9. *Application from the Annamalai University for a grant to investigate the problems of the marketing of the groundnut crop of the South Arcot District. (Rs. 970).*

Rejected.

10. Application from Dr. N. R. Dhar, I.E.S., Professor of Chemistry, Allahabad University, for a grant for work on the photo-chemical aspect of the nitrification in Soils. (Rs. 3,440 spread over one year.)

Rejected.

11. Application from Professor J. B. Seth, M.A., I.E.S., Professor of Physics, Government College, Lahore, for a grant of Rs. 1,800 per annum, for a period of 2 years for investigating an electric method of Hygrometry.

Sanctioned.

12. Application from Dr. A. N. Puri, Ph.D., D.Sc., A.I.C., Physical Chemist, Irrigation Research Laboratory, Lahore, for a grant of Rs. 13,500 spread over five years, to continue his work on 'The standardization of Physico-Chemical Single Value measurements most suitable for Indian soils'.

Sanctioned subject to the condition that Dr. Puri was in a position to give adequate time for the scheme.

13. Application from the Statistician, Imperial Council of Agricultural Research, for a grant of Rs. 5,000 spread over two years for research work on the statistical basis of the production of crops in India.

Sanctioned.

14. A scheme for the continuance of investigations on different aspects of the cereal rust problem and the recommendation of the Special Committee of Mycologists thereon. (Rs. 54,616 spread over two years.)

Sanctioned.

15. Application from Mr. G. R. Toshniwal, Lecturer in Physics, Allahabad University, for a grant of Rs. 11,500 for research on the destruction of insect pests and harmful bacteria with the aid of ultra-sonic waves.

The Advisory Board's recommendation was accepted by the Governing Body and the grant asked for was refused.

16. Application from the Madras Government for a grant of Rs. 73,080 spread over a period of five years for research into the indigenous drugs of India with special reference to their toxicology.

Sanctioned.

17. Application from Lieutenant-Colonel R. N. Chopra of the School of Tropical Medicine, Calcutta, for a grant of Rs. 62,860 spread over a period of 5 years for research in systematic collection of medicinal plants and study of food poisons in India.

Sanctioned.

18. Application from Dr. Sane Higginbottom, Principal, Agricultural Institute, Allahabad, for a grant of Rs. 8,600 spread over a period of 2 years for research on the composition of milk.

Sanctioned.

19. Scheme submitted by the Imperial Dairy Expert for carrying on research work at the Anand Creamery in the manufacture of products and bye-products of milk at a total expenditure of Rs. 1,10,698 spread over a period of 3 years.

Sanctioned.

20. Application from the Government of Madras for a grant of Rs. 49,930 spread over a period of five years for the extension of work on animal nutrition in the Madras Presidency.

Sanctioned.

21. Application from the Government of Bihar and Orissa for a grant of Rs. 17,040 for investigation of the traffic of livestock through that Province.

Rejected.



22. *The Punjab Government scheme for a grant of Rs. 20,128 for investigation into the most suitable and economic methods of combating different types of parasitic infection in ruminants in the field, concurrently with experiments to determine whether certain mineral deficiencies tend to lower animal resistance to parasitic infection.*

Sanctioned.

23. *Participation of India in the Fifth World Poultry Congress, Rome, 1933.*

Approved subject to a monetary limit of Rs. 750.

24. *Participation of India in the Congress of the Far Eastern Association of Tropical Medicine.*

Rejected.

25. *Recommendation of the Committee appointed to consider the improvement of curriculum for veterinary education in the Veterinary Colleges in India.*

Approved.

26. *Scheme of the Animal Husbandry Expert to the Council involving a total expenditure of Rs. 1,02,860 regarding research on diseases of poultry.*

Rejected.

27 and 28. *Application for a grant of Rs. 50,000 towards the development of R. E. I. Dairy of Radhaswami Sat Sangh Sabha, Dayalbagh, Agra.*

*Application from the Principal, Allahabad Agricultural Institute, for a grant of Rs. 54,947-4-0 for equipping the Institute's Dairy to conduct chemical and bacteriological research and to undertake an economic survey of milk supply.*

The Governing Body accepted the recommendation of the Advisory Board that the grants asked for these schemes (Nos. 27 and 28) should be refused.

29. *Application from the Director, Imperial Institute of Agricultural Research, Pusa, for a grant of Rs. 37,000 spread over five years for research work on the genetic of sugarcane at the Imperial Cane-Breeding Station, Coimbatore.*

Sanctioned.

30. *Application from the Government of His Highness the Maharaja of Mysore for a grant of Rs. 21,000 spread over a period of five years for the breeding of thick oanes.*

Sanctioned.

31. *Application from the Government of Madras for a grant of Rs. 1,50,100 spread over a period of five years for research on sugarcane in the Madras Presidency. (Rs. 80,570 net cost.)*

Sanctioned.

32. (a) *Application from the Government of the Punjab for a grant for the establishment of a sugarcane research station in the Punjab. (Rs. 1,32,970 spread over five years.)*

(b) *Application from the Government of the United Provinces for a grant for investigation into various problems of sugar industry in the United Province. (Rs. 1,11,880 spread over five years.)*

(c) *Scheme for a research and Testing Station for the indigenous system of gur and sugar manufacture, drawn up by the Sugar Technologist, Imperial Council of Agricultural Research. Rs. 1,67,380 spread over five years.)*

Sanctioned.

33. *Application from the Government of Assam for a grant of Rs. 48,000 spread over five years for the proposed extension of sugarcane work at the Jorhat Experiment Station, Assam.*

Sanctioned.

34. *Application of Mr. A. R. Srinivasa Rao for a grant for conducting certain experiments in sugarcane.*

The recommendation of the Advisory Board was accepted and the scheme was dropped.

35. *Sugarcane Insect Pests (including the carriers of Mosaic) Scheme for work at Pusa.*

The Advisory Board's recommendation to drop the scheme was accepted.

36. (a) *Application from the Government of Bombay for a grant for a dry-farming research scheme for the Bombay-Deccan. (About Rs. 2,40,000 spread over five years.)*

(b) *Application from the Government of Madras for a grant of Rs. 1,39,510 spread over a period of five years for a dry farming scheme for the ceded districts of Madras Presidency.*

(c) *Application from the Government of His Exalted Highness the Nizam for a grant of Rs. 59,383 spread over a period of five years for a dry-farming research scheme.*

Sanctioned.

37. *Application from the Government of the Punjab for a grant of Rs. 1,65,430 spread over a period of five years for a dry farming research scheme for the south-east Punjab.*

Sanctioned.

38. *Application from His Exalted Highness the Nizam's Government for a grant for the improvement of the Castor crop in India. (Rs. 32,825 spread over five years as recommended by the Advisory Board.)*

Sanctioned.

39. *Application from the Government of His Highness the Maharaja of Mysore for a grant of Rs. 15,288 spread over a period of two years for the investigation of Indian fish poison and other Indian forest products for their insecticidal properties.*

Sanctioned.

40. *Application from the Director, Imperial Institute of Agricultural Research, Pusa, for a grant of Rs. 10,000 for the purchase of a British Diesel Tractor for experiments on tractors at the Pusa farm.*

Rejected.

41. *Provincial schemes of fruit research : (Madras, Bombay, Bengal, United Provinces, Punjab, Bihar and Orissa and Assam.)*

All the Provincial schemes were sanctioned except that of Assam which was to be referred back to the Government of Assam as recommended by the Advisory Board.

42. *Application from the Madras Government for a grant of Rs. 25,912 spread over three years for the investigation of the chemistry of malling cholam (Sorghum).*

Sanctioned.

43. *Application from the Madras Government for a grant of Rs. 16,500 spread over three years for the development of sericulture in the Madras Presidency.*

The recommendation of the Advisory Board was accepted and the scheme rejected.

44. *Application from the Government of Madras for a grant for research work on potatoes.*

Sanctioned.

45. *Application from the Government of Bombay for a grant of £500 (Rs. 6,667) on account of deputation of Dr. B. N. Uppal, Plant Pathologist to Government, to foreign countries to study virus diseases of plants.*

Sanctioned.

46. *Application from the Government of Bengal for the appointment of a cigar curing and blending expert for India and especially for Madras, Bengal and Burma.*

Sanctioned.

47. *Application from the Government of the Punjab for a grant for the establishment of an Agricultural Research Station at Risalewala (near Lyallpur) for work on the water requirements of crops (Rs. 4,06,215) spread over five years.*

Rejected.

48. *Application from the Government of the Punjab for a grant for experimental work on the evolution of machinery for threshing and cleaning wheat in the Punjab.*

The Advisory Board's recommendation to open correspondence with firms abroad was approved.

49. *Application from the Government of the Punjab for a grant of Rs. 38,800 spread over a period of five years for a scheme for the improvement of the tea industry in the Punjab.*

The Advisory Board's recommendation was accepted and the scheme rejected.

50. *Application from the Government of the Punjab for an additional grant of Rs. 5,000 for conducting experiments on designing a small power sugarcane crushing mill.*

Sanctioned.

CHARAN DAS,  
Secretary.

The 10th February 1933.

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## APPENDIX II.

## SUBJECT NO. 2.

## APPOINTMENT OF COMMITTEES.

## 1. COMMITTEE TO CONSIDER PROGRESS REPORT ON THE SCHEME FOR THE BREEDING EXPERIMENTS IN CONNECTION WITH IMPROVEMENT OF GOATS, CONDUCTED BY DR. A. E. SLATER.

As it is considered desirable that all progress reports on the schemes sanctioned by the Imperial Council of Agricultural Research should be first examined by a Technical Committee, the Chairman of the Board has appointed the undermentioned committee to examine the progress report submitted by Dr. A. E. Slater, for 1931-32 on the scheme for the breeding experiments in connection with improvements of goats introduced with effect from the 6th June 1931.

- |   |                                     |
|---|-------------------------------------|
| 1. Diwan Bahadur Sir T. VIJAYA-RAGHAVACHARYA, <i>Chairman</i><br>( <i>ex-officio</i> ). | 3. Mr. T. F. QUIRKE.                |
| 2. Colonel A. OLVER.  | 4. Major P. B. RILEY.               |
|   | 5. Captain Nawab RAIS JUNG BAHADUR. |

Rai Sahib Malik CHARAN DAS, *Secretary* (*ex-officio*).

The Committee will meet at 3 P.M. on Thursday, the 16th February 1933.

## 2. ALL-INDIA LEGISLATION FOR THE PREVENTION AND CONTROL OF CONTAGIOUS DISEASES AMONG ANIMALS.

At an informal Committee of the Veterinary members of the Advisory Board held on the 12th June 1931 to consider the drafting of an all-India bill for the prevention and control of diseases among animals it was decided that when the draft bill and the model rules thereunder were ready, a formal committee composed of official and non-official members should be appointed to consider them. The Vice-Chairman, Imperial Council of Agricultural Research, has accordingly appointed the following committee :—

- |   |  |
|---|--|
| 1. Diwan Bahadur Sir T. VIJAYA-RAGHAVACHARYA, <i>Chairman</i><br>( <i>ex-officio</i> ). | 6. Mr. T. F. QUIRKE.                   |
| 2. Colonel A. OLVER.  | 7. Mr. E. S. FAEBROTHER.               |
| 3. Mr. P. J. KERR.  | 8. Mr. S. M. A. SHAH.                  |
| 4. Mr. F. WARE.   | 9. Mr. J. H. G. JERROM.                |
| 5. Mr. P. T. SAUNDERS.  | 10. Diwan Bahadur T. RAGHAVIAN, C.S.I. |
|   | 11. Mr. Mohd. AZHAR ALI, M.L.A.        |

Rai Sahib MALIK CHARAN DAS, *Secretary* (*ex-officio*).

The Committee will meet at 3-30 P.M. on Thursday, the 16th February 1933.

## 3. APPLICATION FROM THE GOVERNMENT OF BIHAR AND ORISSA FOR A GRANT OF RS. 78,680 SPREAD OVER A PERIOD OF FIVE YEARS FOR A SCHEME OF RESEARCH ON THE ECONOMICS OF IRRIGATION FROM TUBE WELLS.

At its meeting held in July 1932, the Advisory Board recommended that this scheme should first be examined by a Committee to be appointed for the purpose. The Vice-

Chairman has accordingly appointed the undermentioned Committee :—

1. Diwan Bahadur Sir T. VIJAYA-RAGHAVACHARYA, *Chairman* (*ex-officio*).
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. Dr. L. K. Hyder, Ph.D.
4. The Director of Agriculture, United Provinces.
5. The Director of Agriculture, Bihar and Orissa.
6. Mr. T. A. M. BROWNLIE, Agricultural Engineer to the Government of the Punjab.

Rai Sahib Malik CHARAN DAS, *Secretary* (*ex-officio*).

The Committee will meet at 3 P.M. on Friday, the 17th February 1933.

CHARAN DAS,  
*Secretary.*

*The 10th February 1933.*

## APPENDIX III.

## SUBJECT NO. 3.

RECOMMENDATIONS OF THE LOCUST COMMITTEE AT ITS 4TH MEETING  
HELD IN JANUARY 1933—PROPOSALS FOR FUTURE RESEARCH.

As members of the Advisory Board are aware, on the Board's recommendation the Governing Body sanctioned in July 1930 a sum of Rs. 1,76,000 for conducting investigations on the life history of the desert locust and for a survey of the breeding grounds as had been proposed by the Locust Committee. This scheme was accordingly started for one year in the first instance from the 5th December 1930.

2. A meeting of the Locust Committee was again convened in January 1932 when the annual reports of the Locust Research Entomologist and the Deputy Locust Research Entomologist were considered and the Committee recommended that the scheme should be extended for another year from 1st April 1932 and that a sum of Rs. 62,220 in addition to the original grant of Rs. 1,76,000 should be provided to meet the extra expenditure involved. These proposals were placed before the Advisory Board at its January 1932 meeting and on its recommendation the Governing Body sanctioned them.

3. As the period of the present sanction is due to expire on the 31st March 1933, the Locust Committee met again in January 1933 to consider the future of the locust research scheme and copies of its proceedings are enclosed (not printed). It will be seen that after considering the progress made so far the Locust Committee has recommended *inter alia* :—

- (i) that the Panni Laboratory should continue with the existing staff *plus* two additional observation posts at Gwadar and Turbat;
- (ii) that the survey work should be continued in Bahawalpur, Dera Ghazi Khan, North Sind, Thar and Parkar District and Rajputana, and that for this purpose observation posts each with a fieldman and a messenger should be stationed at Mirpur Khas (Thar Parkar District), Rohri (North Sind), Khanpur (Bahawalpur State), and Bikaner;
- (iii) that the compilation of past locust records from 1863 should be continued;
- (iv) that Rao Sahib Y. Ramachandra Rao should be in sole charge of the Council's locust research scheme from 1st April 1933 with headquarters at Karachi, as Mr. Afzal Husain will not be available for the scheme from that date, his services having been resumed by the Punjab Government as from 1st April next;
- (v) that the work at Lyallpur should be confined to the study of the biology and bionomics of the locust and that for this work a suitable grant should be made to the Punjab Government in the usual way, the work to be done by Mr. Afzal Husain.

4. The staff that will be employed on the scheme from the 1st April 1933 in the different places is shown in Enclosure I. The estimated cost of the extended scheme will be :—

	Rs.
Punjab .. .. .	11,600
Main scheme including the compiling staff to be transferred from Lyallpore to Karachi .. .. .	56,700
<b>Total</b> ..	<b>68,300</b>

5. It will be seen from the statement enclosed (Enclosure II) that out of a total grant of Rs. 2,38,200, a sum of Rs. 1,73,622-4-4 has already been spent and a sum of Rs. 45,703 is likely to be spent upto the end of March 1933. This leaves a balance of Rs. 18,875. The Governing Body at its meeting held in October 1932 has sanctioned a sum of Rs. 50,000 to meet the cost of the locust scheme if it is extended. Thus the total sum available for the locust scheme for the next year is therefore Rs. 68,875 which is sufficient to cover the cost of the Locust Committee's proposal mentioned above.

6. The recommendations of the Locust Committee are now for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 23rd January 1933.*

ENCLOSURE I.

A.—*Karachi.*

Deputy Locust Research Entomologist.  
One Research Assistant.  
One Head Clerk.  
One Second Clerk.  
Two Fieldmen.  
Two Peons.

B.—*Survey Party.*

Three Research Assistants. (Third to be appointed if necessary.)  
Four Fieldmen.  
Four Messengers.

C.—*Parsi Laboratory.*

Assistant Locust Research Entomologist.  
Two Research Assistants.  
Eight Collectors and Fieldmen.  
One Peon.  
One Chowkidar.  
Four Messengers.

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Staff at Lyallpur will be decided by the Director of Agriculture, Punjab.



## ENCLOSURE II.

Statement showing actual expenditure of the locust research scheme from 5th December 1930 to 30th November 1932 and estimated expenditure upto 31st March 1933.

	Rs.								
	Initial grant .. .. .						Additional grant .. .. .		
	1,76,000						62,200		2,38,200
	Actuals of						Expenditure upto 30th November 1932	Estimated expenditure up to 31st March 1932.	
	1930-31.		1931-32.						
	Rs.	A. P.	Rs.	A. P.	Rs.	A. P.	Rs.		
<b>Lyallpur—</b>									
Pay of officers .. .. .	4,134	4 0	14,411	11 0	8,580	0 0	6,590		
Pay of Establishment .. .. .	4,256	14 0	23,645	1 0	8,985	8 0	5,830		
Allowances and Honoraria—									
T. A. of officers .. .. .	457	2 0	696	0 0	147	0 0	750		
T. A. of establishment .. .. .	247	2 0	2,106	10 0	142	1 0	2,585		
Grants-in-aid, contributions, etc. .. .. .	1,317	14 0	5,523	13 0	3,336	15 0	1,763		
Contingencies and Supplies and Services .. .. .	842	5 6	8,410	8 10	2,137	10 3	2,500		
<b>Total .. .. .</b>	<b>11,255</b>	<b>5 6</b>	<b>54,896</b>	<b>11 0</b>	<b>23,329</b>	<b>2 3</b>	<b>20,378</b>		
<b>Quetta—</b>									
Pay of officers .. .. .	3,532	4 0	14,825	13 0	7,200	0 0	4,500		
Pay of establishment .. .. .	1,264	2 0	9,312	5 0	2,672	0 0	1,350		
Allowances and Honoraria—									
T. A. of officers .. .. .	751	2 0	3,738	10 0	1,746	9 0	2,225		
T. A. of establishment .. .. .	951	8 0	4,773	11 0	616	13 0	1,000		
Grants-in-aid, contributions, etc. .. .. .			3,742	10 0	1,998	2 0	1,000		
Contingencies, and Supplies and services .. .. .	1,310	11 1	7,178	1 9	1,642	10 6	1,500		
<b>Total .. .. .</b>	<b>7,809</b>	<b>11 1</b>	<b>43,571</b>	<b>2 9</b>	<b>15,876</b>	<b>2 6</b>	<b>11,575</b>		

	Actuals of				Expenditure up to 30th November 1932.	Estimated expenditure up to 31st March 1932.	
	1930-31.		1931-32.				
	Rs.	A. P.	Rs.	A. P.	Rs.	A. P.	Rs.
<b>Survey Party—</b>							
Pay of establishment .. ..	..	..	..	..	4,328	8 0	2,750
<b>Allowances and Honoraria—</b>							
T. A. of establishment .. ..	..	..	..	..	905	3 0	2,000
Grants-in-aid and Contributions .. ..	..	..	..	..	513	7 0	400
Contingencies and Supplies and services .. ..	..	..	..	..	1,516	8 3	2,000
<b>Total .. ..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>7,263</b>	<b>8 3</b>	<b>7,150</b>
<b>Pasni Laboratory—</b>							
Pay of establishment .. ..	..	..	..	..	6,640	10 0	4,000
<b>Allowances and Honoraria—</b>							
T. A. of Establishment .. ..	..	..	..	..	1,481	8 0	2,100
<b>Grants-in-aid and contributions—</b>							
Contingencies, and supplies and services .. ..	..	..	..	..	1,498	2 0	500
<b>Total .. ..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>9,620</b>	<b>5 0</b>	<b>6,600</b>
<b>Grand Total .. Rs. ..</b>	<b>1,73,622</b>	<b>4 4</b>			<b>2,38,200</b>	<b>0 0</b>	
<b>Anticipated Expenditure Rs. ..</b>	<b>45,703</b>	<b>0 0</b>			<b>2,19,325</b>	<b>0 0</b>	
	<b>Rs.</b>	<b>2,19,325</b>	<b>4 4</b>	<b>Balance</b>	<b>18,875</b>	<b>0 0</b>	

## APPENDIX IV.

## SUBJECT No. 4.

APPLICATION FROM DR. G. S. THAPAR, M.Sc., Ph.D., READER IN ZOOLOGY,  
LUCKNOW UNIVERSITY, FOR A GRANT OF RS. 25,460 SPREAD OVER A  
PERIOD OF FIVE YEARS FOR AN ENQUIRY INTO THE HELMINTHIASIS  
OF CATTLE, SHEEP AND GOATS IN THE UNITED PROVINCES.

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Attention is invited to the attached letter (Annexure), from the Government of the United Provinces, No. 2622, dated the 12th January 1933 and enclosures regarding an application (Enclosure I), from Dr. G. S. Thapar for a grant of Rs. 25,460 for staff and equipment spread over a period of five years to conduct investigation into the helminthiasis of cattle, sheep and goats in the United Provinces. The application has been recommended by the Lucknow University and the Provincial Research Committee (Enclosure II) and the Lucknow University is willing to provide the necessary laboratory, etc., facilities for Dr. Thapar's work at Lucknow. The scheme is now for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

NEW DELHI,

*Dated the 20th January 1933.*

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## ANNEXURE.

COPY OF LETTER FROM THE SECRETARY, TO GOVERNMENT, UNITED PROVINCES, INDUSTRIES DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NO. 2622, DATED THE 12TH JANUARY 1933.

*Scheme relating to an inquiry into the helminthiasis of domesticated animals (cattle, sheep and goats) in the United Provinces.*

I am directed to forward for consideration at the next meeting of the Advisory Board of the Imperial Council of Agricultural Research an application (Enclosure I), from Dr. G. S. Thapar, M.Sc., Ph.D. (London), Reader in Zoology, Lucknow University, for a grant of Rs. 25,460, spread over five years, to finance a scheme relating to an inquiry into the helminthiasis of domesticated animals (cattle, sheep and goats) in the United Provinces. The scheme has been recommended by the United Provinces Agricultural Research Committee, a copy of whose resolution in connexion therewith is enclosed (Enclosure II). The investigation which Dr. Thapar proposes to undertake and the work which will be done by the Veterinary Investigation Officer who is to be appointed in these provinces in 1933-34 will not overlap and Dr. Thapar's scheme can be worked in collaboration with the provincial veterinary department.

## ENCLOSURE I.

**MODIFIED SCHEME ON THE "INQUIRY INTO THE HELMINTHIASIS OF THE DOMESTICATED ANIMALS (CATTLE, SHEEP AND GOAT) IN THE UNITED PROVINCES, BY DR. GOBIND SINGH THAPAR, M.Sc., Ph.D. (LONDON), READER IN ZOOLOGY, LUCKNOW UNIVERSITY, LUCKNOW, FOR Rs. 25,460 SPREAD OVER FIVE YEARS.**

*Introduction.*—But for a little record of work by Gaiger during the last century, nothing of any importance has been done in this country about the study of helminthic infections of the domestic animals. The problem is engaging the attention of the research workers abroad and a considerable addition has been made to our knowledge of these forms. It is, therefore, of extreme importance to know the intensity and the sources of the helminthic infections in domestic animals here. While collecting the helminth parasites at the slaughter-houses in Lucknow, I was surprised to find a very heavy infection of these animals with helminths. Similar infections, I believe, must be occurring at other places as well and it is very desirable first to make a systematic inquiry about the occurrence of such infections and then to tackle the problem according to the need of the individual district or station. It may be remarked that these helminths are constantly impairing the health of our live-stock and in part account for the poor yield of milk and bad supply of meat. It is of the utmost importance that an agricultural country, like ours, should look to its live-stock industry rather seriously and try to save the stocks from such infections. The following scheme is therefore prepared and if sanctioned useful work would be brought to a satisfactory conclusion.

*The scope of the inquiry.*—The work will be carried out in collaboration with the Civil Veterinary Department of the province. I have discussed the scheme with the Director, Veterinary Department, United Provinces, and he has agreed to supply me with the materials collected by his officers by post mortem examination for my inspection and identification, and has also promised to render other assistance that may be required in the course of my investigations.

The work of the inquiry will concentrate on the following points :—

- (1) The collection of data of the helminthic infections of the different districts and the identification of the helminths thus obtained.
- (2) Inquiry into the period of longevity of the eggs and larvae outside the body of the host.
- (3) Study of the life-histories of the various helminths thus obtained with a view to combat the intermediate hosts.
- (4) Suggestions of control measures as a result of the above investigations.

*Method of procedure for the investigations.*—Previous to 1930 no work was carried out on this line in these provinces, and it was then decided to undertake a detailed study of the helminth parasites of domestic animals and to record as much information as was available by a collection and identification of the worms from the slaughter-houses and otherwise. During this period I have been able to collect a large number of helminths and have made a preliminary study of the helminth parasites of the animals at the slaughter-houses in Lucknow. The work done so far is being sent to the press. Further investigations are required to be carried out on the following lines :—

- (1) Formation of the cultures of the helminthic ova taken from the worms or from the droppings of the host.
- (2) Study of the conditions under which helminthic ova and larvae develop.
- (3) Experimental infections of other animals with the developing larvae.
- (4) Study of the longevity of ova and larvae under normal and abnormal environmental conditions.
- (5) Identification of the intermediate hosts together with the larvae found in them and their further histories.

(6) Incidentally a study of the relation of these domestic animals to the spread of helminthic infections in man.

(7) Any other method employed as a result of the above investigations.

*Period of inquiry.*—In order that the work may be definitely reliable, it is desirable that it should extend over a period of five years, to enable the investigators to collect the data throughout the province, to make allowance for the seasonal variations and to study the infectivity of the ova and larvae under normal and abnormal environmental conditions, and ultimately to verify the results.

*Expenditure.*

Items.	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
<b>Pay of officers—</b>					
One research assistant on Rs. 150—10—200.	1,800	1,920	2,040	2,160	2,280
<b>Establishment—</b>					
One laboratory assistant on Rs. 35—3—50.	420	456	492	528	564
Two laboratory bearers and peon at Rs. 12—1—16.	268	312	336	360	384
Allowance to sweeper at Rs. 2 per mensem.	24	24	24	24	24
<b>Travelling allowances—</b>					
Officers and staff .. ..	1,500	1,500	1,500	1,500	1,500
Contingency (running) laboratory charges for materials like glass tubes, petri dishes, chemicals, reagents, etc.	500	500	500	500	500
Literature .. ..	200	200	200	200	200
<b>Total .. ..</b>	<b>4,732</b>	<b>4,912</b>	<b>5,092</b>	<b>5,272</b>	<b>5,452</b>
<b>Total for 5 years ..</b>	<b>25,460</b>				

Facilities available and approximate expenditure already involved in the project.

There are considerable facilities available at the University. They are not easy to be translated into money, but the expenditure already involved far exceeds the amount asked for. They would be treated under the following heads :—

(a) *Apparatus.*—Most of the costly apparatus, like microscopes, binoculars, centrifuges, baths, incubators, etc., required for the investigation are already provided for by the University. There is also an adequate stock of reagents and stains required for an average piece of research.

- (b) *Library*.—In this respect we are better fitted than any other place in the province. The department has a number of Research Memoirs on Helminthology and is also subscribing to a large number of periodicals dealing with the subject. A certain number of journals and research memoirs are available at the Medical College of the University and also at the Provincial Hygiene Institute attached to the Medical College. Besides I have in my private collection about a thousand memoirs in Helminthology that are constantly used as references in the Department. All these add to the considerable library facilities available and offer a unique opportunity for research.
- (c) *Collections*.—Local collection of helminths from the slaughter-houses and other sources have been identified and the results of my preliminary survey at Lucknow are available for reference. Besides, we have a fairly large collection of the helminths of vertebrates identified and arranged. All these could be used for comparison with the new collection for the purposes of identification. This would greatly facilitate the work to be undertaken. I am in close touch with many research workers and institutions abroad and can always obtain materials, etc., for reference.
- (d) *General*.—The University has well equipped laboratories and has ample facilities for work on these lines. Hence *no non-recurring* grant is needed for the investigation.

Expert advice on correlated sciences, like Botany and Chemistry, will be readily available. Both these departments have highly qualified staff and are adequately equipped and furnished, both in materials and library, so that the advice received from these sources could always be relied upon.

Owing to the close proximity of the Veterinary Research Laboratory to the University, I hope that they will be in a position to render very considerable assistance in the collection of the data and otherwise in the course of the investigation. The Director of the Veterinary Research Laboratory has very kindly agreed to help during the course of our investigation and will be pleased to place his resources at our disposal, where possible.

The scheme would, therefore, be economical and the opportunities available at the University would considerably facilitate the work.

- (e) *Conclusion*.—In end, I beg to enclose a summary of the work already conducted by me on *Helminthology* and the opinions of a few distinguished persons carrying on research on similar lines, with a view to show my capability for the work.

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*Remarks of* DR. WALI MOHAMMAD, M.A., PH.D., I.E.S., *Dean, Faculty of Science, Lucknow University, Lucknow, on the research scheme of* DR. THAPAR.

Forwarded and strongly recommended to the Vice-Chancellor.

The enclosed research scheme on the Helminthiasis of the cattle, sheep and goat by Dr. G. S. Thapar deserves full support of the University. The Head of the Department of Zoology assures ample laboratory facilities and Dr. Thapar is fully qualified to carry out the work.

WALI MOHAMMAD.

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Forwarded and recommended. We have ample laboratory facilities, and given suitable assistance Dr. Thapar will be able to carry out the work successfully.

K. N. BAHL, D.SC., PH.D.,  
*Professor of Zoology,*  
*Lucknow University.*

*List of Researches, published or in press, by Dr. G. S. THAPAR.*

1. "The Lymph Glands in the genus *Pheretima*, with a note on the Coelomic Organs of *Beddard*."—*Rec. Ind. Mus.*, Calcutta, Vol. XV. 1918.
2. "On the Venous System of the Lizard, *Varanus bengalensis* (Daud)."—*Proc. Zool. Soc.*, London. 1921.
3. "The Occurrence and Significance of a Third Contractile Vacuole in *Paramecium caudatum*."—*Jour. and Proc. Roy. Micros. Soc.*, London. 1922.
4. "On the Arterial System of the Lizard, *Varanus bengalensis* (Daud), with Notes on *Uromastix* and *Hemidactylus*."—*Jour. and Proc. Asiatic Soc.*, Bengal Vol. XIX. 1923.
5. "On *Kiluluma* *Skrbn.*, a genus of Strongylid Nematodes parasitic in the African rhinoceros."—*Jour. Helminthology*, London, Vol. II. 1924.
6. "On the Morphology and systematic position of *Echinopharynx*, a new genus of bursate Nematode from *Testudo tabulata*."—*Jour. Helminth.*, Vol. III. 1925.
7. "On some new members of the genus *Kiluluma* from the African rhinoceros."—*Jour. Helminth.*, Vol. III, 1925.
8. "Studies on the Oxyurid Parasites of Reptiles."—*Jour. Helminth.*, Vol. III.
9. "*Ozolaimus* *Duj.* 1845 (= *Macracis* *Geddes*, 1916), a little known Nematode from the caecum of *Iguana tuberculata*."—*Jour. Helminth.*, Vol. IV. 1926.
10. "On *Acanthogyrus* n.g. from the intestine of the Indian fish, *Labeo rohita*, with a note on the classification of the *Acanthocephala*."—*Jour. Helminth.*, Vol. V. 1927.
11. "The present Status of *Sauricola* and *Echinopharynx*."—*Trans. Far East. Assn. Trop. Med.*, Calcutta. 1927.
12. "Preliminary Observations on Ankylostomiasis in Pariah dogs in Lucknow."—*Trans. Far East. Assn. Trop. Med.*, Calcutta, Vol. III. 1927.
13. "On the Trematodes of the digestive tract of *Tropidonotus piscator* from Lucknow."—*Jour. Helminth.*, Vol. VII. 1929.
14. "Sur un Nouveau Trematode d'un poisson de L'Inde, *Gomtia piscicola* n.g. n.sp."—*Annales de Parasitologie*, Tom. VIII. 1930.
15. "On *Farzandia*, a new genus of Acanthocephalid worms, from the intestine of *Ophiocephalus marulius*."—*Ann. d. Mag. Nat. Hist.*, Ser. 10, Vol. VI. 1930.
16. "Preliminary Survey of the Helminth Parasites of man in Lucknow."—*Pro. Ind. Sci. Cong.*, 1931.
17. "On a New Trematode of the genus *Astiotrema* *Looss*, 1900, from the intestine of a tortoise, *Chitra indica*."—*Jour. Helminth.* (In Press.)
18. "A New Blood Fluke from an Indian tortoise, *Trionyx gangeticus*."—*Jour. Helminth.*, Vol. X. (In Press.)

Work in progress :—

19. An encysted *Cercaria* from an Indian fish.
20. Helminth Parasites of Rodents, with particular reference to the spread of Helminthic infections in man.
21. A preliminary Survey of the Helminth Parasites of the animals killed at the slaughter-houses at Lucknow.
22. Studies on the Amphistomes of Mammals.



**COPY OF A TESTIMONIAL OF DR. R. T. LEIPER, D.SC., F.R.S., PROFESSOR OF HELMINTHOLOGY,  
UNIVERSITY OF LONDON, AND DIRECTOR OF IMPERIAL BUREAU OF AGRICULTURAL  
PARASITOLOGY, LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE, LONDON.**

5th August, 1925.

**TO WHOM IT MAY CONCERN.**

Dr. GOVIND SINGH THAPAR has spent the past two years under my direction at the London School of Hygiene and Tropical Medicine as a whole-time research student of the University of London in Helminthology. During this period he has shown sustained application and industry and has proved himself capable of independent research of a high order. He has at the same time proved himself a pleasant co-worker to other members of the staff and it is to the regret of all that he leaves on the completion of his period of study.

Given opportunity and reasonable facilities in India, I feel sure that Dr. Thapar will brilliantly justify the promise shown by his work here.

(Sd.) R. T. LEIPER.

**COPY OF AN EXTRACT OF A LETTER FROM COLONEL J. STEPHENSON, D.SC., F.R.S., C.I.E.,  
EDITOR OF THE FAUNA OF BRITISH INDIA, BRITISH MUSEUM OF NATURAL HISTORY,  
FORMERLY PROFESSOR OF ZOOLOGY, IN THE UNIVERSITY OF THE PUNJAB, TO THE  
LATE MR. RICHEY, C.I.E., EDUCATION COMMISSIONER TO THE GOVERNMENT OF IN-  
DIA.**

"... Dr. Thapar studied in London for two years, at the London School of Tropical Medicine, under Prof. R. T. Leiper, F.R.S., *the foremost Helminthologist of the present day*, and obtained his doctorate at London University at the conclusion of his course. *He published several papers which are all very thorough pieces of work and do him great credit.* I know Leiper thinks well of him. I have always had a good opinion of him. You probably have some record of my views as to his attainments and capabilities somewhere....."

**COPY OF LETTERS OF COLONEL A. OLVER, C.B., C.M.G., F.R.C.V.S., ANIMAL HUSBANDRY  
EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, TO DR. G. S.  
THAPAR, M.SC., PH.D. (LOND.), READER IN ZOOLOGY, LUCKNOW UNIVERSITY, LUCK-  
NOW.**

D.-O. no. 189/Vet.]

ROCK HOUSE, SIMLA :

The 6th May, 1931.

DEAR SIR,

YOUR letter, dated 7th of January, 1931, to Dr. Leiper; a definite proposal is now before the Imperial Council of Agricultural Research for the financing of systematic investigation by a special disease investigation staff allotted to the Director of Veterinary Services of Provinces and States, and paid for by the Council, of local disease problems of stock, throughout India, and it is hoped that work may be commenced at an early date.

One of the most important subjects for investigation will be Helminthiasis of all classes of domesticated animals and any assistance you can give us in this matter will be much appreciated.

Yours faithfully,

(Sd.) A. OLVER,

*Animal Husbandry Expert.*

D.-O. no. 25/Vet.]

NEW DELHI:

The 21st January, 1932.

DEAR DR. THAPAR,

I AM in receipt of your letter of the 20th and the accompanying scheme. I am very sorry that this did not come up earlier but in any case it would have to come to us through the proper channel, i.e., the Provincial Research Council, and I suggest that you should now send it to them and get Captain Hickey to push it for you. The more local research we can get done on Helminthiasis in this country the better.

I should be glad to see you at any time if you are coming to Delhi.

Yours sincerely,  
(Sd.) A. OLVER.

COPY OF A RESOLUTION OF THE SENATE OF THE UNIVERSITY OF LONDON PASSED AT THEIR MEETING ON THE 18TH NOVEMBER, 1925.

"THE Senate resolved that a grant of £35 from the Publication Fund be made to you in aid of the publication in the Journal of Helminthology of your Ph.D. thesis, entitled 'Studies on Helminth Parasites of Vertebrates,' in accordance with the Regulations in regard to grants from the Publication Fund."

A cheque for the amount of the grant will be sent to you as soon as the evidence required under section 6 of the enclosed Regulations has been received by the Principal Officer.

*Copy of the above forwarded to Dr. Gobind Singh Thapar, Ph. D., Department of Zoology, The University, Lucknow, India, by Edwin Deller, Esq., Academic Registrar, University of London, dated the 19th November, 1925.*

EXTRACT from *Nature*, dated the 19th April, 1924, page 572, under—

"The London Zoological Society's Aquarium  
"The Aquarium is provided with good research facilities—Work on the helminth parasites of fishes which have died during the stocking of the aquarium has already been started by Prof. R. T. Leiper and Mr. G. S. Thapar. It is hoped that, in the near future, researches will be undertaken on many of the other problems relating to food fishes, which are of the greatest economic importance."

G.M.V.

[*Nature*, 19th April, 1924, page 572.]

"DR. G. S. THAPAR, a Reader in Zoology of the Lucknow University, has been appointed correspondent of the Imperial Bureau of Agricultural Parasitology of England, a central agency for the British Empire collecting information, carrying on investigation and helping in other countries in the Empire in connection with research in agriculture and allied problems. Dr. Thapar's appointment as correspondent of the Bureau is evidently, it is believed, the outcome of a number of valuable researches carried out by him in helminthology, which have been incorporated in certain English and German text-books on the subject."

[*The Leader*, Friday, 31st July, 1931.]

EXTRACT FROM THE REPORT OF THE COUNCIL OF THE ZOOLOGICAL SOCIETY OF LONDON FOR THE YEAR 1925.

"THE animals dying in the gardens during the past year, with the exception of rare specimens reserved by the Anatomist for morphological studies, have been examined by the Pathologist for parasitic entozoa and the material collected has been identified and reported upon periodically to the Prosectorial Committee. The identifications have been undertaken by a panel of Parasitologists formed by the staff and associated workers of the

Institute of Agricultural Parasitology (Ministry of Agriculture), and the Helminthological Department of the London School of Hygiene and Tropical Medicine. The following have participated in the scheme:—T. W. M. Cameron, M.R.C.V.S., PH.D., B.SC., R. J. Ortlepp, M.A., PH.D., F.Z.S., T. Goodey, D.SC., D. O. Morgan, B.SC., G. S. Thapar, M.Sc., Ph.D., R. T. Leiper, M.D., D.SC., F.R.S., F.Z.S., Miss M. Triffitt, M.SC., F.Z.S. ”

[Pages 23 and 24 of the Report, for 1925.]

2, OXFORD TERRACE,

EDINBURGH :

The 2nd October, 1927.

MY DEAR GOBIND SINGH THAPAR,

MANY thanks for the reprint of your paper on *Acanthogyrus*—which I am very glad to possess. The scheme of classification seems good, and I am sure represents an advance.

Best wishes always for the continued success of your work.

Yours sincerely,

J. STEPHENSON, D.SC., F.R.S.

THE UNIVERSITY OF ILLINOIS,

DEPARTMENT OF ZOOLOGY.

URBANA :

The 27th January, 1925.

DEAR MR. THAPAR,

I HAVE your letter of January 10 and I think I recognize the paper to which you refer as one that was printed many years ago.

\* \* \* \* \*  
\* \* \* \* \* I am indebted to you for sending me a copy of your paper on *Kiluluma* which is a most interesting discussion of a rather unusual form.

With best wishes for your success, believe me.

Very sincerely yours,

(Sd.) HENRY B. WARD,

*Professor-in-charge, Department of Zoology.*

*Supplement.*

WITH reference to the Research Scheme on the Helminthiasis of the Cattle, I wish to add that the work will mainly be restricted to the helminths of the animals killed at the slaughter-houses, and will further be in collaboration with the Civil Veterinary Department of the Province, who will supply me with the materials collected by them by the action of the various anthelmintics used at their experimental hospitals. They have also agreed to render other assistance in the course of my investigations. Further, it is intended to work out the life histories, with a view to combat the intermediate hosts.

G. S. THAPAR,

*Reader in Zoology, Lucknow University.*

No. 13/V.C./32.]

*The 23rd January, 1932.*

THE attached Scheme of Research which is proposed to be undertaken by Dr. G. S. Thapar, Reader in Zoology in the University, is forwarded with my strong recommendation and with the remark that the Imperial Council of Agricultural Research may be pleased to provide the necessary funds for the carrying on of the research. The Scheme is recommended both by the Head of the Department of Zoology and the Dean of the Faculty of Science of the University. The title of the Scheme is: "An Inquiry into the Helminthiasis of Cattle, Sheep and Goat in the United Provinces."

JAGAT NARAIN,

*Vice-Chancellor, Lucknow University.*

To—The Vice-President, the United Provinces Agricultural  
Research Committee, Lucknow.

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 No. 2177/VIII—1-31.

FROM

CAPTAIN S. G. M. HICKEY, M.B.C.V.S., I.V.S.,

DIRECTOR, CIVIL VETERINARY DEPARTMENT,  
UNITED PROVINCES, LUCKNOW.

TO

THE ECONOMIC BOTANIST TO GOVERNMENT,  
UNITED PROVINCES, AND  
SECRETARY, UNITED PROVINCES, AGRICULTURAL RESEARCH  
COMMITTEE, CAWNPORE.

*Dated the 2nd April, 1932.*

SIR,

IN returning herewith the scheme entitled an enquiry into the Helminthiasis of the cattle, sheep and goat in the United Provinces by Dr. Thapar, I have the honour to say that it does not appear to be a duplication of the United Provinces Government Veterinary Research and Investigation Scheme which has been recommended by the Provincial Research Committee.

The Scheme, if sanctioned, can be worked in collaboration with this department as can be ascertained from the supplementary note by Dr. Thapar (herewith enclosed), which has since been received after he has personally seen me on the subject.

I think, I have no hesitation in recommending the scheme being taken up for consideration, provided funds are available.

I have the honour to be,

SIR,

Your most obedient servant,

S. G. M. HICKEY,

CAPTAIN, I.V.S.,

*Director, Civil Veterinary Department,  
United Provinces.*

FROM

R. R. KHANNA, Esq., M.Sc.,

REGISTRAR, UNIVERSITY OF LUCKNOW,

LUCKNOW,

To

THE SECRETARY,

UNITED PROVINCES AGRICULTURAL RESEARCH COMMITTEE,

SHAHJAHANPUR.

*Dated Lucknow, the 1st October, 1932.*

SIR,

With reference to your letter No. 1131/PRC-VII, dated the 19th September, 1932 regarding the scheme for an enquiry into the Helminthiasis of the cattle, sheep and goat in the United Provinces, I am directed to say that Dr. G. S. Thapar, Reader in Zoology, has a room to himself which he can fully utilize for purpose of this scheme. The University will also be helping this scheme in providing existing laboratory facilities and in giving use of usual laboratory appliances (microscopes, paraffin baths, etc.). Seats in the research room, if available, can be reserved under the University rules, if required for non-students.

No member of the staff nor any laboratory servant can be placed specially at Dr. Thapar's disposal for this scheme, nor can any portion of the laboratory grant intended for the purpose of the University be diverted for this scheme. I hope you will do all you can to push the scheme through.

I have the honour to be,

SIR,

Your most obedient servant,

R. R. KHANNA,

*Registrar.*

COPY OF A LETTER FROM CAPTAIN S. G. M. HICKEY, M.B.C.V.S., I.V.S., DIRECTOR, CIVIL VETERINARY DEPARTMENT, UNITED PROVINCES, TO DR. G. S. THAPAR, M.Sc., Ph.D., No. 178/VIII-10-B., DATED THE 1ST NOVEMBER, 1932.

I HAVE gone through your modified scheme and think that it will not overlap my work on the helminths of domesticated animals. Of course, your main work will be to find the intermediary hosts and methods of their destruction. It may perhaps become necessary to modify your scheme from time to time as we see how the work progresses.

## ENCLOSURE II.

COPY OF RESOLUTION No. 5 OF THE 7TH MEETING OF THE UNITED PROVINCES AGRICULTURAL RESEARCH COMMITTEE, HELD AT THE COUNCIL HOUSE, LUCKNOW, ON NOVEMBER 2ND, 1932, AT 11 A.M.

*Agenda.*

5. Consideration of an application from Dr. G. S. Thapar, M.Sc., Ph.D. (London), Reader in Zoology, Lucknow University, to the Imperial Council of Agricultural Research for a grant of Rs. 31,020 spread over five years for an inquiry into the Helminthiasis of cattle, sheep and goats in the United Provinces.

*Resolution.*

5. Resolved that the scheme as modified amounting to Rs. 25,400 is passed and recommended to the Imperial Council of Agricultural Research.

APPENDIX V.  
SUBJECT No. 5.

APPLICATION FROM THE DACCA UNIVERSITY FOR THE GRANT OF Rs. 1,756 ON ACCOUNT OF APPARATUS, ETC., FOR THE YEAR 1933-34, IN CONNECTION WITH THE SCHEME FOR AGRICULTURAL RESEARCH ALREADY SANCTIONED BY THE COUNCIL.

Attention is invited to the attached letter (Annexure) No. 141, dated the 11th January 1933 from the Government of Bengal and enclosures, on the subject mentioned above.

2. On the recommendation of the Advisory Board, in 1929, it was decided that each year's requirements for apparatus, etc., should be examined on their merits on receipt of details from the University. The annual requirements for apparatus were originally estimated by the University at Rs. 2,000 per annum, but the recurring amounts actually sanctioned up to the year 1932-33 are as follows:—

			Rs.
1930-31	..	..	6,518 including a capital grant of Rs. 5,000.
1931-32	..	..	1,806
1932-33	..	..	2,000 including a capital grant of Rs. 1,450.

3. The application for a grant of Rs. 1,756 for the year 1933-34 is now for the consideration of the Advisory Board.

CHARAN DAS,

Secretary.

The 16th January 1933.

## ANNEXURE.

COPY OF A LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BENGAL, AGRICULTURE AND INDUSTRIES DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, NO. 141, DATED THE 11TH JANUARY 1933.

SUBJECT :—*Seventh meeting of the Advisory Board of the Imperial Council of Agricultural Research.*

With reference to your letter No. 2081-G., dated the 18th November 1932 (not printed) on the subject mentioned above, I am directed by the Government of Bengal (Ministry of Agriculture) to forward herewith for inclusion in the agenda of the meeting of the Advisory Board to be held in February 1933 the two schemes noted below which have been approved by the Provincial Agricultural Research Committee, Bengal together with relevant extracts (Enclosure II) from the Committee meeting on the subject, and to say that the local Government recommend the same, subject to the condition that no financial liability devolves on them.

- (1) The renewal of the annual recurring grant for chemicals and apparatus to the Dacca University for the season 1933-34 in connection with research on (a) mechanical analysis of lateritic soils and (b) the nutrition of rice plant. (Enclosures I).

(2) \*

2. One hundred spare copies each of the scheme will be forwarded to you direct by the Director of Agriculture, Bengal.



## ENCLOSURE I.

Prof. J. C. Ghosh, D. Sc., Head of the Deptt.  
of Chemistry, University of Dacca.

DACCA UNIVERSITY,  
CHEMICAL LABORATORY,

The 10th December 1932.

To

THE SECRETARY,

PROVINCIAL RESEARCH COMMITTEE (AGRICULTURE), BENGAL.

DEAR SIR,

I beg to enclose herewith a list of apparatus and chemicals which are necessary for continuing the research work on the mechanical analysis of lateritic soils and on the nutrition of the rice plant, for the session 1933-34. The total expenditure amounts to Rs. 1,756. I beg to point out that the Dacca University Chemical Laboratory will, as in the past, supply ordinary chemicals and apparatus which are not required in bulk.

I shall be glad if you kindly place this request for a grant from the Imperial Council of Agricultural Research before the Provincial Research Committee at their next meeting.

Yours faithfully,

(Sd.) J. C. GHOSH.

Note regarding grant to Dacca University for researches into—

- (a) Method of mechanical analysis of lateritic soils, and  
(b) the nutrition of the rice plant.

Requirement for the session 1933-34.

Catalogue No.	Description.	Quantity.	Price. Rs. A. P.
Gallen-kamp 2365-6	Aspirator bottles, one each of 10, 5, and 1 litre. and three of 2 litres .. .. .	six	38 0 0
b2076d	Kjeldahl apparatus with glass parts and other fittings for four determinations .. .. .	one set	188 0 0
3096	Hot air oven 25 × 40 × 25 c. m. .. .. .	one	81 0 0
b196b	Water bath 30 × 23 × 9 c. m. six holes .. .. .	one	75 0 0
b3904	Soxhlets fat extraction bath for three tests with a set of spare elements .. .. .	one	170 0 0
3848	Extraction apparatus .. .. .	three	72 0 0
b3423	Rough balance for use in the pot culture house, capacity one Kgm. .. .. .	one	73 0 0
100	Beakers, various sizes .. .. .	4 doz.	63 0 0
373	Flat bottom flasks, 1,000 c. c. .. .. .	½ doz.	15 0 0
374	Conical flasks, 250-300 c. c. .. .. .	3 doz.	47 0 0
376	Kjeldahl flasks, 300 c. c. .. .. .	1 doz.	20 0 0
6316	Petri dishes, 20 cm. dia. .. .. .	1 doz.	45 0 0
1739	Stoppered Reagent bottle 1,000 c. c. .. .. .	1 doz.	25 0 0
1726	Unstoppered bottle for samples, various sizes .. .. .	1 gross	72 0 0
1531	Velvet corks, various sizes .. .. .	1 gross	25 0 0

Catalogue No.	Description.	Quantity.	Price. Rs. A. P.
203	Bunsen burner .. .. .	1 doz.	38 0 0
527	Iron clamp with bosshead .. .. .	1 doz.	45 0 0
511	Retort stands with 24" iron rod .. .. .	$\frac{1}{2}$ doz.	30 0 0
515	Retort stand rings, 4" dia. .. .. .	1 doz.	15 0 0
<b>Arthur Thomas</b>			
9654A	Thermo-regulator, Electric, Clerk, New Model B. .. .. .	one	113 0 0
<b>B T.</b>			
<b>L.</b>			
C5849	Stethoscope Receiver .. .. .	one	65 0 0
Tinsley	Buzzer for Electrolytic conductivity measurements .. .. .	one	75 0 0
	Dip-electrode to be made to order .. .. .	one	50 0 0
Merck	Chromic anhydride .. .. .	12 lbs.	66 0 0
	Conc. Sulphuric acid .. .. .	120 lbs.	120 0 0
	Ferrous ammonium sulphate .. .. .	12 lbs.	14 0 0
	Ether .. .. .	20 lbs.	58 0 0
	Caustic Soda flakes .. .. .	60 lbs.	40 0 0
	Magnesium Uste light .. .. .	5 lbs.	20 0 0
	<b>Total</b> .. .. .		<b>1,756 0 0</b>

## ENCLOSURE II.

EXTRACT FROM THE MINUTES OF THE FIFTH MEETING OF THE BENGAL PROVINCIAL AGRICULTURAL RESEARCH COMMITTEE, HELD IN WRITERS' BUILDINGS, CALCUTTA, ON FORENOON OF THURSDAY THE 15TH DECEMBER, 1932.

\* \* \* \* \*

5. Renewal of the annual recurring grant for chemicals and apparatus in connection with the research work on mechanical analysis of lateritic soils and on the nutrition of rice plant, conducted by the Dacca University. Dr. Ghosh asked for Rs. 1,756 for the session 1933-34. The Committee agreed that the Research Council should be asked to grant this amount.

## APPENDIX VI.

## SUBJECT No. 11.

**LINSEED-ACTION TO BE TAKEN TO TAKE FULL ADVANTAGE OF THE TARIFF PREFERENCE ON INDIAN LINSEED GRANTED BY THE OTTAWA AGREEMENT.**

The attention of the Board is invited to paragraphs 54 and 55 of the Report of the Indian Delegation, Imperial Economic Conference, 1932, and to paragraphs 3(c) and 12 of the Majority Report of the Committee of the Legislative Assembly (Annexure). A table (Statement A) is enclosed showing the imports of linseed into the United Kingdom for the period 1927 to 1931 from which it will be seen that there is a very large market to be captured. The same table shows that the total export of linseed from India to the United Kingdom for the similar period. There has been a very marked contraction in the area under linseed in India during the last 20 years and there appears to be little doubt that this is due to inability to compete in foreign markets. Hence the ten per cent. tariff preference now obtained in the United Kingdom is of very great importance. The attached table (Statement B) shows the area and yield of linseed in India from 1910-11 to 1931-32.

2. An examination of the course of exports shows that on the basis of pre-war production (1910 to 1913) India could supply the whole of the United Kingdom's requirements without reducing her exports to non-Empire countries. Linseed is an important crop in a number of Provinces, particularly the Central Provinces, United Provinces, Bihar, Bengal, Bombay and Hyderabad State as shown from the following table (Statement C) (abstracted from 'Estimates of Area and Yield of principal crops in India'). Linseed is frequently grown on land which is on the margin of profitable cultivation and there appears to be no doubt that a recovery of linseed production would be of real economic value to the country.

3. An enquiry has already been started regarding the types of linseed most in demand in the United Kingdom but it is important to note that Indian linseed or, at any rate the best types of Indian linseed, are not at a disadvantage in regard to quality. On this point, the Royal Commission on Agriculture noted that Indian linseed was more sought after than that of any other countries. A question for early consideration is whether intensive action should be taken to spread the improved types of linseed now available. The bold types Indian linseed have hitherto commanded a premium and some of the new Pusa types combine the advantage of bold seed with a plant habit suitable to the Indo-Gangetic Plain.

4. The Committee of the Legislative Assembly drew attention to the importance of improving India's power of competing in foreign markets by the improvement of grading, marketing and by the reduction of freight and other charges. It is for the consideration of the Board what action should be taken in these respects. A table (Statement D) showing the comparative prices of Indian and Argentine linseed is attached. From this it is clear that Indian linseed is at present out of parity with Argentine linseed even allowing for the higher quality of Indian linseed. The new duty will help to rectify the difference—especially when the new crop comes on the market.

CHARAN DAS,  
*Secretary.*

*Dated the 14th January 1933.*

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## ANNEXURE.

EXTRACT FROM THE REPORT OF THE INDIAN DELEGATION, IMPERIAL ECONOMIC CONFERENCE,  
1932.

54. The most important of the new preferences is that on linseed, on which a duty of 10 per cent. is to be imposed in the United Kingdom. Linseed is a prominent constituent of one of the most important groups of Indian exports—the oilseeds. In recent years Indian exports of linseed have shown a declining tendency and have never recovered their pre-war volume. During the quinquennium 1926 to 1930 the average imports of United Kingdom amounted to 314,000 tons a year, while during the same period India's exports averaged 215,000 tons a year, one-quarter of which was taken by the United Kingdom. It is obvious that in these circumstances the United Kingdom is in a position to absorb a much larger quantity of linseed than India exports and the new preference should lead to a marked increase in India's output of this class of oilseed. It does not appear that the decline in Indian production has been brought about by any factor other than waning demand, and the fact that Indian linseed production reached 533,000 tons in 1922-23 as compared with 257,000 tons in 1930-31 shows that there is considerable room for expansion. Indeed, with the fall in the prices of cereals and cotton, there is abundant scope for a substantial increase of production in several Indian provinces. An enlargement of the area under linseed in India by two million acres (representing an additional production of at least 250,000 tons) should not be difficult of attainment in a year or two in response to an increased demand. It appears to us that from the Indian point of view the preference is of great importance to agriculture and ought to lead to a substantial increase in Indian exports.

55. The United Kingdom is a large buyer of linseed, the oil being required for industrial purposes and the cake as feeding stuff—and at present she draws by far the larger portion of her supplies from the Argentine. The price at which her industrialists and farmers can obtain these commodities is of course a matter of great importance to her, and it would be idle to hope that the preference could be of long continuance unless Indian production increases in proportion to the increased demand. The extraordinary elasticity of Indian agricultural production in response to variations in world demand leads us to believe that India can without difficulty meet a very large part of the United Kingdom's requirements, but the matter is of such importance that we think the attention of the Agricultural Departments in the Provinces should be specially drawn to it.

EXTRACT FROM THE MAJORITY REPORT OF THE COMMITTEE OF THE LEGISLATIVE  
ASSEMBLY.

3 (c). *Linseed*.—While, in view of the large quantity which the United Kingdom at present takes from outside the Empire, there is no doubt that she is in a position to absorb much larger supplies from India than she receives at present, and while we see no reason to think that such a result will not take place we feel some doubt whether in view of selling pressure in the Argentine a preference of 10 per cent. *ad valorem* will lead immediately to displacement on any large scale in the United Kingdom market of supplies from the Argentine by the Indian product. The Delegation's Report recommends to the special attention of Provincial Departments of Agriculture the necessity for a rapid expansion of the production of linseed in order to enable the preference on it to be retained, but, in our view, if the preference is to be made really effective and if the fullest advantage is to be taken of it, a prompt and careful examination will also be necessary into the matter of grading, marketing and transport of Indian linseed with the object of securing the greatest possible reduction in cost. India is the sole supplier of linseed within the Empire.

12. It is difficult to forecast with any accuracy the actual effect which the operation of the preferences contained in the Agreement will have on India's trade with countries other than the United Kingdom and the non-self-governing Colonies. It is possible that

in the case of certain commodities expansion in one direction can be achieved only by diversion of the trade from existing channels. But in other commodities, among which we cite in particular linseed, groundnut oil, linseed oil, castor oil and rape oil, in view of India's capacity for enlarged production and the extent of the market available in the United Kingdom, the preference will evidently lead to a definite expansion of the total volume of Indian trade, since the market for these commodities which may be captured by India in the United Kingdom alone is greater than the total volume of Indian exports of the same products to all countries. The following are the relevant figures :—

Commodity.	Total value of trade held by India in the United Kingdom <i>plus</i> the potential additional market in that country.		Total value of Indian exports to all countries, including the United Kingdom.
	(Rs. 000.)		
Linseed .. .. .	6,58,80	5,72,37	
Groundnut oil .. .. .	90,13	4,02	
Linseed oil .. .. .	1,31,20	4,34	
Castor oil .. .. .	20,67	10,50	
Rape oil .. .. .	23,87	5,85	
<b>Total</b> .. .. .	<b>9,24,67</b>	<b>5,97,08</b>	

## STATEMENT A.

(Taken from the Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Countries, 1931.)

Imports of Linseed into United Kingdom.  
(in tons).

	1927.	1928.	1929.	1930.	1931.
Total .. .. .	352,612	347,111	283,982	222,865	337,913
	1927-28.	1928-29.	1929-30.	1930-31.	1931-32.
* From India .. .. .	57,451	18,072	79,536	57,605	14,033

\* Taken from Sea-Borne Trade Returns.

## STATEMENT B.

## Area and Yield of Linseed in India from 1910-11 to 1931-32.

	Area (Acres).	Yield (Tons.)
1910-11 .. .. .	3,742,400	571,300
1911-12 .. .. .	5,038,000	644,900
1912-13 .. .. .	4,124,900	542,100
1913-14 .. .. .	3,031,000	386,200
1914-15 .. .. .	3,325,000	397,000
1915-16 .. .. .	3,333,000	476,000
1916-17 .. .. .	3,564,000	526,000
1917-18 .. .. .	3,797,000	515,000
1918-19 .. .. .	1,989,000	235,000
1919-20 .. .. .	3,103,000	419,000
1920-21 .. .. .	2,234,000	269,000
1921-22 .. .. .	3,011,000	436,000
1922-23 .. .. .	3,382,000	533,000
1923-24 .. .. .	3,724,000	463,000
1924-25 .. .. .	3,695,000	501,000
1925-26 .. .. .	3,596,000	402,000
1926-27 .. .. .	3,331,000	406,000
1927-28 .. .. .	3,311,000	348,000
1928-29 .. .. .	3,109,000	322,000
1929-30 .. .. .	2,802,000	380,000
1930-31 .. .. .	3,008,000	377,000
1931-32 (Final) .. .. .	3,241,000	411,000

## STATEMENT C.

*Acreage of Linseed in each Province.*

(Taken from Estimates of Area and Yield of Principal Crops in India.)

Province.	1927-28.	1928-29.	1929-30.	1930-31.	1931-32 (Final).
United Provinces ..	1,053,000	760,000	731,000	954,000	903,000
Central Provinces and Berar (a).	1,017,000	1,027,000	839,000	777,000	990,000
Hyderabad ..	318,000	269,000	242,000	253,000	306,000
Bengal ..	118,000	132,000	114,000	116,000	126,000
Bombay (a) ..	109,000	125,000	137,000	145,000	135,000
Bihar and Orissa ..	601,000	658,000	654,000	654,000	654,000
Punjab ..	35,000	28,000	28,000	27,000	32,000
Rajputana (Kotah)	60,000	110,000	57,000	82,000	95,000
<b>Total ..</b>	<b>3,311,000</b>	<b>3,109,000</b>	<b>2,802,000</b>	<b>3,008,000</b>	<b>3,241,000</b>

(a) Including Indian States.

STATEMENT D.  
Actual quotation (per cwt.).  
Monthly prices of Indian and Argentine Linseed.

First week of	1925.						1926.						1927.						1928.						1929.						1930.						1931.						1932.							
	London.			Bombay Bold.	London.			Bombay Bold.	London.			Bombay Bold.	London.			Bombay Bold.	London.			Bombay Bold.	London.			Bombay Bold.	London.			Bombay Bold.	London.			Bombay Bold.	London.			Bombay Bold.														
	La Plata.	Bombay Bold.			La Plata.	Bombay Bold.			La Plata.	Bombay Bold.			La Plata.	Bombay Bold.			La Plata.	Bombay Bold.			La Plata.	Bombay Bold.			La Plata.	Bombay Bold.			La Plata.	Bombay Bold.			La Plata.	Bombay Bold.			La Plata.	Bombay Bold.		La Plata.	Bombay Bold.									
January .. ..	23	0	25	6	21	4	16	9*	19	9*	16	7½	18	9½	18	9*	15	6	15	6	18	1½	15	1½	16	3	18	10½	16	1½	19	9	23	0	20	(a)2¼	8	5¼	*12	0¾	10	1½	8	10½	11	9	9	5		
February .. ..	23	1½	25	9	22	3	16	9	18	6	16	9	17	6	19	0	16	1½	15	4½	18	9*	15	0	16	3	19	4½	16	3	17	0	19	9	17	(a)6	8	4½	..	..	10	4½	8	7½	12	1½	9	7½		
March .. ..	22	6	25	4½	21	8¼	14	3	17	6	15	4	15	3	19	0	16	1½	15	9	17	9	15	0	16	0	19	6	17	3	16	6	18	3	16	(a)9	9	3	..	..	11	5¼	8	10½	12	6	10	5½		
April .. ..	20	3	22	10½	19	8¼	15	0*	17	6*	15	5¼	14	8¼	18	6	15	7½	15	9	18	2¼	15	1½	16	0	18	7½	16	0	18	3	20	3	17	10½	9	0	Nom	10	9	7	10½	11	6	9	0¼			
May .. ..	20	6	22	7½	19	6	15	0*	17	7½*	15	6¾	16	0	19	0	16	4	16	3	18	9¼	16	0	16	1½	18	8¼	16	1½	18	0	19	6	17	0¾	8	7½	11	7½	10	2½	7	9	10	9	8	7		
June .. ..	20	6	23	4½	20	4½	14	9	17	4½	15	4½	16	9	19	4½	17	0	16	0	18	10½	15	10½	15	4½	18	2¼	15	8¼	17	4½	19	1½	16	10½	8	3	11	3	9	0¾	7	6	10	9	8	2¼		
July .. ..	18	6	20	10½	19	9¾	16	2¼	18	10½	16	3	16	2¼	19	3	16	6	15	10½	18	4½	15	9	16	10½	19	0	16	6	15	6	17	7½	15	6	9	1½	12	3¾	10	1	8	0	10	7½	8	9¾		
August .. ..	20	4½	22	0	19	11¼	16	10½	19	6	16	7½	15	9	18	9	15	10½	15	7½	18	3	15	4½	20	4½	21	9	18	9¾	15	3¾	18	6	15	10½	8	2¼	11	3	9	4	8	3	10	9	8	9		
September .. ..	19	4½	22	6	19	6	16	6	18	3	16	0¾	15	7½	18	3	15	6	15	3	17	6*	15	2¼	20	9	22	3	19	0¾	14	9	17	10½	15	10½	7	7½	9	6	8	1½	9	3	12	0	10	0½		
October .. ..	18	9	22	3	19	4½	15	7½	17	9	15	6	15	8¼	18	3	15	3	16	0	18	10½	16	0	22	4½	23	10½	20	6	12	6	15	4½	13	8¼	8	5¼	10	7½	8	8¼	..	..	..	..	..	..	..	..
November .. ..	18	4½	21	1½	18	8	16	3	18	6*	15	7½	15	3	17	9	15	1½	16	0¾	18	7½	15	10½	22	0	23*	9	20	6	11	4½	14	6	12	3	9	6	12	4½	9	8½	..	..	..	..	..	..	..	
December .. ..	18	6	21	6	18	7½	16	6	18	6	15	7½	15	3	18	0	15	6	16	9	19	2¼	16	2¼	20	7½	23	4½	19	10½	11	9*	13	0	10	10½	9	4½	11	9	9	5¾	..	..	..	..	..	..	..	

\* In the absence of comparative quotations for the first week, those for a subsequent week taken.

(a) New crop.



## APPENDIX VII

## SUBJECT No. 6.

**INVESTIGATIONS INTO INDIGENOUS DRUG PLANTS IN THE UNITED PROVINCES AND THEIR EFFECTIVE EXPANSION AS AGRICULTURAL CROPS.**

Attention is invited to the attached letter (and enclosures) from the United Provinces Government, No. 2623, dated the 12th January 1933, forwarding the scheme mentioned above (Annexure I). The recommendation of the Provincial Agricultural Research Committee will be found in Annexure II. The scheme consists of two parts, one requiring a grant to the Benares Hindu University of a total sum of Rs. 40,380 and the other an allotment of Rs. 61,590 to the Agricultural Department of the United Provinces. The total expenditure involved is Rs. 1,01,970 spread over a period of 5 years.

2. The scheme is submitted for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 23rd January 1933.*

## ANNEXURE I

COPY OF LETTER FROM THE SECRETARY TO GOVERNMENT, UNITED PROVINCES, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 2623, DATED THE 12TH JANUARY 1933.

SUBJECT:—*Investigations into indigenous drug plants in the United Provinces and their effective expansion as agricultural crops.*

I am directed to forward for consideration at the next meeting of the Advisory Board of the Imperial Council of Agricultural Research an application from the United Provinces Government for a total grant of Rs. 1,01,970 (Rs. 14,200 non-recurring and Rs. 87,770 recurring), spread over five years, for investigations into indigenous drug plants of the United Provinces and their effective expansion as agricultural crops.

2. The scheme has been approved by the United Provinces Agricultural Research Committee a copy of whose resolution in connection therewith is enclosed and the Director of Agriculture, United Provinces, has revised the details, as requested by the Committee, and has reduced the estimated cost of the investigations from Rs. 1,57,490 to Rs. 1,01,970 spread over five years.

3. The Governor, acting with his Ministers, recommends the application for favourable consideration.

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AN APPLICATION FROM THE UNITED PROVINCES GOVERNMENT TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH FOR A TOTAL GRANT OF Rs. 1,01,970 (Rs. 14,200 NON-RECURRING AND Rs. 87,770 RECURRING SPREAD OVER FIVE YEARS) FOR INVESTIGATION INTO INDIGENOUS DRUG PLANTS OF THE UNITED PROVINCES AND THEIR EFFECTIVE EXPANSION AS AGRICULTURAL CROPS AS REVISED BY DIRECTOR OF AGRICULTURE IN ACCORDANCE WITH RESOLUTION No. 8 OF THE UNITED PROVINCES AGRICULTURAL RESEARCH COMMITTEE HELD ON NOVEMBER 2, 1932.

#### Introduction.

From very ancient times India has been famous as a land of medicinal plants possessing wonderful curative properties, and illustrious writers of the type of Charaka, Sushruta, Narahari Pandita, Madan Pala, Bhava Misra and others have devoted their talents and untiring energy towards the evolution of a system of curative science from these indigenous drugs of India. In more recent times also valuable contributions have been added to this branch of knowledge by such famous authors as Dymock, Warden, Fluckiger, Baden Powell, Dey, Kirtikar, Roxburgh and others. Due to the labours and untiring efforts of these savants India is now in the coveted position of having a *Materia Medica* of its own, namely, the "Ayurvedic" system of medicine. India has given to the world such wonderfully efficacious medicinal plants as colocynth (*Citrullus colocynthis*), poppy (*Papaver somnifera*), aconite, nux vomica, ginger, asafoetida, jalap (*Ipomoea turpenthum*), cassia, kurchi (*Holarrhena antidysentrica*), chaulmugra, nim, isabgul (*Plantago ovata*), chist (*Plumbago rosea and zylanica*), vidanga (*Embelia ribes*), kamala (*Malotus philipinensis*) and hundreds of others, which from the point of view of curative properties in human ailments are unrivalled. Every year vast quantities of these Indian drugs are exported to foreign countries, the trade returns for this item alone often reaching to eight figures in Indian currency. The extraction of the active principles of such medicinal plants in the form of crystalline substances, resins, volatile or fixed oils and tinctures is a flourishing industry in many parts of Europe and America (in recent years it has become an important industry in India also), and the products derived from these industries find a ready market and are very easily absorbed in the preparation of allopathic, homeopathic and biochemic medicines, patent drugs and cures, toilet preparations, insecticides, condiments, preservatives and hundreds of other useful things. In India also the *kavirajas*, *vaids*, *hakims*, *gunans*, quacks, etc., consume vast quantities of these drugs for curing the untold diseases and ailments to which the poverty-stricken multitudinous millions of India are subject.

From what has been said above it can be easily seen that in the medicinal plants of India there is an unlimited resource potentially capable of vastly improving her economic conditions as well as bringing about a better state of general health for her sons and

daughters. In order to evolve such a state of affairs it will require organization on a large scale both from the point of view of systematic chemical and pharmacological examination of the countless medicinal flora as well as their intensive cultivation under suitable conditions. India being essentially a tropical country with a blazing sun and a humid atmosphere with an inevitable concomitant of such conditions, namely, a rank growth of vegetation of all descriptions, it will require a colossal amount of chemical, pharmacological and agricultural research in order to determine the really active plants from the useless ones and evolve methods of their cultivation and improvement.

A perusal of paragraphs 287 to 291 (pages 121, 122, 123) of the report of the Government of India Drugs Inquiry Committee, 1930-31, will clearly bring home the urgency and importance of the subject. The report urges on the Government to impress on the Imperial Council of Agricultural Research the necessity of giving immediate attention to this problem. The following quotations will serve the purpose.

"Many witnesses in different provinces have drawn the attention of the Committee to the difficulty of identifying, selecting and procuring medicinal herbs of good quality. There appears to be a large demand for such raw material, but the supply is not commensurate with it. If a regular supply of genuine raw materials is assured, a great obstacle will be removed from the path of the drug manufacturers in India. It will also confer incidentally a lasting benefit to a large section of the population, dependent on the indigenous practitioners, who now obtain their supply from *panvaries* and *attars* dealing in stocks unusually old and inert and stored under very unsatisfactory conditions.

Cultivation of medicinal plants on a commercial scale under the Government experts will, in the opinion of many witnesses, remove one of the serious obstacles to the development of drug manufacture in India. The Committee considers that the practicability of the suggestions should be further explored. India is a veritable emporium of medicinal plants. Nearly three-fourths of the drugs mentioned in the British and other Pharmacopœias grow here. India possesses climatic conditions varying from the torrid to the frigid. It embraces vast tracts of tropical plains, temperate hills and valleys, irrigated soil, and moist and dry climates. It has, in fact, been described as the epitome of climates, seasons and soils of the British Empire. It is therefore possible that the drugs which do not now grow within her bounds can be made to do so. Acclimatization is possible to a large extent with almost any plant, and there are many instances where plants, indigenous to one country and originally marketed from there only, have been successfully introduced into other countries.

In India, reliance has been, so far, almost entirely placed on the natural resources of the country and herbs growing wild have been chiefly collected and utilized. The great impediment in the development of forest drug resources has always been the question of transport. These forests, in many instances, are situated hundreds of miles from the railway, and consequently the transport of forest products is beset with difficulties and expense. Moreover, the forest resources, even if utilized to the fullest extent, will not be for ever sufficient for the needs of the country, as many important medicinal herbs and plants do not grow in India in a state of nature. The subject of cultivation of medicinal plants, therefore, should receive the special and careful attention of the Government.

Important medicinal plants such as digitalis, ipecacuanha, cinchona and jalap, etc. have already been grown in India and there is no reason why the country should not grow almost every drug needed to supply her own wants and at the same time develop a large export business. A large export trade in some of the pharmacopœial drugs already exists. Little reliance can be placed on the nature and quality of the wild-grown drugs, and this presents a serious drawback to their employment for therapeutic purpose. It is for this reason that India imports not only prepared drugs but also raw materials to the extent of many lakhs of rupees annually. Vast tracts of land are available in this country which if utilized for systematic cultivation, will make genuine drug available to the people at a reasonable price. In countries like Germany and Belgium, medicinal plants and essential oil gardens have proved a great success. The State authorities in France and America have displayed a great deal of interest in growing drugs on an extensive scale. In the United States of America, there is a Bureau of plant industry attached to the Botanical section

of the Department of Agriculture where all questions relating to the development of drug cultivation are considered. This Bureau sends its agricultural experts to the various parts of the world to investigate the climate, soil and environments suitable for the growth of a particular plant with a view to introduce it into their own country. This idea of the progress made is evident from the publications of the department which appear from time to time. Even the Commonwealth of Soviet Russia has started a Bureau for carrying on a drug trade. Those departments are doing splendid work in their respective countries.

The establishment of a drug emporium in India was suggested many years ago, but has not yet materialized. Experimental drug farms have been started on a small scale in places like Mungpoo and Saharanpur but there spheres of activity are limited. Creation of greater interest in this direction will prove advantageous to the country in general and to the drug industry in particular. The Government of the United Provinces has already taken a right step by appointing a committee of experts to investigate this question—a lead which other Local Governments may, with advantage, follow. The co-operation of expert botanists, pharmaceutical chemists and pharmacologists, is essential for the success of any scheme to further drug cultivation. Their advice will be valuable not only regarding the locality where particular drugs can be successfully cultivated, but also about the time suitable for cultivation, collection, etc., with a view to obtain the maximum activity and yield. They can devise methods for improving the content of active principles in cases where they are deficient. The establishment of Imperial Council of Agricultural Research, with the large funds at its disposal, ought to make this easy. The Committee would urge on the Government to impress on the Council the necessity for giving immediate attention to this important aspect. Without development in this direction, the drug industry in this country will take a long time to take root and flourish."

*Sustainability of the United Provinces for such investigations.*

A variety of climatic soil and ecological conditions ranging from low hot country to the big snow clad Himalayan peaks with a limit to vegetation, from the heaviest to the lightest soil, from a very heavy rainfall to very low, from densely-populated tracts to the thinnest ones, all render the United Provinces as the most suitable country for investigations on the cultivation of medicinal plants. The Himalayan drugs and herbs are too well known for their curative properties and the Ayurvedic literature is full of praise for the efficiency of these drugs. They cannot be grown at all nor so elsewhere in this country.

The location of the Imperial Forest Research Institute at Dehra Dun can be utilized with advantage for identification of medicinal flora and other help desired in this direction. The Imperial Institute of Veterinary Research at Muktesar (Naini Tal district) can also take up the veterinary side of the question later, if so desired.

Investigations of the nature of general analysis and commercial preparations of the drugs for the crude materials which form part of the scheme could be developed with the help of Harcourt Butler Technological Institute at Cawnpore. This is one of the best industrial research institutions in Northern India and is situated in the United Provinces.

Attempts at such investigations have also been made in the past in these provinces and some concerted action was taken by Government in Kumaon hills, at Mussoorie and Saharanpur. Though the records of this work are meagre, but these should show some guiding facts for future plan of work. The work on belladonna was carried farther than anything else and yielded very favourable financial results during the last European War even in the unorganized stage. The work appears to have been abandoned of late due perhaps to financial difficulties.

United Provinces was the first Local Government to institute an inquiry into the possibilities of developing medicinal flora. As a result of the recommendations of the Local Drugs Committee, the Government approved of the proposals for carrying out the various investigations on a small scale, but the present financial conditions compelled the work to be carried on with what can possibly be done without funds and staff for the purpose. Under the circumstances it has not been possible to make much headway with this work.

The Ayurvedic School of Benares Hindu University is already engaged on investigation of medicinal plants. The University draws its students from all over India for this training and is unique in possessing facilities in a centralized place for co-ordinating the study of the Indo-European system of medicine. The Government of the United Provinces has recognized the work done by this University in this direction, and has made an annual grant of Rs. 50,000. Fundamental work of enriching the supply of medicinal plants after extensive investigation remains yet to be done. The co-operation of the University is obtained and a part of the scheme as detailed below is entrusted to its care.

The United Provinces has already got a more or less organized system of collection and supply of medicinal plants to India and abroad; many important depots of medicinal plants are situated at Dehra Dun, Almora and Benares, etc. Thousands of rupees worth medicinal plants are supplied by these depots to Punjab, Assam, Central Provinces, Bengal and outside India. The local Drugs Committee, during the course of evidences, found that one of the depots had a contract of supply of drug plants to various municipal and district boards in the Central Provinces. One of the witnesses told the Committee that the total value of herbs consumed in the city of Benares alone amounted to about Rs. 50,000 annually. The Committee received a general complaint of absence of supply of genuine material from the forest. The markets were flooded with spurious articles and some *vaid*s and *hakims* were carrying out trade in most irresponsible manner. The witnesses strongly advocated the urgent necessity of research into this industry, resulting in correct identification of plants and some kind of Government control for supply of right material possessing proper quantity of active principles.

The scheme is forwarded to the Imperial Council of Agricultural Research with the hope that the information contained in the scheme will show that with the help of the grants-in-aid applied for from the Imperial Council of Agricultural Research a very useful centre of farming and investigations of medicinal plants both for plains and hill type of an all-India importance can be developed in these provinces.

The question of an adequate scheme of research in medicinal and drug plants was considered by a Sub-Committee appointed by the United Provinces Agricultural Research Committee. The original scheme as put up by the Sub-Committee was of a much wider character than now submitted as it included chemical investigation, pharmacological research, analytical and commercial research at Allahabad, Lucknow, and Harcourt Butler Technological Institute, Cawnpore, respectively. It was in short a complete scheme dealing with the botanical and agricultural aspects of the problem together with those aspects which are associated with the utilization of the products of cultivation. The original cost of the complete scheme was Rs. 1,57,490. The United Provinces Agricultural Research Committee, however, after examination of this scheme decided that in view of the fact that the Imperial Council of Agricultural Research had already financed schemes which dealt largely with the chemical and pharmacological aspects of the problem, the scheme as proposed by the United Provinces Government should be restricted to the more agricultural aspect of medicinal plant and drug research. It was felt that as the financing of these proposals rested with the Imperial Council of Agricultural Research, a scheme which was principally agricultural in character and designed to develop the growth of drugs on cultivated land, was more in keeping with the objects for which the Research Council exists. The cost of the revised and the reduced scheme amounts to Rs. 1,01,970.

#### I.—BOTANICAL STUDY, COLLECTION AND FIELD CULTIVATION TRIALS OF THE DRUGS AND MEDICINAL PLANTS AS ARE FOUND IN THE PLAINS.

A.—Allotted to Benares Hindu University (Dr. B. N. Singh, Head of the Department of Agriculture, Benares Hindu University).

A co-ordinated study of the Indian and European allopathic systems of therapeutics has been one of the primary aims of the Benares Hindu University. Towards this end the

University started the Faculty of Medicine and Surgery with the following subjects:—

First professional examination.—Hygiene, Chemistry, Physics, Zoology and Botany.

Second professional examination.—Diagnosis and treatment of diseases, Surgery, Pathology, Obstetrics and Gynæcology, Bacteriology, Medical Jurisprudence, Toxicology, Diseases of children and mental diseases.

The objects of the Faculty of Medicine and Surgery of this University were thus formulated:—

To consider and advise so far as funds permit, such measures as it may from time to time deem necessary for—

- (i) "the promotion of scientific study of and researches in Ayurveda and the publication of important works connected therewith ;
- (ii) the investigation of the properties of medicinal herbs and minerals and the manufacture of Ayurvedic medicines ;
- (iii) the correlation of Ayurveda with other systems of medicine, and,
- (iv) the education and examination of students in Ayurveda."

For imparting the necessary instruction the University has established a College of Medicine and Surgery, a hospital with 100 beds, a dissection hall and pharmacy for the preparation of drugs, *rasayan* and other pharmaceutical preparations. The College of Medicine and Surgery is for the present housed in the Sir Sunder Lal Hospital and a large dissection hall, and the laboratory work in Botany, Zoology, Chemistry and Physics is conducted in the respective general departments of the University.

The College has a medico-botanical garden of about 22 acres attached to it, with plenty of land for extension, where plants of botanical and medicinal interest are cultivated. These plants are used for the preparation of drugs and *rasayans* of various kinds both for the use of indoor patients as well as for sale to the general public.

The medico-botanical garden is meant to supply a long-felt want for the cultivation and supply of authenticated medicinal plants for the preparation of drugs.

The need of correctly-identified plants in the preparation of medicines hardly requires to be emphasized. Lack of accurate knowledge about such medico-botanical plants has in the past led to grievous results specially in the hands of *pansearies*. Even among *vaidyas* who are learned in Ayurvedic Shastras only a few possess an accurate knowledge of herbs and so mistakes are made in identification of medicinal plants. There are so many varieties of a species, and each variety has such different medicinal properties that the probability of one being mistaken for another by one who has not been specially trained in the subject is great, and the result cannot but be deplorable. Variations in a species arising from climatic and edaphic causes, from the influence of age and developmental stage of the plants which have their own effect on its therapeutic value further complicate matters, and make it very difficult for the botanically untrained student to select the medicinal plant correctly.

To enable the farming and systematic investigation of medicinal plants obtained from different parts of India on an adequate scale more funds and facilities are required. It hardly needs mention that India is very rich in her natural resources of such plants and if this wealth could be exploited in the standardization and preparation of Indian drugs, it would not only lead to the improvement of the health of the Indian people but also to their economic betterment for the drug industry is a flourishing industry in the western countries. Every facility exists to make it so in India also.

The financial position of the University does not permit it to incur more expenditure on this branch at present. But the work is important. The Imperial Council of Agricultural Research is approached with the request that a suitable grant be made by it for

the development of this branch of investigation. If the grant asked for is received, it is intended to take up the following programme of research :—

(1) Collection, identification, classification, standardization and preservation of medico-botanical plants on a scientific basis. Physiological study of the fundamental conditioning factors leading to the formation, material transformation, storage and transport to various organs of the active principles of plants. Pure line selection of varieties of medicinal plants.

(2) Farming of plain type of medicinal plants on large scale including the erection of nursery, selling of certified medicinal plants after standardization.

To carry out the programme of work outlined above the following facilities in addition to those already existing at the University will be needed :—

(1) Facilities for the collection of plants by touring in different parts of India.

(2) Field facilities for extensive scientific cultivation of medico-botanical plants.

#### DETAILS OF COST.

For botanical investigation and to extend the present area of cultivation from 22 to 50 acres so as to allow of experiment in the suitability of these plants for field cultivation and the best method of doing so.

<i>Non-recurring.</i>						
	Rs.					
(1) Well (increased irrigation facilities) .. ..	..	..	..	..	..	3,000
(2) Fencing of extension .. ..	..	..	..	..	..	1,500
(3) Shedding .. ..	..	..	..	..	..	1,000
(4) Laboratory equipment .. ..	..	..	..	..	..	2,000
(5) Farm equipment, bullocks and implements .. ..	..	..	..	..	..	800
						8,300
						Total ..
<i>Recurring.</i>						
	1st	2nd	3rd	4th	5th	Total.
	year.	year.	years.	years.	years.	
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<i>Staff.</i>						
One Botanical Assistant also in charge of farm (Rs. 150—10—200).	1,800	1,920	2,040	2,160	2,280	10,200
One General and Field Assistant (Rs. 30—2—38).	360	384	408	432	456	2,040
One Laboratory attendant (Rs. 12—1—16).	144	156	168	180	192	840
<i>Allowances.</i>						
Travelling allowance .. ..	800	800	800	800	800	4,000
<i>Contingencies.</i>						
Laboratory and general contingent expenditure.	1,200	1,200	1,200	1,200	1,200	6,000
Farm expenditure, labour, supplies etc.	1,800	1,800	1,800	1,800	1,800	9,000
						Total ..
	6,104	6,260	6,416	6,572	6,728	32,080
Total, recurring .. ..	..	..	..	..	..	32,080
Total, recurring and non-recurring.	..	..	..	..	..	40,380





*Research farms.*  
Two hill farms (20—40 acres).  
*Non-recurring.*

	Rs.
Lay-out (800×2) .. .. .	1,600
Fencing (500×2) .. .. .	1,000
Bullocks (150×2) .. .. .	300
Sheds and godowns (1,000×2) .. .. .	2,000
<b>Total, non-recurring</b> .. .. .	<b>4,900</b>

	<i>Recurring.</i>					Total
	1st year.	2nd year.	3rd year.	4th year.	5th year.	
	Rs.	Rs.	Rs.	Rs.	Rs.	
One fieldman (Rs. 40—5—65) .. .. .	480	540	600	660	720	3,000
Compensatory and hill allowances at Rs. 10 per mensem.	120	120	120	120	120	600
Travelling allowance .. .. .	100	100	100	100	100	500
Running charges of farm .. .. .	1,500	1,500	1,500	1,500	1,500	7,500
Tour charges .. .. .	75	75	75	75	75	375
<b>Total, Recurring</b>	<b>2,275</b>	<b>2,335</b>	<b>2,395</b>	<b>2,455</b>	<b>2,515</b>	<b>11,975</b>
<b>Total, recurring for two farms</b> .. .. .						<b>23,950</b>

*An abstract of the cost of the complete scheme.*

	Recurring.	Non recurring.	Total.
	Rs.	Rs.	
I.A.—Benares Hindu University scheme .. .. .	32,080	8,300	40,380
I.B.—Hill scheme of the Department of Agriculture (United Provinces Government) .. .. .	31,740	1,000	61,590
	23,950	4,900	
	55,690	5,900	..
<b>Total cost</b> .. .. .	<b>87,770</b>	<b>14,200</b>	<b>1,01,970</b>

## ANNEXURE II.

COPY OF RESOLUTION No. 8 OF THE 7TH MEETING OF THE UNITED PROVINCES AGRICULTURAL RESEARCH COMMITTEE HELD AT THE COUNCIL HOUSE, LUCKNOW, ON NOVEMBER 2, 1932, AT 11 A.M.

*Agenda.*

8. Consideration of an application from the United Provinces Government to the Imperial Council of Agricultural Research for a total grant of Rs. 1,57,490 (Rs. 20,600 non-recurring and Rs. 1,36,890 recurring) spread over five years for investigations into indigenous drug plants of the United Provinces and their effective expansion as agricultural crops.

*Resolution.*

8. Resolved that this Committee approves of 1 (a) and 1 (b) of this scheme in principle but as regards details the Director of Agriculture might be asked to look into them again before sending finally to the Imperial Council of Agricultural Research.

## APPENDIX VIII

## SUBJECT No. 7.

**APPLICATION FROM THE GOVERNMENT OF THE UNITED PROVINCES FOR A GRANT OF Rs. 4,650 SPREAD OVER A PERIOD OF THREE YEARS FOR INVESTIGATIONS INTO MALTING AND BREWING TESTS OF IMPROVED BARLEY.**

In May 1930 the Government of the United Provinces submitted an application for a grant of Rs. 15,000 spread over a period of three years for experiments on manuring and marketing of new types of barley (Annexure I). The scheme was considered by the Advisory Board at its meeting held in January 1931 and the Board recommended it for sanction (Annexure II). The Governing Body, however, at its meeting held in May 1931, refused sanction to the scheme (Annexure III).

2. The United Provinces Government have now submitted (Annexure IV) a revised scheme (enclosure II to Annexure IV) for investigations into malting and brewing tests of improved barley which involves a total expenditure of Rs. 4,650 spread over a period of three years.

The revised scheme is for the consideration of the Advisory Board.

CHARAN DAS,  
*Secretary.*

*The 19th January 1933.*

## ANNEXURE I

## APPLICATION OF THE U. P. DEPARTMENT OF AGRICULTURE FOR A GRANT OF Rs. 5,000 FOR 3 YEARS FOR EXPERIMENTS ON MANURING AND MARKETING NEW TYPES OF BARLEY.

A number of new strains of barley were isolated by the Assistant Economic Botanist in 1927 and 4 of these are now being distributed in the principal barley growing tracts of the province.

Samples of grain have been sent for examination by experts of the Institute of Brewing, London, who were impressed by their quality and superiority to the barley usually shipped to their country. The Institute submitted through the Secretary of State and the Government of India a request to the U. P. Government to extend this work and offered the assistance of the Barley Research Committee. This offer has been accepted.

Three important points for examination are :—

- (i) Methods of packing for shipment.
- (ii) Manurial requirements.
- (iii) Further investigation of types cultivated in districts which have not been completely surveyed.

In subsequent correspondence with the experts of the Institute it has been decided that the best course would be to send samples of 50 quarters of grain of selected types for a period of 5 years for duplicate or triplicate brewing tests and at the same time to examine methods of packing and times of shipment. The experiments on packing with samples grown by cultivators will be started in the Rabi of 1931.

Three kinds of containers will be tried :

- (i) Double Hessian bags,
- (ii) Jute canvas bags,
- (iii) Single jute bags,

with the object of deciding which type of material afford the best protection against deterioration of germinating capacity during transit.

It is proposed to carry out the manurial experiments at the Cotton Research Farm, Raya, in the Muttra district ; as these can be easily fitted in with cotton experiments. The manurial scheme will be framed with the object of ascertaining the effect of varying dressings of nitrogen in forms commonly available on the quality of barley under Indian conditions.

The U. P. produces 60 per cent. of the barley grown in India and there is still a large area in the eastern and north-eastern parts of the province in which the types grown have not been examined. It is proposed to make a collection of types from these districts and isolate pure cultures.

The U. P. Department of Agriculture have received numerous communications from exporting firms, trade commissioners, and others interested in developing the barley trade indicating the eagerness of barley consumers overseas to obtain increased supplies from the surplus stocks available for export from the United Provinces, and there is little doubt that a premium would be paid for types of barley which meet the requirements of the overseas market.

The broad details of the expenditure involved are given in the Enclosure.

The Imperial Council of Agricultural Research is asked to provide a grant of Rs. 5,000 for 3 years (a total grant of Rs. 15,000) for this work subject to the condition that a report on the results of the work done will be submitted by the Assistant Economic Botanist through the Local Government at the end of 12 months from the date on which the grant is placed at the disposal of the Local Government and thereafter at yearly intervals during the currency of the grant.

The scheme for which assistance is now sought appears to the U. P. Government to fulfil the conditions laid down in paragraph VI of the memorandum\* on the constitution and functions of the Empire Marketing Board and the Imperial Council are asked if they cannot entertain the application themselves to forward it to the Empire Marketing Board for consideration according to the procedure laid down in paragraph VII of the memorandum\* referred to above.

With regard to the contribution of the Local Government to the scheme it is impossible to give separate figures for the amounts allotted to barley investigations but evidence that the contribution exceeds the sum asked for is furnished by the following :—

The total budget allotment of the Assistant Economic Botanist is Rs. 30,164 plus Rs. 11,580 pay of 7 members of the Subordinate Agricultural Service. He is working on three problems, cotton, barley and wheat.

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\* Not printed.

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## ENCLOSURE TO ANNEXURE I.

*Estimated items of expenditure from the grant of Rs. 5,000 applied herewith.*

	Rs.	A.	P.
1. Sample of 300 maunds of barley at Rs. 4/8 per maund ..	1,350	0	0
2. Packing .. .. .	120	0	0
3. Loading and other handling charges at /1/ per bag ..	9	6	0
4. Railway freight to Karachi at /12/ per maund ..	225	0	0
5. Unloading and other charges at /4/ per maund ..	37	8	0
6. Steamer freight to London (estimated) ..	250	0	0
7. Unloading and other expenses in London ..	37	8	0
8. Other charges, commission, wharfage, customs, etc. ..	150	0	0
9. Barley Survey—Cost of arranging the collection, pay of staff and travelling expenses, etc. .. .. .	2,000	0	0
10. Manurial experiments .. .. .	750	0	0
11. Rounding .. .. .	70	10	0
Total	5,000	0	0

EXTRACT FROM THE MINUTES OF THE 2ND MEETING OF THE UNITED PROVINCES AGRICULTURAL RESEARCH COMMITTEE HELD ON JUNE THE 2ND, 1930.

\* \* \* \* \*

III. The Committee considered an application from the Department of Agriculture, United Provinces, for a grant of Rs. 5,000 annually for 3 years for experiments in marketing new types of barley.

The application was discussed and approved and the following resolution was passed by the Committee :—

“ The Committee agrees to recommend to the Imperial Council of Agricultural Research, the application of the Department of Agriculture, United Provinces, for a grant of Rs. 15,000 spread over a period of 3 years for experiments on manure and marketing in new types of barley.”

## ANNEXURE II.

## EXTRACT FROM THE PROCEEDINGS OF THE ADVISORY BOARD, JANUARY 1931.

“ Mr. Sethi introduced the scheme. Mr. Burt said that it was very satisfactory to note that through the agency of the Indian Trade Commissioner arrangements had now been made whereby at the request of the Council the Institute of Brewing would carry out detailed examination of barleys including actual malting tests at the moderate cost of from 3 to 4 guineas per sample. Mr. Milne recalled that a few years ago a firm of barley exporters had found that while certain cargoes of barley which they exported to England from the Punjab were quite good, other cargoes did not germinate evenly on the malting floor. He had found that barleys from different localities germinated after different periods in germination pans and he advised firms to see that consignments from Karachi consisted of barleys from the same locality. He thought that this was a matter which should be further investigated. In any case he would like the Punjab to be included in this investigation. Mr. Burt said that there would be no difficulty in the Punjab participating, if Mr. Milne would put up a suitable scheme it could be considered at the next meeting of the Board.

The Board agreed to recommend the scheme for sanction.”



## ANNEXURE III,

EXTRACT FROM THE PROCEEDINGS OF THE GOVERNING BODY MEETING HELD IN MAY 1931,

14. *Application from the United Provinces Government for a grant of Rs. 5,000 for three years for experiments on manuring and marketing new types of barley. (Subject No. 12 of the Agenda.) Cost of the scheme over a three year period : Rs. 15,000.*

Mr. Gokhale was of opinion that without any extra expenditure of money the scheme instead of being located in the United Provinces should be worked from Pusa. This would be of help to Bihar which was also interested in barley. Mr. Mehta said that they in the United Provinces were quite willing to co-operate with Bihar in this matter but the reason why his province had put forward the scheme was that they had a well qualified officer, on whose work the Empire Marketing Board had commented very favourably, to carry it out. Sir Joseph Kay said that as 60 per cent. of the barley grown in India was grown in the United Provinces—the scheme was of purely provincial concern. Mr. Carpenter said that this was an example of a piecemeal scheme. It had no relation to the major problems of India. The Hon'ble Mr. Deshmukh supported Mr. Gokhale in recommending that the scheme should be worked from Pusa. The Hon'ble Maulvi Abdul Hamid said that to his mind it was a question of selection of varieties and there was no need of a grant from the Council. The Hon'ble Sir Frank Noyce supported the scheme. He said it was, at this time especially, a major national problem to get goods out of this country. Just as we wanted to get the surplus of wheat exported so it would be a good thing if the surplus of barley also found a market abroad. Sir Joseph Kay did not agree. He said that in the Bombay Research Committee a somewhat similar scheme of the export of mangoes was not recommended because they considered that it was a purely provincial matter. The fact that 60 per cent. of the barley grown in India was grown in the United Provinces confirmed him in the opinion he had already expressed that this was a matter of provincial concern.

In the result the Governing Body refused sanction to the scheme by 8 votes to 7.

## ANNEXURE IV.

COPY OF A LETTER FROM P. M. KHAREGAT, ESQ., I.C.S., M.L.C., SECRETARY TO GOVERNMENT, UNITED PROVINCES, No. 1713, DATED THE 13TH JANUARY 1933.

With reference to the correspondence ending with your letter No. 1151/Agri., dated May 30, 1932 (not printed), I am directed to forward herewith an application, with 100 spare copies, from the United Provinces Government for a total grant of Rs. 4,650 (recurring) spread over three years for investigations into malting and brewing tests of improved barley. The scheme has been revised in accordance with Mr. Burt's note, dated December 31, 1931 (not printed), received with Diwan Bahadur Sir T. Vijayaraghavacharya's demi-official No. 52-Agri., dated January 8, 1932, to Dr. Nehru (not printed), and has been approved by this Government. A copy of resolution No. 2 (Enclosure to Annexure IV) passed at the 7th meeting of the United Provinces Agricultural Research Committee held on November 2, 1932, approving the revised scheme is forwarded for the information of the Imperial Council of Agricultural Research.

## ENCLOSURE I TO ANNEXURE IV.

COPY OF RESOLUTION No. 2 OF THE 7TH MEETING OF THE UNITED PROVINCES AGRICULTURAL RESEARCH COMMITTEE HELD AT THE COUNCIL HOUSE, LUCKNOW, ON NOVEMBER 2, 1932, AT 11 A.M.

*Agenda.*

2. Consideration of an application from the United Provinces Government to the Imperial Council of Agricultural Research for a grant of Rs. 4,650 (recurring) spread over three years, for investigations into malting and brewing tests of improved barleys.

*Resolution.*

2. Resolved that the scheme be recommended to the Imperial Council of Agricultural Research.

## ENCLOSURE II TO ANNEXURE IV.

## AN APPLICATION FROM THE UNITED PROVINCES GOVERNMENT TO THE COUNCIL OF AGRICULTURAL RESEARCH FOR A TOTAL GRANT OF RS. 4,650 (RECURRING) SPREAD OVER 3 YEARS FOR INVESTIGATIONS INTO MALTING AND BREWING TESTS OF IMPROVED BARLEY.

*Introductory Remarks.*—The Assistant Economic Botanist to Government, United Provinces, has evolved certain new types of barley which combine high outturn per acre and malting and brewing qualities. Small samples of these types were sent to the Organiser of Research to the Institute of Brewing in London for examination and classification of merit from the malting and brewing point of view. The samples attracted much attention and were highly appreciated by the barley experts attached to the institute and it was recommended by the institute that the work on barley in the United Provinces should be continued and extended.

A scheme involving expenditure of Rs. 5,000 per year, or Rs. 15,000 for 3 years was prepared by Rai Sahib Th. Rama Prasada Singha to meet the expenses of (a) sending samples to England for malting and brewing tests under suitable conditions to ensure good germination on reaching their destination as well as of (b) conducting a botanical survey of the different districts where possibilities of finding new varieties existed. In addition to these it was also proposed to (c) lay down a series of manual experiments to find out the suitable treatment which gave best results.

The scheme was unanimously passed by the United Provinces Agricultural Research Committee and recommended for a grant from the Imperial Council of Agricultural Research. The governing body of the Imperial Council of Agricultural Research turned down the scheme because it wanted the co-operation of the other adjoining provinces Bihar and Orissa and the Punjab who were also interested in the problem of improvement of the Indian barleys.

But on referring the question to the adjoining provinces named above, it was found that co-operation with them was not possible and a co-ordinated scheme with other barley-growing provinces as desired by the Imperial Council of Agricultural Research could not be a practical proposition.

The United Provinces Agricultural Research Committee again recommended that the United Provinces' application for Rs. 15,000 may be reconsidered by the Imperial Council of Agricultural Research as co-operation with other provinces was not feasible.

The matter was referred to the Secretary, Imperial Council of Agricultural Research, who sent a note from Mr. Burt suggesting the lines on which the scheme should be revised before being submitted to the Imperial Council of Agricultural Research.

In the note sent by Mr. Burt he suggested that instead of sending samples of 50 quarters annually for duplicate or triplicate brewing tests advantage may be taken by utilizing Dr. Bishop's methods evolved at Rothamstead which enabled the estimation of the value of barley for brewing by scientific tests on a much smaller scale. The cost of testing each sample thus could be considerably reduced. But in the note sent by Mr. Burt it was not clear as to how much quantity as the minimum was necessary for estimation of the merits of a sample. A reference therefore had to be made to Dr. Bishop at Rothamstead and his reply has just been received. He advocates two methods. In one of the methods he suggested only 2-lb. sample to be sufficient to serve the purpose. The other method which he calls the "prediction method" is not fully described by him in his letter under reference. But he has arranged for the reprints of these methods to be sent to me and when they are in hand the details will be fully known.

In the meantime I would prefer to send 2-lb. samples and try his former method, bag malting.

Expenditure on barley survey has for the present been dropped as this work is held to be of provincial interest only. The expenditure on the scheme has now been reduced from Rs. 15,000 to Rs. 4,650 only (as given in Appendix A) and this is being submitted for reconsideration by the Imperial Council of Agricultural Research at their next meeting.

## APPENDIX A.

—	1st year.	2nd year.	3rd year.	Total for 3 years.
	Rs.	Rs.	Rs.	Rs.
Cost of samples, packing in tin and wooden cases, railway freight, steamer insurance and other charges to England ..	200	200	200	600
Charges of sets of 25 samples at Rs. 50 each	1,250	1,250	1,250	3,750
Manurial experiments .. .. .	100	100	100	300
Total ..	1,550	1,550	1,550	4,650

## APPENDIX IX.

## SUBJECT No. 8.

APPLICATION FROM THE GOVERNMENT OF THE CENTRAL PROVINCES FOR A GRANT OF Rs. 46,700 SPREAD OVER A PERIOD OF 3 YEARS IN CONNECTION WITH A SCHEME FOR FURTHER INVESTIGATION INTO VACCINATION OF CATTLE AGAINST RINDERPEST.

Attention is invited to the letter from the Central Provinces Government No. 1217/879-XIV, dated the 29th November 1932 (Annexure I), forwarding the scheme mentioned above. An enquiry has been made from the local Government whether the scheme has been recommended by the Provincial Agricultural Research Committee and their reply will be circulated to the Advisory Board as soon as received.\*

2. The application is now for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 23rd January 1933.*

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\* Please see enclosure II.

## ANNEXURE 1.

LETTER FROM C. D. DESHMUKH, Esq., I.C.S., REVENUE SECRETARY TO GOVERNMENT, CENTRAL PROVINCES, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 1217-879-XIV, DATED NAGPUR, THE 29TH NOVEMBER 1932.

SUBJECT :—*Scheme for further investigation into vaccination of cattle against rinderpest.*

I am directed by the Government of the Central Provinces (Ministry of Agriculture) to address the Imperial Council of Agricultural Research for financial assistance in connection with the appended scheme (enclosure I) for further investigation into the problem of vaccinating cattle against rinderpest drawn up by the Director of Veterinary Services, Central Provinces.

2. A perusal of the brochure accompanying this application will show the work that has already been done. The further investigation that is necessary cannot be undertaken by the veterinary staff in the ordinary course of its duties. The scheme is of far-reaching importance and is expected to provide the solution of a problem affecting the whole of India. The Local Government has considered and approved it, and I am to express the hope that it will receive the approval of the Imperial Council and the financial assistance necessary. In the event of the scheme being sanctioned the team of workers will operate from one of the veterinary dispensaries in the province and the Local Government undertakes to provide any serum, drug, instruments or appliances that may be required in connection with it.

## ENCLOSURE.

**THE CENTRAL PROVINCES VETERINARY DEPARTMENT'S SCHEME FOR FURTHER INVESTIGATION INTO VACCINATION OF CATTLE AGAINST RINDERPEST.**

Rinderpest is the most important disease of live-stock in India and the best method of preventing it has exercised the whole veterinary profession in this country for years past.

At present there exists a safe method of inoculating cattle by what is commonly known as the serum-simultaneous method, which consists of injecting living virus simultaneously with protective serum and thus producing a mild attack of the disease. The immunity thus obtained lasts for at least three years and may be life long.

The difficulty which arises when large numbers of cattle have to be protected is the cost of the serum which may be any thing up to Rs. 2 for an individual animal.

Workers in Africa and the French veterinarians in Persia have evolved a method of vaccination with the pulp of dead animals (the method of Curasson and Delphy). This method produces good results although some workers find that the immunity conferred is of comparatively short duration. The method requires a well equipped laboratory and for many reasons is not suitable for use in India.

Since December 1930, the workers in this province have been engaged in trying to find a reliable and cheap method of vaccinating cattle by means of attenuated living virus. The results that have been so far achieved are excellent. About 2,000 animals have been successfully vaccinated by means of virulent blood passaged (i.e., blood transferred from animal to animal) through goats—two, three or more times depending on the amount of attenuation desired.

So far these experiments have been carried out by three or four workers more or less in addition to their ordinary duties.

The experimental stage is now over and what remains to be done is to eliminate all adventitious circumstances and overcome many difficulties that may arise before the method can be used on a large scale throughout all India.

It is, therefore, proposed to have a team of one head Veterinary Assistant Surgeon and ten junior men working under the control of the Imperial Council and with the present Director of Veterinary Services (Major Stirling) as immediate adviser on the work to be undertaken.

The questions to be studied could, to begin with, be grouped as under :—

1. The best method of obtaining virus. Should goat virus first be used or would local virus from an actual outbreak give better results ?
2. How should the virus be distributed in the field ? This is a big question as expenses soon mount if ice-boxes have to be supplied in each area.
3. By what method of feeding or by what adjuncts to normal food during all seasons of the year can sufficient vitamin A be introduced into the animal's system so as to prevent the loss of flesh so commonly found after vaccination ?

Another large problem which has given concern to the field workers. To study this at least two or three years will be required in order to examine the varying conditions in all the seasons.

4. What is the number of passages through goats required for safe and yet efficient vaccination in the various breeds ? It is known that two or three are sufficient for cattle which have been frequently exposed to natural infection and that six or seven are required in other cases, but so far there has not been the staff necessary to investigate adequately this question.
5. How can the recrudescence of piroplasmiasis and/or coccidiosis after vaccination be controlled ?

Another very important point as deaths may and have occurred from this cause as apart from any effect of vaccination.

6. Under what conditions can vaccination be undertaken during actual out-breaks ?



If the scheme is sanctioned the team of workers will operate from one of the veterinary dispensaries in the province and the Local Government will provide any serum, drugs, instruments or appliances required.

To be of substantial value to India the investigations should continue over a period of three years.

A statement of expenditure is enclosed and also a copy of a brochure on what has already been done in this province up till May 1932. Since then some further hundreds of animals have been successfully dealt with by this method.

RECURRING EXPENDITURE.

	Rs.
<b>1. Staff—</b>	
One senior officer on Rs. 140 per mensem for three years—	
Rs. 140 × 12 × 3 .. .. .	5,040
Ten junior officers on Rs. 60—5/2—65 per mensem for three years—	
Rs. 60 × 10 × 24 + 65 × 10 × 12 .. .. .	22,200
Allowances in lieu of free quarters at Rs. 10 per mensem each for 11 men for three years—	
Rs. 11 × 10 × 36 .. .. .	3,960
Eleven peons* on Rs. 14-8-0 per mensem each (pay Rs. 13, fixed travelling allowance Rs. 1-8-0) for three years :—	
Rs. 11 × 36 × 14½ .. .. .	5,742
	• <hr/>
Total staff for three years .. .. .	36,942
	<hr/>
<b>2. Travelling allowance—</b>	
At Rs. 2,500 per annum for three years .. .. .	7,500
	Rs.
<b>3. Contingencies—</b>	
(a) Service postage for correspondence and parcels at Rs. 20 per mensem.	240
(b) Hire charges for goats at Rs. 20 per mensem.	240
(c) Cost of goat virus, etc., at Rs. 20 per mensem.	240
(d) Miscellaneous charges for packing materials, etc.	30
	<hr/>
Total .. .. .	750 per annum.
For three years 750 × 3 .. .. .	2,250
	<hr/>
Grand total .. .. .	46,692
Or say .. .. .	46,700 for three years.

\* Coolies for controlling animals.

ENCLOSURE II.

In continuation of the note on the subject mentioned above already circulated, it is stated for the information of the members of the Advisory Board that the Government of the Central Provinces have since intimated that the scheme has been approved by the Provincial Agricultural Research Committee.

CHARAN DAS,  
*Secretary.*

*The 16th February 1933.*

## APPENDIX X.

## SUBJECT NO. 9.

## APPLICATION FROM THE GOVERNMENT OF MYSORE FOR A GRANT OF Rs. 20,400 SPREAD OVER A PERIOD OF 3 YEARS FOR THE INVESTIGATION OF JOHNE'S DISEASE AMONG CATTLE IN MYSORE.

Attention is invited to the attached letter from the Government of Mysore, No. D/3323/(sus.)/A/E-90-32-21, dated the 12th January 1933, on the subject mentioned above. The scheme involves a cost of Rs. 20,400 spread over a period of 3 years.

2. It may be mentioned in this connection that the Governing Body has sanctioned, on the recommendation of the Advisory Board, a scheme for the appointment of a special staff at Muktesar for the investigation of Tuberculosis and Johne's diseases. That scheme will again be submitted to the Governing Body at its next meeting for consideration of certain points raised by the Animal Husbandry Expert to the Council.

3. The Mysore Government scheme is now submitted for the consideration of the Advisory Board.

CHARAN DAS,  
*Secretary.*

*The 31st January 1933.*

COPY OF A LETTER FROM THE SECRETARY TO THE GOVERNMENT OF HIS HIGHNESS THE MAHARAJA OF MYSORE, DEVELOPMENT DEPARTMENT, BANGALORE, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. D/3323/(sus.)/A./E.-90-32-31, dated the 12th January 1933.

With reference to your letter No. 2081/G., dated the 18th November 1932 (not printed) regarding the seventh meeting of the Advisory Board of the Imperial Council of Agricultural Research, I am directed to forward herewith copy of letter No. H.A.-274, dated 17th June 1932, with its enclosures, from the Superintendent, Civil Veterinary Department in Mysore, Bangalore, to the Director of Agriculture in Mysore regarding the scheme for the investigation of Johne's disease among cattle and to request that the scheme may be kindly placed before the Advisory Board of the Council for consideration at the next meeting.

COPY OF A LETTER FROM THE SUPERINTENDENT, CIVIL VETERINARY DEPARTMENT, BANGALORE, TO THE DIRECTOR OF AGRICULTURE IN MYSORE, BANGALORE, No. H.A.-274, DATED THE 17TH JUNE 1932.

I am forwarding herewith a short note by Mr. K. Ranganatha Rao, Assistant Superintendent, Scientific Section for further research on Johne's disease among cattle in Mysore, and request you to kindly recommend the same to the Imperial Council of Agricultural Research for financial assistance to carry on the work.

The problem of Johne's disease is of immense economic importance to Mysore where the disease is widespread both at Mysore and Bangalore, and valuable dairy cattle are affected. The problem is not confined to the State alone, but is met with in all Dairy Farms in India. That enormous losses are caused to the Dairy Industry by this disease all over the world is a recognised fact.

The importance of the problem has been recognised by the Imperial Council and was the subject of a resolution in their meeting held on 11th May 1931 proposing the appointment of a special Research Officer to work on Johne's disease and Tuberculosis under the Animal Husbandry Expert.

I may say that there is no thought of supplanting the work now being done at Muktesar, but since we have sufficient material in the State, we wish to supplement that work and in the course of three years we shall be able to accumulate a large amount of data to enable more intensive research being continued when the special Johne's disease enquiry officers commence their work at Muktesar.

The work now proposed to be undertaken will not benefit Mysore alone, but will be of value to all parts of India where this disease has become endemic. A scheme to provide assistance is therefore, I submit, one which should receive the sympathetic consideration of the Imperial Council of Agricultural Research.

The work in Mysore will be carried out by Mr. K. Ranganatha Rao, the Research Assistant to the Department. He has had three years' intensive training at Muktesar under Dr. Edwards, and has been closely associated with the work on Johne's disease in Mysore since his return from Muktesar in 1928. He has continued the work laid down by Dr. Edwards for the treatment of Johne's disease in the Palace Dairy and is fully qualified to undertake this investigation.

The work at present is greatly hampered by lack of funds and under present financial conditions it is doubtful if full provision can be made in our budget for expenditure in this connection. Our main requirements in the way of staff will be an additional Inspector, two Salutries, one Laboratory Assistant to work under Mr. Ranganatha Rao and funds for the purchase and maintenance of experimental animals.

The requirements to carry on further work on the investigation of Johne's disease and additional staff and equipment are as follows :—

	Total for 3 years.	
	Ra.	Rs.
Cost of purchase of experimental animals	1,000	3,000
Maintenance, feed and keep for 12 months	3,600	10,800
Pay of a veterinary Inspector on Rs. 60— 5—150 for 3 years .. ..	780	2,340
Fieldmen Salutries, 2 at Rs. 30 each ..	720'	2,160
One Laboratory Assistant at Rs. 30 ..	360	1,080
Contingencies .. ..	340	1,020
	<hr/>	<hr/>
Total ..	6,800	20,400
	<hr/>	<hr/>

Laboratory facilities are available at the Mysore Serum Institute which is fully equipped for research work. Facilities are also available in the Laboratories of the Agriculture Department.

The plan of work proposed to be taken up is described in the enclosed note prepared by Mr. Ranganatha Rao.

#### NOTE.

The prevalence of Johne's disease among cattle in Mysore was first recognised in 1923, at the Palace Dairy Farm, Rayanakere and has since assumed serious proportions and has been causing a depletion of milking stock in the State—more particularly among the crossbreds and imported animals.

The earliest knowledge of a wide spread infection of Johne's disease was first obtained at Rayanakere, when a good number of heavy milking and valuable cattle including a pure bred Holstein bull showed symptoms of scouring and wasting. This was first mistaken for parasitic diarrhoea and anthelmintic medication was adopted without success. As the number of sick cattle began to increase, a suspicion that Johne's disease might have been introduced from the purchases made from the Imperial Dairy Farm was strongly felt. Accordingly, the Muktesar authorities were consulted and the whole herd was submitted to a double intradermal test with avian tuberculin. The tests were conducted by Mr. M. B. Menon, the Research Officer from Muktesar. It was found as a result of the test, that nearly 40 per cent. of the herd reacted to the test and were infected. After

reviewing the results of the test, Dr. Edwards recommended that, short of destruction of the whole herd, the reactors should be eliminated from the Dairy, and the young stock between the ages of six months and two years, be vaccinated with a live vaccine of avian T. B. This was carried out, and between 1927-30, a batch of 82 calves were vaccinated from material supplied by the Imperial Institute of Veterinary Research.

In spite of the preventive and curative methods adopted, the disease has been running through the Dairy causing an annual mortality of 10 per cent. to 15 per cent. ; in addition, 6 per cent. of the vaccinated calves have since died on Johne's infection.

In 1930, Colonel Olver, who had come here to preside over the All-India Veterinary Conference, was also shown round the Palace Dairy at Rayanakere.

Johne's disease is probably one of the most chronic of all those caused by bacteria and as in tuberculosis, the infection is never overcome by the bovine animal. The period of incubation is sometimes unbelievably long—it may be many months or years in length. In young stock particularly until after the first calving, the clinical symptoms are not manifested. Although primarily a disease of cattle, it is also found in deer, sheep and goats. Its importance in the sheep industry cannot be estimated because it has been confused with other diseases of sheep.

The prevalence of the disease depends upon the opportunity for infection, rather than on the susceptibility of the different breeds, and this opportunity is created by an affected animal excreting thousands of viable organisms and infecting the pasture, the portal of entry being the digestive tract.

Since the disease runs a chronic course through a herd, and the recognised mode of transmission is by an affected animal and contaminated pasture, the problem requires to be studied in more than one place and presents immense possibilities for research all over the country.

It is our experience in Mysore, that it is not only the half bred or imported cattle that are affected, but the indigenous cattle also. Often-times, the disease is mistaken for parasitic diarrhoea, and has been allowed to spread from herd to herd and very often the best milkers succumb. This seriously affects the Dairy industry in the country and indirectly the milk supply. It is therefore of primary importance to Mysore that an intensive study of the disease should be undertaken with a view to discover more satisfactory methods of control. At present allergic tests for evidence of Johne's disease in an animal are not very satisfactory. Avian tuberculin and Johnin have not given the desired results. In the experiments of Krishnamoorthi of Madras, he found that animals that were negative to avian tuberculin, were positive for Johne's on post-mortem examination ; and Hagan in America has not experienced much difference between the results in tests with avian tuberculin and Johnin, and favours avian tuberculin as more reliable. Complete fixation tests have not been practised on a large scale as yet, but so far, it does not appear to be specific, any acid fast bacilli being capable of causing the reaction. It will therefore be necessary to maintain a small herd of experimental animals for the study of complement fixation and other serological methods to investigate the varying importance of these tests. This will aid in an epidemiological survey being undertaken in the state.

Secondly in a country like India where slaughter cannot be resorted to for the eradication of the disease, it may be necessary that chemotherapeutic methods should be explored to mitigate the loss among the Dairy cattle. More work on the rationale of treatment has to be carried out before satisfactory curative methods can be evolved.

Recently, it is observed that some of the cattle affected with Johne's disease, mostly, the heavy milkers are found to be suffering from granulomatous polypoid growths of the upper respiratory passages. Whether this is a sequel to Johne's disease, requires further work to establish.

At Bangalore and Mysore, the disease is widely prevalent due to the sale of milking-cattle from the infected dairies, and a herd of naturally infected cattle will be easily available for the work.

The following will be the proposed programme of work, and may extend for more than three years :—

1. Epidemiological survey of the disease in Mysore State commencing with Bangalore and Mysore cities.
  2. Preparation and investigation of avian tuberculin and Johnin for testing and comparing the results with complement fixation and other serological tests.
  3. Extension of work on the chemotherapy of Johne's disease using 01. Chauloorgra and its derivatives.
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## APPENDIX XI

## SUBJECT No. 10.

## ENQUIRY INTO THE SUPPLY OF COCOANUT PRODUCTS AND COCOANUT OIL IN INDIA.

The discussions on the Ottawa agreement brought into prominence certain important factors regarding the cocoanut industry in South India. Indian Oil-crushers have maintained for some years past that the supply of *copra* (dry cocoanut kernel), which is the raw material for cocoanut oil, is insufficient, and they have repeatedly asked the Government of India to reduce the duty on *copra* from Ceylon.

2. By the Ottawa agreement India obtains a preference of 15 per cent. in the United Kingdom on the six principal vegetable oils which she manufactures and exports and a 10 per cent. preference on all other vegetable oils; the 15 per cent. preference is granted on castor oil, linseed oil, rape-seed oil, sesamum oil, ground-nut oil and cocoanut oil. India has also received some valuable tariff preferences from Ceylon, e.g., on rice and cotton piece-goods and has given to Ceylon in return a 10 per cent. preference on cocoanuts and cocoanut products. This preference has been made effective by raising the duty on foreign, i.e., non-Empire, cocoanuts and cocoanut products by 5 per cent. and reducing the duty on Ceylon cocoanut and cocoanuts products by 5 per cent.; the present duties are 30 per cent. non-preferential and 20 per cent. preferential.

3. From the enclosed statistics (Statement A) it will be seen that India is at present importing very large quantities of cocoanut oil which is a raw material for the vegetable fat industry and also for the soap industry as well as being used for domestic consumption in important quantities. It is also important to note (*vide* Statement B) that India has a valuable export trade in coir mats and matting and in coir yarn but imports coir fibre (the raw material) and a little coir yarn from Ceylon.

4. The trade figures seem to indicate fairly clearly that there is a shortage in the supply of cocoanuts and cocoanut products. On the other hand, a number of reports have reached us to the effect that the price of cocoanut products in South India is considered to be unduly low. It is of moment to obtain a correct statement of the position, especially as the enclosed table (Statement C) showing the arrears under cocoanuts for the past 10 years indicates that cocoanut production in South India is not expanding with any great rapidity.

It is suggested that a special enquiry should be made by a whole-time officer under the Research Council appointed for the purpose for a period of, say, 3 to 6 months, in order that the real facts of the position in South India may be obtained.

CHARAN DAS,

Secretary.

The 12th January 1933.

(Taken from the sea-Borne Trade Returns.)

## STATEMENT A.

IMPORTS OF COCOANUT OIL INTO INDIA (IN GALLONS).

(Years—1st April to 31st March.)

1922-23.	1923-24.	1924-25.	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.	1931-32.	1932-33. (April to November— 8 months)
7,032	126,632	564,104	1,151,269	69,346	1,449,724	2,393,392	1,563,109	1,201,430	3,331,140	5,286,057

## STATEMENT B.

EXPORTS AND IMPORTS OF COIR INTO INDIA (IN TONS).

*Exports—Unmanufactured.*

490	386	368	404	260	228	343	228	190	96	14
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*Exports—Manufactured (excluding rope).*

33,116	31,465	30,540	29,839	27,869	33,359	31,997	31,497	25,862	26,390	16,736
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*Imports—Unmanufactured.*

275	1,126	411	753	967	656	729	939	726	670	488
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*Imports—Manufactured (excluding rope and belting).*

300	146	119	183	92	80	75	42	45	37	1
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## STATEMENT C.

(Taken from Agricultural Statistics of India and Season Crop Reports.)

AREAS UNDER COCOANUTS IN SOUTH INDIA DURING THE YEARS  
1921-22 TO 1931-32.

(Years.)

Province or State. 1921-22. 1922-23. 1923-24. 1924-25. 1925-26. 1926-27. 1927-28. 1928-29. 1929-30. 1930-31. 1931-32.

Madras	559,404	543,263	548,960	525,445	555,465	552,815	557,102	570,330	576,083	565,971	539,031
Mysore	124,346	122,970	122,414	127,170	128,355	138,783	132,070	139,959	142,273	Not known.	
Travancore	454,811	465,594	500,686	498,592	503,933	511,612	511,726	533,051	531,411		
Cochin	17,100	17,650	28,423	28,627	29,750	65,762	47,986	58,113	49,015		



**APPENDIX XII**

**SUBJECT No. 12:**

**APPLICATION FROM THE GOVERNMENT OF THE PUNJAB FOR A GRANT OF Rs. 22,300 IN CONNECTION WITH A SCHEME FOR THE INSTALLATION OF WHEAT MILLING AND BAKING LABORATORY AT LYALLPUR.**

Attention is invited to the attached letter (and enclosures) from the Government of the Punjab, No. 138-D., dated the 16th January 1933 (Annexure) forwarding a scheme for the installation of wheat milling and baking laboratory at Lyallpur.

The scheme which involves to the Imperial Council of Agricultural Research an expenditure of Rs. 22,300 is now for the consideration of the Advisory Board.

**CHARAN DAS,**

*Secretary.*

*The 19th January 1933.*

## ANNEXURE.

COPY OF LETTER FROM THE DEPUTY SECRETARY TO THE GOVERNMENT OF THE PUNJAB, DEVELOPMENT DEPARTMENT, LAHORE, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 138-D., DATED THE 16TH JANUARY 1933.

SUBJECT.—*Scheme for the installation of wheat milling and Baking Laboratory at Lyallpur.*

I am directed by the Punjab Government (Ministry of Agriculture) to forward for consideration by the Council at its next meeting a scheme for the installation of a Wheat Milling and Baking Laboratory at Lyallpur which has obtained the approval of the Punjab Council of Research. Details of the scheme are contained in the attached note (Enclosure).

## ENCLOSURE.

## SCHEME FOR THE INSTALLATION OF A WHEAT MILLING AND BAKING LABORATORY AT LYALLPUR.

Although yield carries the greatest weight with the farmer in his choice of a wheat variety, yet quality of the grain is of no less importance. On this account spring wheats of Canada commands in the English market a premium on other wheats. In prosperous days this premium amounted to several shillings per quarter. In the Punjab markets Bombay merchants buy the choice vitreous lots of wheat at a premium, because hard grain is associated with several good qualities. The aim of present day wheat-breeders is, therefore, to combine the two desiderata, viz., yield and quality.

Quality, particularly from the baking point of view, is a complex of many things. Many correlations have been worked out and several appliances and physical and chemical methods have come into use for judging it by a single criterion. The grinding of wheat into flour and baking it into bread remains as yet the only sure method for this purpose.

Large commercial modern mills exist in many places and milling tests can be arranged for, but for the carrying out of such large scale tests, the required amount of grain cannot be produced where numerous varieties have to be tested at a preliminary stage prior to final selection. To meet this need, small laboratory milling plants have been devised. It is the well-considered opinion of authorities who have had experience with such plants that experimental milling, although not entirely comparable with commercial milling, gives results which indicate as truly the relative milling value of different wheats, as tests made on a commercial mill. Tests made on an experimental (laboratory) mill show even less variation in milling yields and in the baking quality of flour than those observed in commercial milling.

The testing of the milling and baking qualities of new wheats at an early stage is an important step in their evolution. This is recognised in all the major wheat producing countries of the world, and the necessary machinery is provided in many places in Canada, in all the important wheat growing States in the United States of America, whilst they are also coming into general use in Europe and Australia. India is the third largest wheat growing country in the world. The Punjab is the predominating contributor to this position but Sind is likely also to be a large grower of wheat in the future. Lyallpur is favourably situated in the centre of the wheat growing tract in Northern India and it is proposed that the experimental plant for milling and baking tests should be located there. Lyallpur also has advantages in that the laboratories and staff of the Research Institute there will be available to carry out all the work required in the conduct of the tests. The proposed equipment would be available for testing wheat for other provinces also. It will be necessary, however, to provide an additional Chemical Assistant to deal with the large number of determinations of moisture, protein, ash, fat, etc., as well as a miller and a baker. Situated in Lyallpur also is a large modern flour mill with the owners of which arrangements can be made for the services of an expert miller to supervise and advise occasionally on the operations. The necessary training in milling operations for an employee of the Agricultural Department can be arranged with this mill also, whilst training in baking will be obtained by another employee at one of the military or other bakeries.

An estimate of the cost of the equipment, so far as it has been possible to ascertain it, is given below, and it is requested that the Imperial Council of Agricultural Research may give a grant to finance its purchase. The buildings necessary to accommodate it, as well as the staff to operate it, will be provided by the Punjab Government.

ESTIMATE OF COST OF EQUIPMENT FOR A MILLING AND BAKING LABORATORY AT LYALLPUR.

*Milling equipment.*

(1) Wolf Experimental Mill with four single stands of rolls, three machines corrugated, one smooth, and one five-aleve Rotary Sifter, all set up on suitable framework, including a 2 H. P. motor with driving connections for driving the roller machines and a 1/10 H. P. motor with driving connections to drive the Sifter, with stop clock, self-contained, boxed and delivered F. A. S. New York—

Price .. .. .	\$ 1,960.00
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(2) Four Calibrator adjustments for adjusting at minute fixed distances the rolls of the four machines, i.e., the four pairs of rolls at \$150.00 per machine, F. A. S. New York—

Price .. .. .	\$ 600.00
(3) One separator with dust collector .. .. .	175.00
(4) One scourer ditto .. .. .	175.00
(5) One Disc Aspirator ditto .. .. .	175.00

Items 1—5 are manufactured by and obtainable from the Wolf Company, Chambersburg, Pa., U. S. A.

(6) A Bahonson Humidifier for the milling plant, for maintaining the relative humidity of the atmosphere within the mill room at a uniform figure, obtainable from the Bahonson Company, 93, Worth Street, New York City, price F. O. B. Factory Winston-Salem, North Carolina, U. S. A.—

\$ 175.00

(7) Estimated freight, etc., on items 1—6, from U. S. A. to Karachi \$ 150.00

Total estimated cost of the milling equipment .. .. .	\$ 3,410.00 (A).
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*Baking equipment.*

(8) Proofing and fermentation cabinet, electrically heated and equipped with an automatic thermo-regulator for controlling the temperature of the air within, and also equipped with a humidifier capable of creating sufficient humidity to counteract any drying that takes place during the fermentation of the dough. This need would be met by No. 520 Despatch cabinet of dimensions 46" (wide), 13" (deep), and 20" (high)—

Price with shelving .. .. .	\$ 128.00
Freight, etc., to Karachi .. .. .	\$ 22.00

(9) Test and Experimental Baking Oven, No. 101 Despatch, with Bristol control system—

Price .. .. .	\$ 394.00
Freight, etc., to Karachi .. .. .	\$ 51.00

(10) Pekar Silok Oven, dimensions 12.5" × 13" × 6.5"

Price .. .. .	\$ 37.00
Freight, etc., to Karachi .. .. .	\$ 14.00

Items 8—10 are manufactured by and obtainable from the Despatch Oven Company of Minneapolis, Minnesota, U. S. A.

(11) Dough mixing machine: Hobart mixer (c-10 model); three-speed with two beater arms, electrically driven, one bowl for handling ten or twelve one-pound loaves of bread, obtainable from the Hobart Manufacturing Company, Troy, Ohio, U. S. A.—

Price, F. O. B. Troy, Ohio, U. S. A.	..	..	..	..	\$ 145.00
Freight, etc., to Karachi	..	..	..	..	\$ 20.00

(12) Volume of loaf measuring apparatus (designed and perfected by the Research Department of the American Institute of Baking), manufactured by E. H. Sargent and Company, 155—165 East Superior Street, Chicago, Illinois—

Price	..	..	..	..	\$ 85.00
Freight, etc., to Karachi	..	..	..	..	\$ 14.00
Total estimated cost of (foreign) baking equipment	..	..	..	..	\$ 99.00 (B).

(13) Some tin flour pans, size  $6\frac{1}{2}'' \times 8'' \times 2\frac{1}{2}''$  with covers.

(14) Some earthenware fermentation crocks, size  $\frac{1}{2}$  gallon, with earthenware or tin lids for sponging and doughing.

(15) Some iron baking pans  $3'' \times 5\frac{1}{2}''$  at bottom,  $3-7/8'' \times 6\frac{1}{2}''$  at top and  $5\frac{1}{2}''$  deep.

(16) Five hundred (500) air-tight tincans, each with a capacity of 6—8 lbs., for storing wheat and flour samples.

Items 13 to 16 can either be made or obtained locally in India. They are arbitrarily estimated to cost not more than .. .. . Rs. 500 (C).

The total estimated Cost of the milling and baking equipment comes to:—

A+B+C.

= \$ 3,410 + \$ 99 + Rs. 500.

= \$4,320 + Rs. 500.

= Rs. 18,275 + 500 at the present exchange rate.

= Rs. 18,775.

Adding to this another Rs. 3,525 to meet erection expenses, railway freight, wiring connections, etc., etc., the total estimated cost comes to Rs. 22,300.

## APPENDIX XIII.

## SUBJECT NO. 13.

APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT SO FAR AS THE COUNCIL IS CONCERNED OF Rs. 84,580, SPREAD OVER A PERIOD OF 10 YEARS FOR RESEARCH IN SHEEP BREEDING.

Attention is invited to a letter from the Government of Bombay, No. 9150-A./28, dated the 22nd December 1932 (Annexure) forwarding the above mentioned scheme. The scheme has been drawn up by the Live Stock Expert to the Government of Bombay under whose supervision the proposed research if sanctioned will be carried out. The estimated cost of the scheme is Rs. 92,350 of which Rs. 7,770 representing the rent of the land, will be borne by the Bombay Government.

2. The scheme is now for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 13th February 1933.*

## ANNEXURE.

COPY OF A LETTER NO. 9150-A./28, DATED THE 22ND DECEMBER 1932, FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

*Sheep breeding scheme.*

Grant-in-aid for ———.

I am directed by the Government of Bombay (Transferred Departments) to forward 100 copies of the Sheep-breeding scheme (Enclosure) prepared by the Live Stock Expert to Government. The object of the scheme is to breed on a central farm, a type of sheep which would eventually improve the wool carrying capacity of the Indian sheep. The site has been selected in the Bhamburda forest area and comprises of 279 acres, of which an area measuring about 240 acres is in charge of the Forest Department. That Department, by erecting a fence, planting trees and encouraging natural tree regeneration has converted an area of negligible value into one yielding a rental of Rs. 777 per annum. The land is considered to be an asset to the Forest Department, which in these times of financial stringency, cannot afford lightly to forego annually recurring revenue of this kind.

2. The scheme involves a cost of Rs. 92,350 spread over a period of ten years. Of this, an amount of Rs. 28,450 will be required for capital expenditure on the construction of buildings and purchase of equipment and live stock and provision of equipment for a wool spinning and weaving experiment. An amount of Rs. 63,900 spread over the same period will be necessary for the pay of the staff to be entertained, charges for the upkeep and maintenance of the stock and rent of land referred to in paragraph 1 above. Against the proposed expenditure, an income of Rs. 20,000 is anticipated from the receipts of the scheme.

3. The scheme was laid before the Provincial Agricultural Research Committee at its meeting held on 15th June 1932, when the Committee recommends it to Government for submission to the Imperial Council of Agricultural Research for favourable consideration. The Committee suggested that the Local Government should agree to provide the land required for the scheme free of cost. The Government of Bombay accept the Committee's recommendations and strongly support the scheme for the favourable consideration of the Imperial Council of Agricultural Research. Their contribution towards the cost of the scheme will be limited to the supervision to be exercised by the Live Stock Expert to Government and the provision of the suitable land mentioned in paragraph 1 above, free of rent. Beyond this it is not possible for the Government of Bombay to undertake any additional liability in the present state of their finances.

## SHEEP BREEDING SCHEME.

## INTRODUCTION.

As far as one is able to gather, sheep are indigenous to India and that the present sheep in Europe especially the Merino had its origin in the fat tail sheep of Northern India the "Dumba". From the Indian Munitions Board's Bulletin "Notes on Wool in India" by A. H. Silver, C.I.E., and J. K. Mehta, M.A., it appears that the foundation stock of the sheep industry of Australia which now yields several millions of £ sterling originally came from India.

The plains and hilly country of Central India and the Deccan of which there must be millions of acres, consists to a large extent of grass lands, which are not fit for the larger domestic animals, but which with the aid of the number of shrubs and trees, such as Babul (*Acacia arabica*), Khair (*Acacia catechu*), Hewar (*Acacia leucophloea*), Devbabul (*Acacia latronum*), Arkar (*Mimosa hamata*), Pandhur phali (*Fluggea microcarpa*), Bor (*Zizyphus jujuba*), etc., which are good sheep food would carry sheep very profitably. The mere fact that sheep have been maintained for these hundreds of years is in itself evidence that the lands known in the Bombay Presidency as Mal lands are fit for little else. That there are possibilities in the sheep industry in India was realized many years ago. In the year 1787 one Dr. Hone described the type of sheep in the Bombay Presidency as being the finest that he saw in India, with long wool which was as white as the finest cotton. This description evidently applies to what is known as the Bikaner sheep. Dr. Hone was an authority, as he was especially brought out for this purpose. If this statement be correct, a very rapid deterioration has since set in.

Colonel Davies in the year 1835 represented to the Court of Directors of the Honourable the East India Company that the Deccan and Gujarat were well adapted to sheep growing. Being convinced of the possibilities he started a farm on his own account. The Bombay Government started two sheep farms, one at Ahmednagar and the other at Junnar about the same year (*i.e.*, 1835). The work was put under the charge of one Mr. Webb. The types of sheep imported were the South-Down, Leicester, Cotswold and Merino. In 1843, Sir George Arthur of considerable colonial experience in sheep reported in most favourable terms on the possibilities.

It is due to this work that one to-day comes across occasionally long tailed sheep among the Indian short-tailed sheep.

Spasmodic attempts have been made with sheep improvement for the past 100 years in India, but unfortunately, no records are now available stating why these were stopped. It is more than possible that it was due to want of funds and experience in this business. Be what the cause may for these failures, sheep still exist even though they be of poor quality.

It will not be out of place here to mention the great success achieved by Colonel Sturdy, C. B. E., D. S. O., Director in charge of Live Stock to the Government of Peru. The indigenous sheep of Peru were if anything poorer in every way to Indian sheep. The method of utilizing the wool produced was similar to our village methods of to-day. Colonel Sturdy estimates that 2 acres of Peru pasture lands are required per sheep, this is approximately the carrying capacity of sheep for the grass lands of this Presidency.

The rainfall of Peru is on an average about 31 inches per annum. Prior to Colonel Sturdy taking up the improvement of the sheep of Peru the Peruvian export trade in sheep consisted of a dry meat known as "Chalona". The Peruvian sheep yielded from 1½ to 1¾ lbs. of wool per annum. In a period of 6 years this has gradually increased to from 3 to 5 lbs. Colonel Sturdy started his work of improvement in 1921. In 1926, Alfred F. Baker, M.Sc., Professor of Textile Industries, Leeds (England) visited Peru and reports as follows:—

"The quality of wool already produced suggests that the improved Peruvian wool when stabilised and produced in a sufficient quantity may well challenge comparison with the wools from Australia and the Cape as sold at the London Wool Sales."

In the foregoing we see that Australia has built up a wool trade equalled by no other country from a nucleus flocks of Indian sheep. Peru having almost the same conditions as India is now a wool exporting country: therefore, there seems no reason why India cannot do the same. That there is an urgent necessity of improving the sheep and wool of India was very clearly brought out by Mr. A. H. Silver, C.I.E., in his written evidence before the Royal Commission on Agriculture. Mr. Silver is possibly the best authority on the wool requirements and possibilities in India. His considered opinion is that the demand far exceeds the supply, so much so that he fears that world renowned Indian woollen carpet trade known as the cheapest woollen carpet in the world is likely to be eclipsed by Greece and Turkey. He states that to-day the only army clothing on which India is dependent on outside supply of raw material is the Army Woollen Shirt. If a good Merino wool could be grown in India, this difficulty would be solved. The Wool Tariff in America, a rebate of 12½ per cent. is given on carpet wools. The best wools of India come under the category of carpet wools, although a great deal of it compares favourably with Australia cross-bred wool, which is not considered a carpet wool. Consequently Indian wool is exported for carpet making, and Indian mills cannot compete with the prices offered, although they could utilize the best of Indian wools to a better purpose. The Indian mills are compelled to import wool.

From the figures received from Dr. D. B. Meek, O.B.E., M.A., D.Sc., Director General of Commercial Intelligence and Statistics, it appears that India during the year 1928-29 and 1930-31 imported on an average about 20,00,000 lbs. of wool and exported about 52,00,000 lbs. of wool. The import prices realized 13 annas 4 pies per lb. The present average price of wool in the Indian village in the Deccan is 4 to 5 lbs. of wool per rupee.

It will be seen, therefore, how essential it is that some methodical manner of improving and marketing Indian wool should be undertaken. In recent years, the improvement of sheep has been taken up by the Governments of the Punjab, United Provinces and Mysore. Many types of Merino, Dorset Horn, South-Down Rams and Ewes have been imported, the indigenous Indian sheep being crossed with the above breed Rams. Those in charge of these experiments all report that there are great possibilities and yields have been increased from 1½ to 3 to 7 lbs. of wool. There seems to have been a tendency in all cases for the cross bred of the 2nd, 3rd and 4th generation to lose size, but the wool has increased in quality and quantity. Now the point is:—Is this lack in size due to breeding or to methods of feeding, seasonally mating or some other cause not yet ascertained?

From the foregoing, it will be seen that other countries similarly situated as ourselves have made sheep breeding a success; that in India experiments have proved that there are possibilities. I feel sure, that if systematic breeding experiments were conducted in a suitable climate that there is a big future for this industry.

In India to-day the only classification or wool classing is on colour,—for export, white wool being valued at twice the price of black or brown wool, yellow wool fetching an anna or two less than white wool. In Indian villages, black wool is more expensive being utilized in the country blanket trade.

In India sheep are shorn twice a year (i.e.) the Chaitri (March-April) season and Shravni (August-September). Exporters find that in the Shravni clip there is more white than coloured wool.

In the Bombay Presidency proper we have about 20,00,000 sheep, of this number 14,00,000 are located in the Deccan proper. If by introducing systematic breeding we could increase the yields of wool only one pound per sheep, it would mean an increased income of 5 lakhs of rupees per annum. By better methods of shearing and marketing a further increase of a couple of lakhs a year is easily possible.

The Bombay Presidency and especially Poona offers in my opinion, the most suitable place to conduct such experiments. The temperature never exceeds 110 F. and this only for a couple of months of the year.



### OBJECT OF THE FARM.

The object of the Farm would be :—

- (i) To produce a sheep that would yield more and better wool, and a better carcass, and which would transmit such qualities.
- (ii) To ascertain the best time of mating (i.e.) seasonal versus all the year round mating as at present practised.
- (iii) The best time of the year to shear (i.e.) once a year or twice a year as at present practised.
- (iv) The husbanding of grazing resources, (i.e.), block system of grazing, making of silage and hay.
- (v) Best time for castration, docking, etc., etc.
- (vi) The teaching of better methods of shearing and wool classing.
- (vii) The packing and marketing of wool.
- (viii) It will take time to produce sufficient of the improved wool to command a market, which would pay full value. It seems, therefore, necessary that a small Wool Utilization Section be added to the objects of the Farm, such as improved methods of combing, carding and weaving to teach the sheep breeder to make better use of his wool. Attached is a small estimate put up by the Director of Industries to meet this need. His report on a sample of wool grown at (i) Tegur Government Farm, and (ii) on a private breeder's farm is also attached. This wool can hardly be called improved, as at first only grade Merino rams were used and for the past 3 years progeny of these rams have been brought into use.
- (ix) To investigate diseases of sheep in collaboration with the Superintendent, Civil Veterinary Department.

### SITE.

The site selected is known as the Bhamburda Forest area, a low hill having an altitude of 2,000 feet above sea level. The hill runs from north-west to south-east. This situation offers protection against the south-west monsoon and the cold north winds during the winter.

The Agricultural Department have at present a small block of about 40 acres on this site, which is fenced in, the remainder of the area measuring 239 acres and 13½ gunthas must be obtained from the Forest Department. All we require is the grazing rights. That tree growth would be protected. The sheep by manuring the land would do more good than harm.

### STOCKING THE FARM.

I would suggest the keeping of three flocks :—

- (i) Pure bred South African Wangelia Merino (Peppin blood) from South Africa to be bred pure. This is one of the best strains of Merino in the world to-day. The export from Australia of this strain is prohibited.
- (ii) A flock of Bikaner sheep to be bred pure.
- (iii) A flock of Bikaner sheep for crossing with the abovementioned Merinos; both crosses Indian male and Merino female, and Merino male and Indian female to be carried out.

The future programme of breeding depends entirely on results obtained.

It will be necessary in the interest of this work that an assured regular budget be provided for at least 10 years.

Before proceeding with the estimates of such a scheme, I would here like to make it very clear that this is an experiment and that at no time must it be considered as a com-

mercial self-supporting proposition. If the element of commerce enters the scheme the results we have set out to gain will be lost.

No live-stock experiment work at any time in any place can be made a commercial success.

I have had personal experience with sheep farming, sheering and wool classing, having spent considerable time on one of the largest Australian Sheep stations. Sir Richard Cooper was pleased to remark as follows on a report submitted by me to the then Governor, Sir Leslie Wilson, at the request of Lord Birkenhead, on the sheep problem of this Presidency :—

“ Mr. Bruen has had extensive practical experience in Australia and fully realises the difficulties which have to be faced, but given adequate support and with the necessary funds, which should not be very onerous, there seems to be every prospect of success being achieved in a reasonable time.”

### ESTIMATES FOR THE PROPOSED SCHEME.

#### CAPITAL EXPENDITURE.

##### *First Year.*

	Rs.
<i>Buildings and Equipment—</i>	
One row of 8 corrugated huts, 14' × 112', at Rs. 3 per square foot ..	4,704
One shearing shed, 32' × 20', at Rs. 3-8-0 per square foot ..	2,240
Lime concrete floor for above .. .. .	600
One well .. .. .	1,000
Miscellaneous fittings .. .. .	300
Four shearing machines or stands at Rs. 150 each ..	600
One Crude Oil Engine .. .. .	900
Troughs .. .. .	600
One Sheep Dip .. .. .	200
Fencing .. .. .	1,200
Miscellaneous, erection, oil, spares, combs, grinding stone, etc., etc. ..	1,500
Total ..	13,844
<i>Live-stock—</i>	
5 Wanganella flocks, Rams landed in Bombay at Rs. 250 each ..	1,250
15 Wanganella Ewes at Rs. 180 each .. .. .	2,700
5 Bikaner Rams at Rs. 30 each .. .. .	150
150 Bikaner Ewes at Rs. 20 each .. .. .	3,000
Total ..	7,100
Grand Total Expenditure for the 1st year (Rs. 13,844 + 7,100) ..	20,944

*Second Year.*

	Ra.
<i>Live-stock—</i>	
5 Wanganella Rams at Rs. 250 each .. .. .	1,250
5 Bikaner Rams at Rs. 30 each .. .. .	150
Total ..	<u>1,400</u>

## RECURRING EXPENDITURE.

*First Year.*

	Ra.
<i>Upkeep charges—</i>	
Feeding charges for the whole year .. .. .	1,000
	Ra.
<i>Staff—</i>	
One Graduate Assistant in the grade of Rs. 105—5—140, Probationary period for one year on Rs. 100 (100×12) ..	1,200
One Kamgar in the grade of Rs. 30—1—45 (30×12) ..	360
5 Shepherds at Rs. 20 per mensem each (5×20×12) ..	1,200
1 Night watchman at Rs. 18 per mensem (18×12) ..	216
1 Peon at Rs. 16 per mensem (16×12) .. .. .	192
	<u>3,168</u>
	3,168
<i>Rent of land—</i>	
Annual rent for the Forest area .. .. .	777
Total ..	<u>4,945</u>

*Second Year.*

<i>Upkeep charges—</i>	
Feeding charges for the whole year .. .. .	1,200
	Ra.
<i>Staff—</i>	
One Graduate Assistant in the grade of Rs. 105—5—140 (105×12) .. .. .	1,260
One Kamgar in the grade of Rs. 30—1—45 (31×12) ..	372
6 Shepherds at Rs. 20 per mensem each (6×20×12) ..	1,440
Carried over ..	<u>3,072</u> 1,200

*Second Year—contd.*

	Ra.	Ra.
Brought forward ..	3,072	1,200
1 Night watchman at Rs. 18 per mensem (18 × 12) ..	216	
1 Peon at Rs. 16 per mensem (16 × 12) .. ..	192	
	3,480	3,480
	3,480	

*Miscellaneous—*

	Ra.	Ra.
Miscellaneous, oil, medicines, etc., .. ..	300	300
Travelling Allowance provision .. ..	250	250
<i>Rent of land—</i>		
Annual rent for the Forest year .. ..	777	777
	Total	6,007

**INCOME.**

*First Year.*

	Ra.
200 lbs. country wool at Re. 0-4-0 per lb. .. ..	50
60 lbs. Merino wool at Re. 0-12-0 per lb. .. ..	45
	Total
	95

*Second Year.*

300 lbs. country wool at Re. 0-4-0 per lb. .. ..	75
200 lbs. X-bred wool at Re. 0-8-0 per lb. .. ..	100
80 lbs. Merino wool at Re. 0-12-0 per lb. .. ..	60
20 X-bred Rams at Rs. 20-0-0 each .. ..	400
	Total
	635

*Third Year.*

500 lbs. country wool at Re. 0-4-0 per lb. .. ..	125
400 lbs. X-bred wool at Re. 0-8-0 per lb. .. ..	200
100 lbs. Merino wool at Re. 0-12-0 per lb. .. ..	75
40 X-bred Merino Rams at Rs. 20 each .. ..	800
	Total
	1,200

It will be possible from the 3rd year to stock other farms in the different Provinces or for private individuals.

**SUMMARY OF COST AND INCOME FOR 10 YEARS IN ROUND FIGURES.**

(Rough Estimates).

**ESTIMATES OF EXPENDITURE.**

*Capital Expenditure.*

	Rs.
(i) Building and equipment .. .. .	15,000
(ii) Purchase of Live-stock .. .. .	13,000
(iii) Equipment for a Wool spinning and weaving experiment (details attached). This experiment will be conducted for the first three years .. .. .	450
	<hr/>
Total ..	28,450

*Recurring Expenditure.*

(i) Expenditure for 10 years at an average of Rs. 5,500 per year ..	55,000
(ii) Upkeep and repairs to buildings, fencing, etc., etc., at an average of Rs. 500 per year .. .. .	5,000
(iii) Expenditure for staff, etc., for wool spinning and weaving experiment (details attached), to be conducted for 3 years at Rs. 1,300 per year .. .. .	3,900
	<hr/>
Total ..	63,900

*Estimates for Income.*

Income for 10 years at an average of Rs. 2,000 per year (2,000 × 10) ..

20,000

Grand Total Expenditure for 10 years ..

92,350

Total Receipts for 10 years ..

20,000

E. J. BRUEN,

*Livestock Expert to Government,*

*Bombay Presidency, Poona.*

*A rough estimate for carrying on wool spinning and weaving experiments at Poona (prepared by the Director of Industries, Bombay).*

						Ra.
<b>Expenditure—</b>						
Non-recurring, approximate	..	..	..	..	..	450
Recurring	..	..	..	..	..	1,300
						<hr/>
<b>Total</b>					..	<b>1,750</b>
						<hr/>
<b>Non-recurring—</b>						
1 Spinning wheel from Calcutta	..	..	..	..	..	15
1 Single box pit fly shuttle loom of 52" reed space	..	..	..	..	..	75
1 Double box fly shuttle slay of 60" reed space	..	..	..	..	..	35
Extra reeds, healds, shuttles, pirus, etc.	..	..	..	..	..	30
Sizing brush and materials, etc.	..	..	..	..	..	20
Wood and Bamboo pieces	..	..	..	..	..	5
Warping frame	..	..	..	..	..	15
Woollen yarn for weaving	..	..	..	..	..	100
One box to keep yarn	..	..	..	..	..	15
One box to keep cloth	..	..	..	..	..	20
Railway freight and cart hire	..	..	..	..	..	25
Miscellaneous	..	..	..	..	..	95
						<hr/>
<b>Total</b>					..	<b>450</b>
						<hr/>
<b>Recurring—</b>						Ra.
One Demonstrator on Rs. 60×12 months	..	..	..	..	..	720
One Spinner and winder, 40×12 months	..	..	..	..	..	480
Petty supplies, such as oil, cord, nails and sizing accessories	..	..	..	..	..	100
						<hr/>
<b>Total</b>					..	<b>1,300</b>
						<hr/>

E. J. BRUEN,  
*Livestock Expert to Government,*  
*Bombay Presidency, Poona.*

No. L.A. 40/5049.

OFFICE OF THE DIRECTOR OF INDUSTRIES,  
 OLD CUSTOM HOUSE,  
 Bombay, 12th August 1931.

From

P. B. ADVANI, Esq., M.Sc., M.I.E., J.P.,  
 DIRECTOR, INDUSTRIES, BOMBAY,

To

THE LIVESTOCK EXPERT TO GOVERNMENT.

BOMBAY PRESIDENCY, POONA.

*Subject.*—Utilisation of improved wool.*Reference.*—Your letter No. 331 of 19th February 1931.

SIR,

In connection with the above I have the honour to inform you that a test of the improved wool received from you and the Deputy Director of Agriculture, S. D., Dharwar, was taken by the Wool Weaving Staff of this Department at its Wool Weaving Demonstration, Benchimardi, district Belgaum, under my Weaving Assistant Mr. S. V. Wagh.

2. A copy of Mr. Wagh's report on the test taken is forwarded to you for your information. The samples of Dhables woven from the three kinds of wool are also being sent to you per railway parcel, receipt of which may please be acknowledged.

3. I agree with the remarks of Mr. Wagh after examining the report of the test and the samples.

4. I shall feel obliged if you will kindly favour me with the information required by Mr. Wagh in the last paragraph of his report.

5. The samples of Dhables and wool, etc., may please be returned to Mr. S. V. Wagh, Government Weaving Assistant, Gadag, when no longer required by you.

I have the honour to be,

SIR,

Your most obedient servant,

(Sd.) P. B. ADVANI,

*Director of Industry.*

(True copy.)

E. J. BRUEN,

*Livestock Expert to Government,**Bombay Presidency, Poona.*

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No. 420 of 1931.

*Benchmardi, 29th July 1931.*

To

THE DIRECTOR OF INDUSTRIES,

BOMBAY.

SIR,

With reference to your No. I.A. 40/1434, dated 6th March 1931, I beg to state that the samples of wool Dhablis wool thread and wool slivers have been despatched by railway parcel which is not paid. The receipt and the statement containing the information called for is attached herewith. Please acknowledge receipt.

The wool slivers will show that the local wool No. 3 has less waste and free from dirt. Nos. 1 and 2 has more waste and therefore requires more labour while carding. The percentage of waste for each quality is as shown below :—

No. 1—Waste at 20 per cent. to 25 per cent.

No. 2—Waste at 28 per cent. to 40 per cent.

No. 3—Waste at 16 per cent. to 20 per cent.

No. 3 local wool can be had at 4 to 5 lbs. per rupee. No. 1 will be purchased at 6 to 7 lbs. per rupee. No. 2 at 10 lbs. per rupee because the latter two give more waste and one has to pay more for carding. Only that No. 3 white wool cannot be had in large quantities.

I think at both the places these samples are not well washed before sheering. The local sheep here are washed before sheering. Nos. 1 and 2 will require brush while washing.

The Live stock Expert may be requested to inform how much quantity of white wool is available through him, in what month and at what rate. I may have to order some quantity when required.

I beg to remain,

SIR,

Your most obedient servant,

(Sd.) S. V. WAGH,

*Weaving Assistant.*



*Result of test taken.*

Quality of Wool.	Wool quantity used.	Wastage found.	Net quantity got when spun.	Time required for carding in hours.	Time in hours for spinning.	Time to warp, size, weave, etc.	Price.	
	Lbs. tolas.	Lbs. tolas.	Lbs. tolas.	Hours.	Hours.	Hours.	Rs. A. P.	
<b>No. 1—</b>								
Supplied by Livestock Expert, B. P. .. ..	5	2 1	0 4	2	32	16	12	3 12 0
<b>No. 2—</b>								
Supplied by Deputy Director of Agriculture, S. D., Dharwar .. .	4	36 1	15 3	20	32	16	16	3 4 0
<b>No. 3—</b>								
Purchased locally by Department of Industries, Bombay .. ..	4	37 0	32 4	5	24	16	12	3 12 0

*Remarks.*

*Sample No. 1.*—The trouble is only while carding and the surface of cloth will show some dirt of grass pieces but good to weave.

*Sample No. 2.*—This is very rough and gives trouble while weaving also.

*Sample No. 3.*—This is quite alright.

VREDE,

GRAAFF-REINET,

SOUTH AFRICA,

2nd June 1931.

To

THE LIVESTOCK EXPERT TO THE GOVERNMENT OF BOMBAY,  
POONA, INDIA.

SIR,

I am indebted to the Honourable Member for Agriculture for your name. I wrote to him a short time ago to enquire the name of the Government Department in India, which may be interested in the importation of Wanganella Sheep for the purpose of improving the quality of the local sheep.

You are no doubt aware that Australia has placed an embargo on the export of Wanganella Rams. In South Africa prior to the embargo very extensive importations were made from Australia, and we are now in a position to supply Wanganella Stud Rams of the very best quality.

The Wanganella has for many years been considered one of the best breeds of fine wool sheep, combining strong constitution, quantity and quality of wool. The breed is very hardy.

Large sums of money were spent in Australia by South African farmers to acquire the best. For instance a friend of mine Senator Andrew Conroy purchased one ram and twenty ewes in Australia for £6,300. This man has since bought stud ewes from me for £3,400.

In South Africa the ideal country for the Wanganella consists of grass and short bushes known as the Karroo with a rainfall of from 20 to 30 inches, and an altitude of from 4,000 to 5,000 feet. At the same time the breed is so hardy that I have been supplying rams to the semi-tropical country in the Northern Transvaal, to the desert lands of South West Africa, to the Native Territories in the Cape Province, to Natal, the Orange Free State, Griqualand and Namaqualand, and many parts of the Cape Province. So far as I have heard these rams are all doing well.

About three months ago I had an enquiry from India with a view to supplying 300 to 500 Wanganella Flock Rams to improve the quality of the sheep grown there. Experiments already made in some parts of India prove that by the introduction of good Wanganella Rams, the progeny of the first cross produced double the quantity of wool and of a far better quality. It has occurred to me that you may possibly be prepared to import a few Wanganella Rams and Ewes with a view to forming a small stud from which you can supply your farmers with rams, thus improving the quality of the sheep, and accordingly increasing the weight of wool produced, and consequently improving the monetary return per sheep.

I am taking the liberty of enclosing some literature regarding my stud, also a few photographs of my stud rams and ewes.

In August of this year Mr. Noel Roberts, H. D. A., Sheep Expert, will be classing about 800 young rams. These rams will be valued by him at £3; £5; £7-10-0; £10; £15; £20; £25 and £35. Stud Rams at from £50; £75; £100; upwards. He will value my stud ewes at £3; £5; £7-10-0; £10; £15; and £20 upwards.

With reference to Mr. Roberts, I should like to say that we consider him the premier sheep expert in the Union of South Africa. He first studied in Australia, and then took up Government work in South Africa for a considerable period, which he eventually left of his own accord to take up more lucrative private practice. I am telling you all this because should you care to place a trial order, you will know that you will receive very

good value. I should imagine that you would prefer to import a small stud and produce flock rams in your own country as the cost of importing flock rams is likely to be out of proportion to their original cost.

I append a list of weights of thirty flock rams sold to Mr. Mey of Volks-rust, Transvaal. These were specially selected for weight and will be a little above the average weight produced by my £3 line.

Should you consider business, I will be prepared to send you copies of references, which I think would satisfy you regarding my *bona fides* and desire to build up an export trade, which would merit repeat orders.

Assuring you of my best services,

I remain,

Yours faithfully,

(Sd.) FRANK BIGGS.

(True copy.)

E. J. BRUEN,

*Livestock Expert to Government,*

*Bombay Presidency, Poona.*

RAMS PURCHASED BY J. C. MEY, VOLKSRUST, TRANSVAAL, SHORN.  
21st MARCH 1931.

	No. of Ram.	Price £3.	Weight of wool at 14½ months.	Age 4 tooth.
1	2216		21½ lbs.	
2	5114		20½ "	
3	5315		19 "	
4	2469		19½ "	
5	4968		18 "	
6	4430		23 "	
7	4705		21½ "	
8	2219		22 "	
9	4398		16 "	
10	2390		25½ "	
11	2166		21 "	
12	7433		23 "	
13	4420		23 "	
14	7407		23½ "	
15	3878		21½ "	
16	4154		24 "	
17	2722		24½ "	
18	2344		20½ "	
19	2432		19½ "	
20	2105		21½ "	
21	2228		22½ "	
22	3805		21½ "	
23	2357		21 "	
24	2146		25½ "	
25	4175		21½ "	
26	4375		20½ "	
27	4459		22 "	
28	3751		21½ "	
29	4235		21½ "	
30	2519		19 "	

APPENDIX XIV.

SUBJECT NO. 14.

APPLICATION FROM THE GOVERNMENT OF MADRAS FOR A GRANT OF Rs. 92,487 SPREAD OVER A PERIOD OF THREE YEARS FOR A SCHEME OF RESEARCH FOR IMPROVING THE FISHING INDUSTRY AND DEVELOPING THE SUPPLY OF FISH MANURE.

Attention is invited to the attached letter from the Government of Madras, No. 3563-II/33-1, dated the 11th January 1933 (Annexure) regarding a scheme of research for improving the fishing industry and developing the supply of fish manure. The scheme which is fully explained in Mr. Slater's letter (Annexure) involves, in so far as the Council is concerned, an expenditure of Rs. 92,487 spread over a period of three years.

The subject is now for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 19th January 1933.*

## ANNEXURE

LETTER FROM S. H. SLATER, Esq., C.M.G., C.I.E., I.C.S., SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 3563-II/33-1, DATED FORT ST. GEORGE, THE 11TH JANUARY 1933.

*Fish manure—Research.*

I am directed to forward a scheme of research for improving the fishing industry and developing the supply of fish manure for favourable consideration by the Imperial Council of Agricultural Research.

As the Council is aware, the Department of Fisheries in Madras has been engaged for some time in introducing improvements in the manufacture of fish guano, fish meal and fish manure. Prior to the investigations made by the department, the method of producing fish fertilizer was primitive in character and consisted in drying sardines in the sun on the sands of the open beach. This system had two drawbacks. Large quantities of valuable oil of no manurial value were lost and the manure became so highly impregnated with sand that analysis frequently showed the resultant mass to contain as much as 40 per cent. of this useless adulterant. Experiments were, therefore, undertaken at the Tanur station on the West Coast and had a speedy success. It was found that a simple and inexpensive plant could be devised to separate the oil and fertilizer effectively and profitably and the oil and the fertilizer so separated were of such good quality and fetched such high prices that numerous private factories came into existence on the Malabar and South Kanara coasts. Further experiments have shown that it is likely that a good proportion of the fish guano now used as a fertilizer will eventually be used more profitably as food for livestock, cattle pigs, dogs, poultry, etc. Success has already been obtained in producing fish meal on a small scale from all the common fish found on the West Coast. Samples of these were exhibited at the Wembley Exhibition and several enquiries followed for the supply of the meal in bulk. The conversion of 'scrap' (fish pressed for oil) into fish meal is more remunerative to the manufacturers and useful to the agriculturist than conversion into fish guano.

The processes now followed at Tanur for separating the oil and the fertilizer are, however, still empirical and crude. Much remains to be done by technological research to improve the quality of the oil and to develop the manufacture of guano and fish meal on approved scientific lines. The process of boiling and expressing the oil by hand presses which is now done at the Research station and in private factories is wasteful inasmuch as the proteins and other nitrogenous substances from the fish are lost in liquid form. The mechanical devices for manufacture of these products on a commercial scale have still to be improved so that production may be cheapened and quality standardized. Every step in the manufacture of oil and guano requires careful and detailed investigation and experiment. The degree of freshness of the fish required for high class manure and meal, the correct temperature for cooking, methods of cooking in closed or open vessels by steam or open fire, the period for which cooking should be continued, method of separation of oil without detriment to the quality or manure, the degree of dryage of scrap, etc.—all require detailed investigation and accurate experiment. Though general methods of manufacture are the same everywhere, details of the process differ with each kind of fish. The process suitable for Indian fish have therefore to be specially ascertained before the fish guano industry can claim to have attained even a reasonable degree of success. The perfection of the methods of manufacture, of fish meal referred to above, which is a more remunerative industry and one of considerable importance to the agriculturist in feeding livestock requires also the services of an expert Fisheries Chemist and Technologist.

The Tanur station as at present equipped and staffed is not competent to deal with any of the problems enumerated above. The Director of Fisheries proposes, therefore, that a bio-chemical laboratory should be established at Tanur and the services of a competent and experienced Bio-Chemist should be engaged for a period of at least three years to

begin with. As the research is of a highly technical nature, the officer to be recruited should be a technologist of wide experience and it is not anticipated that such an officer could be obtained for less than Rs. 1,200 per mensem. One of the Assistants of the United States Bureau of Fisheries with considerable experience in the manufacture of oil and guano who has actually patented improved processes and machinery, was interviewed by the Director in 1929 when he agreed to come to India for a short term of years but considered that a salary of Rs. 1,200 per mensem was the minimum which he could accept. It is understood that this officer, though he has since left the Bureau, will be available to undertake the proposed research at Tanur.

It will be convenient and economical to locate the laboratory at Tanur where there is ample accommodation for the Technologist, his staff and his laboratory. It is considered that if the experiments prove as is expected, a success, the laboratory will be required as a permanent measure and it will then be necessary to have a suitable Indian specially trained in charge of the work. To that end, it has been suggested that a Chemistry Honours Graduate of an Indian University of approved merit and high academic qualifications should be recruited at once on an initial salary of Rs. 200 a month. In order to enable him to acquaint himself with local conditions and specific problems relating to Indian fish oil and manure industry he will be deputed for a period of one year to visit the private oil and guano factories on the coast and to work under the immediate control and guidance of the expert at the Tanur station. After a preliminary study and training he should be deputed to America, for an advance course of bio-chemistry with special reference to fish oil, guano, and fish meal manufacture for a period of one year. The deputation to America is proposed as it undoubtedly offers the best facility for study and training to Indian students. In America, the student will visit the Atlantic and Pacific coasts, where two different kinds of fish are used in the industry. On his return at the end of the second year he will resume his work under the expert, the intention being that he should eventually succeed the expert. During the one year when the student will be away on training the expert will need the assistance of a suitable well-trained assistant of the department. An assistant on Rs. 70—250 will therefore be attached to the expert during the second year of the recruit's training abroad.

The total cost of the scheme is as shown below :—

<i>Non-recurring.</i>			
			Rs.
Apparatus, chemicals, etc., for the laboratory	..	..	10,000
Furniture and fittings	..	..	1,500
Site, buildings, plants, laboratory and office	..	..	39,120
Total			50,620
<i>Recurring.</i>			
			Rs.
Pay of Bio-Chemist at Rs. 1,200 a month	..	..	43,200
Pay of Research Assistant at Rs. 150 (one year)	..	..	1,800
Pay of laboratory assistant on Rs. 65—125	..	..	2,484
Pay of clerk on Rs. 35—60	..	..	1,278
Pay of peon on Rs. 12—18	..	..	432
Contingencies	..	..	3,000
Apparatus and chemicals	..	..	3,000
Travelling allowance	..	..	3,000
Passage of the expert	..	..	3,500
Total			61,694

To the above expenditure will be added the cost of training of an Indian candidate as shown below :—

	Rs.
Pay at Rs. 200 (for 12 months) .. .. .	2,400
Travelling allowance in India .. .. .	1,000
Charges on account of the candidate going to America for a period of one year at 2,000 dollars .. .. .	8,500
Pay for the third year on return at Rs. 230 .. .. .	2,760
Passage to and from America (£160) .. .. .	2,133
Travelling allowance in America .. .. .	2,500
Total .. .. .	19,293

The scheme as explained above was placed before the Provincial Research Committee and has been approved by it. The contribution of Madras Government towards the cost of the scheme will be the cost of buildings, site, etc., estimated at Rs. 39,120 and included under non-recurring expenditure shown above. The continuance of the Tanur station has at present been sanctioned only up to 31st March 1934, and even if they decide to discontinue the work now done there after this date they would have no objection to allow the use of the buildings, laboratory, etc., for the conduct of the proposed investigation. The scheme is of importance not only to Madras but to all India. The Government of Madras attach great importance to the development of fish manure industry and I am to express the confident hope of His Excellency the Governor acting with his Ministers that the scheme will receive the sympathetic consideration of the Imperial Council of Agricultural Research.



## APPENDIX XV.

## SUBJECT NO. 15.

**APPLICATION FROM THE GOVERNMENT OF MADRAS FOR A GRANT OF  
Rs. 63,632 SPREAD OVER A PERIOD OF FIVE YEARS FOR A SCHEME  
FOR RESEARCH ON RURAL PISCICULTURE.**

Attention is invited to the attached letter from the Government of Madras, No. 3522-II/32-2, dated the 9th January 1933 (Annexure I) forwarding a scheme for research on Rural Pisciculture. The scheme involves a non-recurring and a recurring expenditure of Rs. 32,450 and Rs. 62,222 respectively or a total expenditure of Rs. 94,672 spread over a period of five years. Out of this Rs. 26,450 towards non-recurring expenditure and Rs. 4,690 towards recurring expenditure will be provided by the Madras Government. The net amount required from the Council is thus Rs. 6,000 on account of non-recurring expenditure and Rs. 57,632 on account of recurring expenditure.

2. In this connection, a reference is invited to principle No. (iii), extract attached (Annexure II), of the principles laid down by the Governing Body to govern grants by the Imperial Council of Agricultural Research which reads as follows :—

“That ordinarily land and buildings required under a scheme should be provided by the Government or Governments, concerned, the Council making a grant for equipment and staff alone.”

In accordance with this principle, the ordinary practice for the Council is not to bear the cost of accommodation of staff employed by Governments on schemes submitted by them whether such cost takes the form of outlay on buildings or the provision of a house-rent allowance. The present scheme provides for the grant of house-rent allowance for research officer, research assistant, laboratory assistant and sub-assistant inspector. It is, therefore, for the consideration of the Advisory Board whether provision on account of the house-rent allowance should not be omitted.

3. The scheme is now for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 20th January 1933.*

## ANNEXURE I

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 3522-11/32-2, DATED THE 9TH JANUARY 1933.

*Scheme for research on Rural Pisciculture.*

I am directed to forward 100 printed copies of the scheme (Enclosure) for research on Rural Pisciculture prepared by the Director of Fisheries, Madras, and to recommend it for favourable consideration of the Council. The opening of the biological station which forms part of the scheme is being considered in connection with the budget of next year and when that is approved, requisite provision which will represent the contribution to the scheme from Provincial Revenues will be included in the budget subject to the vote of the Legislative Council in March.

The Provincial Research Committee at its meeting held on 2nd December 1932 has accepted the scheme and recommended it for consideration of the Council (Annexure II).

(ENCLOSURE.)

## RESEARCH ON RURAL PISCICULTURE.

With reference to the recommendations of the Royal Commission on Agriculture in paragraph 415 of their report, Government sanctioned in 1930 an Assistant Director of Fisheries and staff for propaganda in favour of Rural Pisciculture. But, owing to financial stringency, the staff had to be disbanded in 1931 after about a year. In reviewing the work of the Assistant Director for Rural Pisciculture, the Government observed that—

“ The Assistant Director and staff sanctioned for the purpose carried on propaganda work throughout the year and the description of the work given in section VIII (a) of the Director's report shows that it is possible to awaken an interest not only among individuals but also among public bodies owning private waters in the possibilities of developing pisciculture as an important remunerative industry. Though for financial reasons, it has been found necessary to disband the special staff, it is hoped that the Department would, through the existing organization of the Inland section, be able to render whatever help may be needed for the continuance and development of this work in suitable areas.”

2. The propaganda done during the thirteen months has awakened considerable interest in pisciculture on the part of private individuals and public bodies. Applications from different parts of the Presidency are received for advice and help in growing fish in wells, ponds and tanks. But the Department is not in a position to render assistance not merely for want of staff but for want of the necessary information regarding fish suitable for small wells and tanks in the different district, and the factors that govern their growth and fattening in such waters. The experience gained during the thirteen months has served to disclose the possibility of using several local fish for well and pond culture. So far the only fish used is “ Catla ”—a North Indian Carp—the fry of which are available only in the Kistna and Godavari rivers in July and August. Not only is it expensive to transport the fry to South India but stocking operations have to be limited to the hot weather months of July and August when most ponds and wells are dry. It will be a great advantage, therefore, if fish that breed at other times and are locally abundant can be used for stocking but at present we have little or no information concerning them. Recently when the Director of Agriculture and his staff in Coimbatore, Tinnevely, and the Northern Circars kindly offered to help the Department to carry on the propaganda in favour of rural pisciculture provided fish for stocking, advice and help in growing them are given by the Fisheries Department, I had to confess the inability of the Department to provide fish or necessary instructions concerning them as practically nothing is known regarding the local varieties of fish. Therefore, the propaganda for rural pisciculture is impeded not merely through want of a special staff but also through want of knowledge regarding the fish which are likely to prove of the greatest value to the owners of wells and ponds.

3. For assisting the ryots in the different districts in growing fish in their wells and ponds, the following information is essential :—

- (1) Which of the 60 odd kinds of fresh-water food fish available in this Presidency are suitable for stoking wells and ponds ?
- (2) What is the breeding season of the selected kinds and where the young fish for stocking wells and ponds can be obtained plentifully and cheaply by the ryots ?
- (3) Are such fish available locally ? If not, the nearest source where they can be had and the cheapest mode of transport ?
- (4) What is the favourable food of these fish and how is such food natural or artificial to be obtained abundantly and cheaply ?
- (5) What weeds, snails and other vegetable and animal organisms are associated with the occurrence and abundance of these fish and how could they be cultured in ponds and wells ?

- (6) What are the favourable physical and chemical characters of water in which the different fish thrive best and how could unfavourable conditions present in certain wells and ponds be remedied ?
- (7) What are the enemies of the fish to be reared and how can they be eradicated in ponds and wells for successful results ?
- (8) What are the diseases of fish in captivity and how are they to be controlled ?

4. For the above investigation and research (i) a properly equipped research station and (ii) qualified staff are necessary. In pursuance of the recommendations in section IV, Chapter III of the report of the Committee on Fisheries in Madras, the Madras Government are considering the establishment of a fully equipped fresh-water biological station and fish-farm. The Old Brickfields at Chetput near Madras have been assigned to the Department for the establishment of the station. In addition to the valuable site which measures about 13 acres in the Old Chetput Brickfields and the quarters for the Resident Officer, the expenditure, involved in the proposals now under the consideration of the Madras Government is estimated at Rs. 13,450. Six fish ponds will be constructed. Plans and estimates for laboratory, offices, and store shed have also been submitted to Government and these are estimated to cost another Rs. 13,000.

5. As the proposed research on pond and well culture is the direct outcome of the recommendations made by the Royal Commission on Agriculture, I propose that the Agricultural Research Council be approached for funds for the scheme of special investigations detailed in paragraph 3 above for a period of five years. The cost of the investigations will be approximately as follows:—

	Rs.
<i>Staff—</i>	
1 Qualified Research Officer (Assistant Biologist) on Rs. 250—25— 750 per mensem .. .. .	3,000
House-rent allowance for Qualified Research Officer (Assistant Biologist) at Rs. 50 per mensem .. .. .	600
1 Research Assistant on Rs. 70—5—250 per mensem .. .. .	840
House-rent allowance for Research Assistant at Rs. 15 per mensem .. .. .	180
1 Laboratory Assistant on Rs. 65—4—125 per mensem .. .. .	780
House-rent allowance for Laboratory Assistant at Rs. 15 per mensem .. .. .	180
*1 Sub-Assistant Inspector on Rs. 38—1—45 per mensem .. .. .	456
House-rent allowance for 1 Sub-Assistant Inspector at Rs. 6—8—0 per mensem .. .. .	78
1 Fieldman on Rs. 23—1—35 per mensem .. .. .	276
3 Fishermen on Rs. 18 each per mensem .. .. .	648
1 Peon on Rs. 15—20 per mensem .. .. .	180
*1 Day Watchman on Rs. 15 per mensem .. .. .	180
* 1 Night Watchman on Rs. 15 per mensem .. .. .	180
Travelling allowance .. .. .	2,500
<i>Running charges—</i>	
Purchase of fish .. .. .	500
Contingencies including expendible stores and books .. .. .	1,000
<i>Non-recurring charges—</i>	
Scientific apparatus .. .. .	3,000
Hatching boxes and hatchery apparatus .. .. .	500
Furniture, fittings, etc., including over-head tank, oil engine and pump .. .. .	1,500
Conditioning boxes, carriers, syringes, aerators, and special aquaria for pond life .. .. .	500
Nets .. .. .	500

\* Existing staff of the Powder Factory Fish Farm provided by the Madras Government.

The immediate item of investigation that will be started at the station is shown in Enclosure II. I do not consider that it will be possible to complete the observation in less than five years. The total cost of the scheme will be as follows:—

<i>Capital cost.</i>		Rs.
Fish ponds .. .. .	.. .. .	13,450
Laboratory and buildings .. .. .	.. .. .	13,000
Apparatus, fittings, hatchery boxes and aquaria, etc. .. .. .	.. .. .	5,000
Conditioning boxes, carriers, syringes, aerators and aquaria and nets		1,000
Total		32,450

<i>Recurring charges.</i>		Per year. For 5 years.	
		Rs.	Rs.
Research Officer and staff .. .. .	.. .. .	7,578	42,222
Travelling allowance .. .. .	.. .. .	2,500	12,500
Purchase of fish .. .. .	.. .. .	500	2,500
Contingencies including expendible stores, etc. .. .. .	.. .. .	1,000	5,000
Total		11,578	62,222

The total cost of the scheme for five years will, therefore be Rs. 32,450 for capital expenditure, and Rs. 62,222 for running charges. Out of this, Rs. 26,450 towards capital expenditure and Rs. 4,590 towards running expenditure will be provided by the Madras Government who will in addition provide a valuable site measuring 13 acres in extent very near the City of Madras and staff quarters valued at Rs. 1,581. The contribution by the Imperial Council of Agricultural Research will be Rs. 6,000 for capital expenditure, and Rs. 57,632 for running charges.

#### ENCLOSURE II.

*A memorandum of studies and investigations which it is proposed to carry out at the station.*

1. The study and selection of the best kinds of fish for tank and well stocking in rural areas.
2. The artificial breeding of the most important class of fish for small tank and well culture such as problems relating to Catla breeding at Satyavedu.
3. Adoption of the best and cheapest methods for the transport of live fry to tanks and wells by special tin carriers such as hermetically sealed receptacles with oxygen.
4. Intensive study of fresh-water microfauna and flora of ponds and wells and the selection of those that form the food of fish.
5. The effect of different fresh-water weeds, snails, shrimps and insects in fish under culture.
6. The value of different classes of artificial food in promoting growth and fattening of fish for the market.
7. The examination of hydrographical conditions in fish ponds and wells, i.e., chemical composition, the physical conditions of water which affect fish breeding.
8. Experiments in the destruction of predaceous fish with poisons or electricity.
9. The study of diseases of fish under culture; such as the parasitic worms in Catla, tumours and the torsion of the vertical column in Gourami.

ANNEXURE II.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE GOVERNING BODY OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD AT SIMLA ON THE 29TH JULY 1930.

\* \* \* \* \*

The Governing Body adopted the following principles which in its opinion should govern grants by the Imperial Council of Agricultural Research in future :—

\* \* \* \* \*

- (iii) That, ordinarily, land and buildings required under a scheme should be provided by the Government or Governments concerned, the Council making a grant for equipment and staff alone.

## APPENDIX XVI

## SUBJECT NO. 16.

## APPLICATION FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, FOR A GRANT OF Ra. 5,100 FOR THE EXPORT OF ALPHONSO MANGO FRUITS TO GREAT BRITAIN IN 1933.

Attention is invited to the attached copy of a letter (and enclosure) from the Director of Agriculture, Bombay Presidency, Poona, No. 493-A.B.I. of 1932, dated 25th November 1932 (Annexure) regarding the export of Alphonso mango fruits to Great Britain during the mango season April—June 1933. The scheme involves an expenditure of Rs. 5,100 in 1933 but there will be countervailing receipts estimated at Rs. 3,500 which will be credited to the Council.

2. It will be remembered that on the recommendation of the Advisory Board made at its meeting held in January 1932 the Governing Body of the Imperial Council of Agricultural Research made a grant of Ra. 4,000 for work on experimental consignments of mangoes during the season in 1932. A report in respect of the same which has now been received is enclosed for information. (Not printed.) The receipts for the 1932 shipments amounted to Ra. 4,100 so that the experiments cost nothing eventually.

3. The subject is now for the consideration of the Advisory Board.

CHARAN DAS,

Secretary.

The 9th February 1933.

LETTER FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, NO. 493-A.B.I. OF 1932, DATED POONA, THE 25TH NOVEMBER 1932.

SUBJECT.—*Export of Alphonso mango fruits to Great Britain in 1933. Application for a grant-in-aid of Ra. 5,100 for the—.*

I have the honour to state that the Horticulturist to the Government of Bombay, Dr. G. S. Cheema, desires to repeat in 1933 the experiments on the export of Alphonso mangoes to Great Britain. I attach herewith a statement by him indicating what is desired and I have the honour to state that I fully concur with his ideas. It seems to me essential that this matter should not be allowed to drop and that the success of 1932 should be immediately followed up by a further set of consignments in 1933. The London market has now been taught to expect mangoes at a particular time of the year and it seems to me that we should continue these experimental shipments for at least another year in order to confirm the results of the first year and to give confidence to both the Indian exporter and the British importer. Incidentally we shall also get further valuable data on storage conditions and practical experience as to the possibilities of reducing the landing cost of the fruits.

I wish to make clear that this scheme does not overlap the Cold Storage Scheme which is now before the Imperial Council of Agricultural Research. The Cold Storage Scheme is a research of a more fundamental nature in order to get exact data as to a considerable number of points.

The export of fruit in the manner carried out in 1932 and suggested for 1933 is partly experiment, but more of the nature of propaganda and I contend that this propaganda should continue along with the more exact scientific experiments on cold storage which I trust will shortly be sanctioned by the Council.

Last year the amount sanctioned was Ra. 4,000 and the amount recovered in sales was Ra. 4,100. In the current year Ra. 5,100 is requested and Ra. 3,500 is expected as receipts. The difference between the proposed expenditure and the expected income is largely due to travelling expenses which are included.

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*Application for Grant-in-aid of Rs. 5,100 for the Export of Alphonso Mango fruits to Great Britain in the year 1933.*

The results of the experiments on the export of Alphonso mangoes to Great Britain in 1932 have already been submitted to the Imperial Council of Agricultural Research, New Delhi. I herewith enclose a copy of my report for reference. The probable conclusions which may be drawn from these investigations are as follows :—

1. Mango fruits promise to reach England in good condition if stored in the Purser's Cool room at a proper temperature.
2. Mango fruits of stage " B " weighing 24-28 tolas fetch a good price.
3. The landing cost per fruit is five annas and six pies.

It is now considered essential that these statements must be confirmed before and advice on this matter is offered to the public. The exporters feel shy to follow these results unless repeated success is shown to them.

Besides, the landing cost must be reduced to 4d. per fruit before its sale on a commercial scale is possible. The Indian Trade Commissioner in London is keen on this subject. Lastly, it is considered imperative to maintain interest in this field of work till it is taken up by the people.

It is chiefly on these considerations that I suggest that this export of mango fruits to England may be repeated in the year 1933.

Our future experiments will be planned in co-ordination with the Empire Marketing Board, London, who will help us in getting necessary shipping concessions and cool space on steamship for direct stowage. Further the cool rooms will be equipped with thermographs to record storage temperatures. In 1932 it was not possible to determine these temperatures on boats for want of this apparatus. For future experiments a number of thermographs will be obtained on loan from different sources in India as well as from England.

The fruits for shipment will be collected from all the important centres such as Ratnagiri, Bombay, Surat, Poona and Dharwar. The quantity to be handled will be only one ton per shipment. Only ten shipments will be tried. The shipments will commence from the last week of April.

An attempt will be made further to improve methods of picking, sorting, grading, and packing of the fruits. An effort will be made to secure a better type of wood-wool. Besides wood-wool, the effect of grass and rice straw will be noted.

The history of the fruits will be recorded as in 1932 and the fruits will be consigned to the Agent appointed by the Empire Marketing Board.

The details of expenditure likely to be incurred on this experiment will be as follows :—

	Rs.	s.	p.
1. The cost of 1,000 trays, packing material, etc., inclusive of inland freight charges and other transport charges at Rs. 40 per 100 .. .. .	400	0	0
2. The cost of 10,000 fruits at Rs. 20 per 100 .. .. .	2,000	0	0
3. The ocean freight charges for ten tons at Rs. 50 per ton .. .. .	500	0	0
4. The agencies on ten tons in India as well as in England at Rs. 70 per ton .. .. .	700	0	0
5. Travelling allowance :—			
(a) Non-voted .. .. .	700	0	0
(b) Voted .. .. .	800	0	0
<b>Total .. .. .</b>	<b>5,100</b>	<b>0</b>	<b>0</b>



It is anticipated that the receipts from the sale of fruits may go up to Rs. 3,500. If the market in London is good, then we might get even more money. So there is not much loss in this work.

Every conceivable effort will be made to cut down the cost of fruits and agencies. These are the only two items on which, it is felt, that economy can be shown in reducing the cost of landing.

In case the Imperial Council of Agricultural Research would like to include fruits from other provinces, the expenditure may be proportionately increased. It is estimated that I shall require Rs. 35 per 100 fruits for other provinces (inclusive of freight charges in India). The additional expenditure depends upon the number of varieties and the number of fruits which other provinces would like to include. I may also point out here that the receipts are likely to be reduced as it is not possible to say at this stage if this fruit will ship well and sell well. At any rate I leave this question for the Council to settle.

I may, however, submit that the Bombay Presidency Fruit Growers' Association as well as others interested in England would like this work to be repeated.

(Sd.) G. S. CHEEMA,

*Horticulturist to Government, Bombay, Poona.*

## APPENDIX XVII.

## SUBJECT No. 17.

PROCEEDINGS OF THE SUB-COMMITTEE APPOINTED TO CONSIDER AN APPLICATION (ANNEXURE II) FROM THE GOVERNMENT OF BIHAR AND ORISSA FOR A GRANT OF Rs. 78,680 SPREAD OVER A PERIOD OF FIVE YEARS FOR A SCHEME OF RESEARCH ON THE ECONOMICS OF IRRIGATION FROM TUBE WELLS.

## PRESENT :

- |   |                           |
|---|---------------------------|
| 1. Diwan Bahadur Sir T. VIJAYARA-<br>GHAVACHARYA, K.B.E., <i>Chairman</i> , | 3. Mr. B. C. BURT.        |
| <i>ex-officio</i> .   | 4. Mr. T. A. M. BROWNLIE. |
| 2. Mr. R. G. ALLAN.   | 5. Dr. L. K. HYDER.       |
|   | 6. Mr. D. R. SETHI.       |

Rai Sahib Malik CHARAN DAS, *Secretary*.

The Committee agreed that the provision of an electric motor was not necessary and that item (a) in the programme of work, paragraph 9 (Enclosure to Annexure II), might well be omitted. So far as this research is concerned, the economic rate per unit for electric power can be calculated from the results obtained with an oil-engine-driven pump.

2. After a full discussion of the programme of work, the Committee agreed that an Assistant Engineer on Rs. 300 to Rs. 400 per mensem was not necessary and that he could be replaced by an Engineering Supervisor on half this pay. The Committee agreed that there was great need for research on items (b) to (1) of the programme (paragraph 9). In view of the importance of determining channel losses, one self-registering water-meter alone would not be sufficient and provision should also be made for one weir and water-level recorder at the pump and for three water-level recorders at the fields, 9 chambers for the latter would be required, making a total cost for water recording apparatus of Rs. 13,500 instead of Rs. 6,000 as proposed. Items 3 of the expenditure described under paragraph 16 (a) does not seem to be necessary but, on the other hand, the same amount will be required for experiments with simple forms of lined channels. There would be an increase in non-recurring expenditure of Rs. 5,500 and a decrease in recurring expenditure (over the 5 years) of Rs. 10,500, giving a net reduction of Rs. 5,000 in the amount of Council's grant.

3. Subject to the amendment of the scheme (Enclosure to Annexure II), as proposed, the Sub-Committee recommend it to the Advisory Board for approval. They are of opinion that there is great need for work of this nature and that the results will be of value to several provinces. The Committee wish to draw attention to the necessity of the water from the tube well being analysed chemically from time to time, during the course of the experiments. Recent experience has emphasised the desirability of a knowledge of the composition of the water used for irrigating crops and the point is also of importance in connection with the life of tube-wells.

CHARAN DAS,

*Secretary*.

The 17th February 1933.

## ANNEXURE I.

APPLICATION FROM THE GOVERNMENT OF BIHAR AND ORISSA FOR A GRANT OF Rs. 78,680 SPREAD OVER A PERIOD OF FIVE YEARS FOR A SCHEME OF RESEARCH ON THE ECONOMICS OF IRRIGATION FROM TUBE WELLS.

At its meeting held in July 1932, the Advisory Board of the Imperial Council of Agricultural Research considered an application (Enclosure), from the Government of Bihar and Orissa for a grant for research on the economics of irrigation from tube wells in that province and decided (Annexure III), that the Scheme should first be examined by a Committee appointed for the purpose.

2. The Vice-Chairman of the Council has accordingly appointed the undermentioned Committee to examine the scheme in question :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, K.B.E., *Chairman, ex-officio.*
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. Dr. L. K. HYDER, Ph.D.
4. The Director of Agriculture, United Provinces.
5. The Director of Agriculture, Bihar and Orissa.
6. Mr. T. A. M. Brownlie, Agricultural Engineer to the Government of the Punjab (Subject to the approval of the local Government).

Rai Sahib Malik CHARAN DAS, *Secretary, ex-officio.*

The Committee will meet during the next session of the Advisory Board on an afternoon, which will be fixed later to meet the convenience of members, between the 16th and 18th February 1933.

CHARAN DAS,

*Secretary.*

*The 10th January 1933.*

## ANNEXURE II

COPY OF A LETTER FROM THE SECRETARY TO GOVERNMENT, EDUCATION AND DEVELOPMENT DEPARTMENT, RANCHI, TO THE SECRETARY TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 120-D.R., DATED THE 20TH MAY 1932.

SUBJECT.—*Scheme of research on the economics of irrigation from tube wells.*

I am directed by the Government of Bihar and Orissa in the Ministry of Education to submit for the approval of your Council a scheme (enclosure) of research on the economics of irrigation from tube wells, Bihar and Orissa.

2. The scheme has been drawn up by Mr. D. R. Sethi, I.A.S., officiating Director of Agriculture, Bihar and Orissa, and approved by the Bihar and Orissa Agricultural Research Committee. I am to request that steps may be taken to place it before the meeting of the Advisory Board of your Council in June 1932 and allot funds in case the scheme meets with the approval of your Council.

## ENCLOSURE TO ANNEXURE II

## RESEARCH ON THE ECONOMICS OF IRRIGATION FROM TUBE-WELLS, BIHAR AND ORISSA.

1. In recent years the tendency on the part of estate owners not having facilities for irrigating their lands from canals has been to go in for large diameter tube-wells. The capital cost of such wells, however, is comparatively large and the total cost per irrigation much higher as compared to that of supplies from canals. In order that existing and prospective tube-well farmers be placed in possession of accurate information on all relevant points it is necessary to carry out research on this method of irrigation farming with special reference to its economic aspects.

2. That such studies are of more than provincial importance is evident from their nature. While it is true that the results obtained at any one station may not be applicable in their entirety wherever tube-wells are used for irrigation farming yet in their general applicability they would be of immense assistance to all concerned.

3. The position in Bihar and Orissa is that during the past few years there has been an increasing demand on the part of zamindars for large diameter tube-wells. Realizing the great necessity of studying all the problems connected with irrigation farming from the tube-wells, the Local Government set apart 60 acres of land at Patna farm for this purpose. This area has been fully equipped in every way including a 12 inch diameter 310 feet deep tube-well, about 1,500 feet of main cement masonry channels, and a 15-30 B.H. P. International Tractor outfit. The rated capacity of the well is two cusecs with a depression of 8 feet.

4. The financial conditions of the Province have so far precluded the recruitment of trained staff necessary to carry out the work. The future prospects also do not hold out any hope that it will be possible to get together the funds and staff necessary for the work without extraneous help. It is, therefore, necessary to approach the Imperial Council for the sanction of a modest grant to enable the investigations to be carried out for a period of five years in the first instance.

5. Research on irrigation farming, irrespective of the source of irrigation, requires studies on agricultural, engineering, soil physics and plant physiological aspects of the problems involved. The first two of these are mainly concerned with the economic aspects of the problem and these being of immediate importance it is considered that the a present scheme should confine itself to them. The other two are concerned more with the scientific aspects and as these are to be taken up in detail at the proposed Irrigation Research Station to be established in the Punjab it is not intended to take up these in Bihar for the present.

6. The whole scheme of investigations will be under the control of the Director of Agriculture, Bihar and Orissa. The Deputy Director of Agriculture, South Bihar assisted by a separate research Assistant Director of Agriculture will be in charge of the Agricultural investigation while the Assistant Engineer will carry out the engineering investigations.

It is not possible to provide accommodation for the proposed staff on the farm but as the farm is situated within the municipal limits of the town of Patna, the staff will find no difficulty in securing accommodation. Office accommodation, etc., however will be available at the farm. The farm, consisting as it does of 200 acres has a resident staff of Agricultural Assistants, sardars, etc., and there would, therefore, be no difficulty in the proper supervision of the research station when the expert officers are not on the spot. In fact it is proposed to partially utilise the resident farm staff for ordinary farm operations at the Research Station.

7. The cost per unit of water at the pump head from tube-wells varies with the size of wells and the machinery employed. It is therefore essential that data regarding capital cost and working expenses of various sizes of tube-wells should be collected in order to arrive at reliable figures regarding the cost per unit of water from such wells. It is therefore proposed to utilize the Engineering staff provided for in the scheme in collecting data from the wells that are already operating in the province. As this will involve touring, provision in the scheme has been made for expenditure on this account.

*Technical Aspect.*

8. In tube-well irrigation farming the most important problems are :—

- (1) The cost per unit of water.
- (2) The prevention as far as practicable of wastage in distribution.
- (3) The optimum quantities of water to be allowed to different crops consistent with yield and profit; and
- (4) most profitable systems of framing that will fully utilize the available water.

9. That the results obtained from investigations that are proposed to be carried out at this station will be a fairly wide applicability is evident from the fact that the proposed research station has a fairly wide variety of soils varying from Gangetic alluvium to heavy-black clays which are to be met with over extensive tracts in this as well as other neighbouring provinces. It is, therefore, proposed to take up the following lines of investigations :—

- (a) Cost per unit of water at pump head using two types of Power Plant—Oil Engine and Electric Motor.
- (b) Total cost including distribution cost per unit of water applied to the land.
- (c) Total cost per acre irrigation of major crops.
- (d) Measurement of losses of water in distribution.
- (e) Effective methods of distributing water so as to minimize losses in distribution.
- (f) Suitable size and shape of fields for different discharges.
- (g) Suitable methods of preparing tube-well irrigated fields so as not to disturb surface levels leading to wastage of water.
- (h) Optimum quantity of water required by major crops from the point of view both of outturn and profit.
- (i) Most suitable rotations for tube-well irrigated lands in order to fully use the available supply.
- (j) Effects of varying depths of preparatory tillage on the subsequent water requirements of crops.
- (k) Economics of flat, *vr.* ridge and furrow irrigation from tube-wells.
- (l) Frequency of irrigation :—
  - (i) Best intervals at which to apply water to various crops.
  - (ii) Effects of interculture of crops on frequency of irrigation and economics of the same.

10. As has already been stated the 12 inch tube-well at the Patna Government Farm has a rated capacity of 2 cusecs. It is equipped with an 8 inch Centrifugal pump driven by a 20-25 B. H. P. Rustan Crude Oil Engine. It is proposed to instal a 20 B. H. P. Motor complete with starter, etc., for purposes of comparison. Current at industrial rates is available from a large town-supply steam station adjoining the farm.

11. In order to minimize losses due to seepage in the main channels, about 1,500 feet of cement masonry mains have been constructed during the past three years. To complete these and to construct a few sub-mains additional funds are necessary.

12. The proposed research station is at present laid out in 4 acre plots and the whole area is adequately drained and well served with *pucca* and *bacha* roads. The shape and size of the plots can, however, be altered to suit experimental needs.

13. For its cultivation the station is fully equipped both with Bullock and Tractor power and with a representative collection of implements.

14. It is proposed to demonstrate the results obtained from the research station on the adjoining 140 acres of farm.

*Financial Aspect.*

15. That the Government of Bihar and Orissa attach very great importance to this research will be evident from the following non-recurring and recurring contributions which they are willing to make, in spite of their financial difficulties, in the financing of the proposal.

*Local Government's contributions.*

*A. Non-recurring—*

	Rs.
(i) 60 acres of fully equipped research station including office accommodation, etc.—Price of 60 acres of land at Rs. 1,500 an acre.	90,000
(ii) One 12 inch tube-well fully equipped with 20—25 B. H. P. Engine, Engine house, pump, pump house and pucca distribution channels.	12,000
(iii) One set of 15—30 Tractor complete with its implements	9,000
(iv) Farm equipment consisting of bullocks, implements, etc.	2,500
<b>Total</b>	<b>1,13,500</b>

*B. Recurring—*

(i) All annual expenses of working the research station including cost of running tube-well and tractor.	8,000
(ii) Part time services of the Resident Farm staff consisting of 3 Agricultural Assistants, 2 sardars, and mechanic.	2,000
<b>Total</b>	<b>10,000</b>
<b>Five years' cost</b>	<b>50,000</b>

**NOTE.**—All receipts from the Research station to be credited to the Government of Bihar and Orissa.

16. The Imperial Council of Agricultural Research is requested to sanction the following:—

A. *Non-Recurring*—

	Rs.
(i) One 20 B. H. P. Motor complete with starter, etc. ..	2,000
(ii) One self-registering water-meter .. ..	6,000
(iii) Construction of main and sub-main masonry channels (3,000 feet at Re. 1 a foot).	3,000
(iv) Iron outlets .. ..	500
(v) Furniture, Typewriter, Levelling instruments, stationery, etc.	1,500
Total ..	13,000

B. *Recurring*—

(a) *Staff*—

*Agricultural Section.*

	Rs.
(i) One A. D. A. at .. ..	250—20—330
(ii) One Agricultural Research Assistant at ..	80—5—100
(iii) One sardar at .. ..	20—1—24
(iv) One clerk at .. ..	40—2—48
(v) Two peons at .. ..	10 each

*Engineering Section.*

	Rs.
(i) One Assistant Engineer at .. ..	300—25—400
(ii) One Sub-overseer at .. ..	60—5—80
(iii) One Sardar at .. ..	20—1—24
(iv) Two peons at .. ..	10 each

(b) Travelling allowance at Rs. 1,500 per annum.

(c) Contingencies including stationery, stamps, liveries, etc., Rs. 500.

17. The attached table shows details of annual expenditure for five years which is requested from the Imperial Council. Abstract statement below shows the total cost for five years to Local Government and the Imperial Council:—

ABSTRACT OF EXPENDITURE.

<i>Share of the Government of Bihar and Orissa.</i>				<i>Share of the Imperial Council of Agricultural Research.</i>	
<i>Non-Recurring.</i>				<i>Recurring.</i>	
Rs.				Rs.	
1,13,500				13,000	
			Rs.		Rs.
1st year	..	..	10,000		11,720
2nd year	..	..	10,000		12,428
3rd year	..	..	10,000		13,136
4th year	..	..	10,000		13,544
5th year	..	..	10,000		14,552
		Total	50,000		65,680
Grand total of Non-Recurring and Re-				1,63,500	78,680
curring.					

18. If to the annual contribution of the Local Government is added the depreciation and interest on the plant and machinery provided the total contribution will amount to nearly the same as that of the Imperial Council. It is also clear that on a 50/50 basis the Local Government are contributing much more than their fair share. In fact the request to the Imperial Council amounts to nothing more than the bare minimum of expert staff required and a very small non-recurring grant which the Local Government are unable to provide. In the view of the above and in view of the importance of the research scheme and its wide applicability it is hoped that the Council will sanction the scheme.

It may be added that when sanctioned it is proposed to recruit the Assistant Director of Agriculture and the Assistant Engineer through the Public Service Commission, India.

(Sd.) D. R. SETHI,

Offg. Director of Agriculture,  
Bihar and Orissa.

PATNA;

The April 1932.

Items.	1st year.	2nd year.	3rd year.	4th year.	5th year.
1. One Asstt. Dir. of Agri.	3,000	3,240	3,480	3,720	3,960
2. One Asstt. Engineer ..	3,600	3,900	4,200	4,500	4,800
3. One Agril. Asstt. ..	960	1,020	1,080	1,140	1,200
4. One Sub-overseer ..	720	780	840	900	960
5. One clerk .. ..	480	504	528	552	576
6. Two Sardars .. ..	480	504	528	552	576
7. Four peons .. ..	480	480	480	480	480
8. Travelling allowance ..	1,500	1,500	1,500	1,500	1,500
9. Contingencies .. ..	500	500	500	500	500
Total .. ..	11,720	12,428	13,136	13,844	14,552



## ANNEXURE III

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD HELD IN  
SIMLA, ON TUESDAY, THE 19TH JULY 1932.

\* \* \* \* \*

*Application from the Government of Bihar and Orissa for a grant of Rs. 78,680 spread over a period of five years for a scheme of research on the economics of irrigation from tube wells.*

Mr. Sethi introducing the scheme explained how very important it was to ascertain—

- (a) the cost per unit of water ;
- (b) the prevention, as far as practicable, of wastage in distribution ;
- (c) the optimum quantities of water to be allowed to different crops consistent with yield and profit ; and
- (d) the most profitable systems of farming that will fully utilise the available water.

He then went through the various items of recurring and non-recurring expenditure and pointed out that the local Government were providing more than the usual 50 per cent. of the total expenditure and commended the scheme to the favourable consideration of the Board. Dr. Hyder stated that it would be much better to refer this scheme also to the Committee which would be appointed in due course to examine the Punjab scheme for scientific research in Irrigation. Mr. Allan pointed out that a great deal of the proposed work was already in progress in the United Provinces. Referring to paragraph 9 of the printed scheme, he said that it would appear that the investigations were not restricted merely to tube-wells. He doubted whether the problem required a special station but favoured the suggestion for referring the scheme to the Committee. Dr. Hector was of opinion that a major part of the work proposed would be of value to western Bengal and agreed with Dr. Hyder. Mr. Hadow thought that the present scheme had no connection whatever with the Punjab Irrigation research scheme. Mr. Milne approved the idea of referring the scheme to a committee. He, however, emphasised the importance of the scheme and incidentally observed that the Punjab Agricultural Engineer had invented a new strainer costing considerably less than those already on the market. Mr. Ramamurty said that Madras was interested in tube-well problems. Conditions of supply of water differed in the cases of tube-wells and canals. He recommended that the Bihar and Orissa scheme should be referred to a Committee and would personally prefer, if possible, that the Punjab water requirements of crops scheme, Punjab Irrigation Research scheme and the present scheme should all be examined together by the said committee. Mr. Milne explained that as the water requirements scheme had already been examined by a special committee and recommended by the Board, there was no question of any further reference to a committee. Mr. Carpenter considered that the proposed investigations would be of very great value to the ordinary soil-agriculturist. The results already obtained in the United Provinces should be available to Bihar and Orissa. He preferred a reference to the committee. Mr. Sethi, in reply, pointed out that the Royal Commission on Agriculture had recommended that each province should carry out such work and that the principle of the scheme had already been accepted by the Board when it recommended the Punjab Water Requirements scheme, to which the present one was only a complement. He was not in favour of referring the matter to the Committee as proposed. The Board, however, decided by a majority of votes that the scheme should first be examined by a Committee to be appointed for the purpose.

## APPENDIX XVIII.

## SUBJECT NO. 18.

PROCEEDINGS OF THE MEETING OF THE COMMITTEE APPOINTED BY THE ADVISORY BOARD OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH TO CONSIDER THE PROGRESS REPORT (ANNEXURE II) FOR THE YEAR 1931-32 ON THE SCHEME FOR BREEDING EXPERIMENTS IN CONNECTION WITH THE IMPROVEMENT OF GOATS CONDUCTED BY DR. A. E. SLATER, HELD AT NEW DELHI ON THURSDAY, THE 16TH FEBRUARY 1933.

The following were present :—

- |  |                        |
|--|------------------------|
| (1) Diwan Bahadur Sir T. VIJAYARA-       | (3) Mr. T. F. QUIRRE.  |
| GHAVACHARYA, K.B.E. ( <i>Chairman</i> ). |                        |
| (2) Colonel A. OLVER.                    | (4) Major P. B. RILEY. |

Raj Sahib Malik CHARAN DAS, *Secretary*.

The meeting lasted from 3 to 3-15 P.M.

2. After considering the report (Annexure II) the Committee was of opinion that it was interesting record of useful work which had been carefully done and that the grant made by the Council had been usefully employed. The Committee adopted the report with the suggestion that Dr. Slater might be asked to investigate the causes of heavy mortality among goats mentioned in the report. The importance of isolation of sick animals was emphasised.

CHARAN DAS,

*Secretary.*

*The 16th February 1933.*

## ANNEXURE I.

**REPORT FOR THE YEAR 1931-32 ON THE SCHEME FOR BREEDING EXPERIMENTS IN CONNECTION WITH THE IMPROVEMENT OF GOATS CONDUCTED BY DR. A. E. SLATER.**

At its meeting held in January 1931 the Advisory Board recommended a scheme for breeding experiments in connection with the improvement of goats to be conducted by Dr. Slater at the Mission Poultry Farm, Etah, and this was sanctioned by the Governing Body at its meeting held in May 1931. The scheme was started with effect from the 6th June 1931.

2. Dr. Slater has submitted a report on the progress made by him during the period 6th June 1931 to 31st March 1932 (Enclosures).

The report is now for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 19th January 1933.*

## ANNEXURE II.

REPORT BY DR. A. E. SLATER.

*The Improvement of Goats in the United Provinces.*

A note on the work done for year 1931-32 with a copy of accounts as audited by the Accountant General, United Provinces, with tables of Live Stock Statement (adult and kids).

By A. E. Slater, B.S.A., and Sirdar Singh Bhatia, I.D.D.

*Introduction.*—An application from Mr. A. E. Slater to the Imperial Council of Agricultural Research for sanction of a grant of Rs. 40,000 (Rs. 15,000 non-recurring and Rs. 25,000 recurring spread over five years) for a revised scheme for the improvement of goats in the United Provinces, was submitted in 1931, and considered by the Imperial Council, which on June 6th voted to approve a non-recurring grant of Rs. 7,000 and a recurring grant of Rs. 25,000 spread over five years.

The Local Government of the U. P. made a non-recurring grant of Rs. 2,500 for main goat shed and kidding pens.

The balance of Rs. 5,500 non-recurring was provided by the Mission Poultry Farm, by the provision of a house for the Assistant Manager, an office, dairy, and godown, and quarters for four herdsmen.

*Lines of Research.*—The project calls for four lines of research.

(a) Selective breeding of the best Jumna-Paris by means of recorded milk yields and progeny tests.

(b) Selective breeding of the best Bar-bari by means of recorded milk yields and progeny tests.

(c) Experimentation with the acclimitization of imported Toggenburg goats, to test their suitability for Indian conditions, and to determine whether they will reproduce themselves pure in India, without serious loss of vigour.

Recorded milk yields and progeny tests as in (a) and (b).

(d) By mating of Toggenburg bucks with local village goats (i.e., desi goats other than Jumna-Pari and Bar-bari) and putting the progeny most closely resembling the Toggenburgs back to pure Toggenburg bucks say for 5 or 6 generations, it should be possible to eliminate the local desi strain and build up an indigenous strain of Toggenburg goat, which should be more likely to thrive under Indian village conditions than freshly imported strains.

Recorded milk yields and progeny tests as in (a), (b) and (c).

*The Plant.*—(a) *Land.*—About 6½ acres of land which has been fenced with stock fencing out of Imperial Council Grant have been provided by the Mission Poultry Farm. Of this about 1/2 acre is occupied by buildings. Two and one half trenched acres have been put down to cultivation of Guinea Grass, Napier, and Passamuli for fodder. About one acre to lucerne, and 2½ acres to paddocks and kidding pen yards.

(b) *Buildings.*—A main goat shed 100-ft. × 20-ft. to hold 100 head of adult stock. All pukka with exception of earth floor, which needs to be of concrete, but funds did not permit. The interior is divided into 50 stalls, 25 down each side, 4-ft. wide, each accommodating two.

(c) *Kidding Pens.*—Thirteen in number 8½-in. × 6½-in. all pukka. Each kidding pen provided with a small yard. Earth floors. Four kidding pens accommodate the stock bucks.

(d) Other buildings consist of house for Assistant Manager, quarters for four herdsmen, office, dairy for milk recording and grain godown.

*Equipment.*—(a) *Fencing.*—This consists of stock fencing around cultivated areas and fencing of paddocks for adult stock and yards for kids.

(b) *Dairy equipment*.—Consisting of milk cans, strainers, spring weighing balance, measures, complete Gerber test for determining per cent. of fat in milk, and thermometers.

(c) *Office equipment*.—Consists of desk, almirahs, chairs, records for milk, stock history ledgers, cultivation books and periodicals, files and typewriter.

(d) *Miscellaneous*.—Platform scales for weighing stock and rations, and Chaff cutter. Thela and Bins for grain. Castrator numbered tags, collars and chains, medicines, and surgical supplies.

*The Staff*.—Consists of Mr. A. E. Slater, and his Assistant Manager and Dairy Supervisor, Sirdar Singh Bhatia, I.D.D., Mr. Bhatia is an Honour Graduate in Dairying. After graduation he worked as Dairy Supervisor at the Agricultural Institute, Allahabad, for about one year, coming to Etah from that post. I wish to take this opportunity of expressing to Government, my appreciation of the faithful and efficient service that he has rendered and the marked personal interest that he is showing in this project. His services commenced on October 15th, 1931, at a salary of Rs. 100 per month.

*The Herd*.—Adult breeding stock purchased during the year amounted to 131, as follows:—

Jumna-paris 51 ; Bar-baris 39 ; Toggenburg 11, six being imported from U. S. A., and five from England. Local village goats (desi) 20 ; 10 cross bred goats were presented by the Mission Poultry Farm, free of cost.

*Purchase of Jumna-Paris, and Bar-baris*.—The Veterinary Department of the U. P. assisted us in the purchase of these. In November and December 1931, Mr. Slater and S. S. Bhatia on their advice went to the Etawah District, to Chattarnagar, and personally selected these from about 500 which had been collected from the villages. The highest price paid for a Jumna-Pari was 25 and the lowest 12.

Maximum for Bar-bari 24, minimum 10. Average price paid for Jumna-Pari 17 and for Bar-bari 16.

Local village goats purchased in Etah District, at an average of about 8 each.

The imported Toggenburgs, were purchased at an average of about Rs. 306 each which included ocean freight, crates, feed and attendance on voyage, railway freight and insurance.

*Breed Characteristics*.—The Jumna-Paris are a large dual purpose goat, combining meat and milk qualities. They seem to be of Nubian and Egyptian origin, and closely resemble the Nubina goats as bred in England and the United States of America. Their characteristics are as follows:—

H. S. Holmes Pegler in his, "The Book of the Goat", states. "The best Indian goats are chiefly the lop-eared type, known as the Jumna-Pari. They closely resemble the Nubian, having, like these, long, wide pendulous ears a bow-shaped face, and being tall and leggy. They are said by residents to be splendid milkers, carrying immense udders with big teats. Specimens were at one time brought into this country, having been used on Board P. and O. Steamers to supply milk to the passengers".

To this description, we would add that these goats are not bred to any standard colour or markings ; they have a most pronounced Roman nose (see Photo No. 1 and 2). Carry a large amount of long and thick hair on the buttocks. The average length of adult males from nose to root of tail is 53-in ; height from withers to hoofs 37-in. ; weight 155 lbs. Females length 46-in., height 34-in., weight 110 lbs.

*Bar-baris*.—The Bar-bari is of a dairy type. Their small size renders them unsuitable for meat production. They can be compared, with the Jersey cow. Their origin seems to be Africa. H. S. Holmes Pegler in his book referred to above calls what clearly appear to be Bar-baris. "The dwarf goat of Guinea".

The Encyclopaedia Britannica defines Bar-baris as "The dwarf goat or Guinea goat, of Central and West Africa, resembles a small English goat in appearance. It is highly

resistant to trypanosomiasis. These goats are also found on the Nile and in Mauritius, Madagascar, and Bourbon.

Our experience would seem to show that these goats give a large amount of milk for their size. They carry large well shaped udders. Are short haired, and have small upright ears, and the facial line is straight. They are very short in the leg which is of fine bone. They have the typical dairy wedge shape.

Colonel Oliver, C. B. Animal Husbandry Adviser to the Imperial Council of Agricultural Research, wrote in his report, dated 9th May, 1932, after his visit of inspection in April, as follows: "I was very pleased with the health and appearance of the goats and young stock as a whole particularly the Jumna-Paris. Evidently the Bar-bari goat is not so hardy and not likely to be so valuable for open grazing conditions though a valuable goat for more confined conditions". The average length of the adult male is 40-in.; height 27-in.; weight 80-lbs. of the adult female length 36-in.; height 23-in.; weight 75 lbs. See photos 3 and 4. (Not printed.)

*Toggenburgs.*—Quoting again from H. S. Holmes Pegler (the famous English authority on goats, we find the Toggenburgs described as follows:—"In the matter of colour they are uniformly of a light or occasionally rather dark drab, best described as mouse colour, with white or greyish-white markings. There is always a streak on each side of the face right up under the ears down to the muzzle. White is also displayed on each side of the tail, under the body, and sometimes on the ribs but always on the legs between the thighs, and from the knees downwards. The head is rather long, the facial line being straight, or slightly concave, the eye is full; the ears are of medium size more or less erect. The neck is long and slender, and there should be always the two tassel like appendages observable now and again in other breeds. The Toggenburg is nearly always a lean animal, small in bone, of medium size, with a slender neck". See photos 5 and 6.

The average length in the male is 54-in.; height 36-in.; weight 182 lbs. In the female length 44-in.; height 29-in.; weight 130 lbs. The Toggenburg is probably the most popular breeds of goat in England, in Europe and in the United States of America. This is due to two important qualities its great milking capacity and its docile, kindly nature. It is claimed that in Switzerland Toggenburg does produce from 4-5 quarts a day, some of the best even more. A pure-bred doe in California, U. S. A. weighing 160 lbs. is credited with the production of 2,096 lbs. of milk in 10 months. Another doe is credited with producing 2,680 lbs. in a lactation period. This doe weighed 136 lbs.

The Toggenburg may be claimed to have its equivalent in the Holstein. Seen at a distance they much resemble the females of the Black Buck familiar to all.

They are claimed to be one of the most prepotant breeds of all, and have been very extensively used in grading up the native stock in the United States of America.

Our imported stock have been secured from Mr. W. L. Te Walt, Secretary of the American Milk Goat Record Association, of Vincennes, Indiana, United States of America and a famous judge and well known breeder.

Also from Mrs. A. W. Abbey, likewise a well known judge and breeder in England. Her address is Doune Hall, Roydon, Essex.

*The Kids.*—Throughout the year controlled selective breeding has been carefully carried on. Every goat is numbered and the stud males do not run with the herds, but each female is served when in heat, and a record made.

We have had 117 kids during the year, of which 34 died, and 32 males were sold, leaving an increase of 51 strong healthy kids. (See Enclosure No. 3.)

*Feeding.*—(a) *Adult Stock.*—Method followed is as follows. Stud males confined in paddocks. All females sent out to graze in separate herds, according to breed. Grazing supplemented by green fodder consisting of guines grass, napier, paesamuli and lucerne, also weeds and leaves of trees. Kids kept confined in paddocks till about 3 months old when allowed to go out to graze. Grain rations are fed, morning and evening while the goats are being milked, the quantity given being determined by the milk yield and size of the animal.

The following crushed ration is used a mixed one consisting of barley, maize, wheat bran linseed cake, in the following proportions. In every 100 lbs., 40 lbs. barley, 25 lbs. maize, bran 15 lbs. and linseed cake 20 lbs. From 6 chittacks (12 ozs.) to 12 chittacks (1½ lbs.) is given daily to milking herd. Stud males got 1 lb. of grain ration daily, substituting crushed grain (Chana) for wheat bran.

Dry goats receive about ½ lb. daily. Rock salt is available at all times in the paddocks, and crushed salt is fed in the grain ration (3 per cent.).

(b) *Kids*.—Receive milk morning and evening, all they can drink. As soon as they show a desire to nibble, dry bran is fed in hoppers and green fodder, as in adults, only more lucerne is fed.

*Records*.—The following records have been kept, (a) milk records. (b) History and breeding records; (c) Feed records (concentrates and fodder).

(a) *Milk Record*.—The ideal method is of course separation of the kid at birth, pan or bottle feeding of the same, and the weighing daily of all the milk produced by the dam. This method is, however, not practicable in India with unskilled labour.

The method followed has been weighing and recording the milk once a week, always on the same day. On this day the kids receive no milk from their mothers, but are hand fed. The same herdsmen always milk the same goats. The milking always commences at the same time, to give uniform conditions, recording was commenced when the animals purchased started to kid, i.e., in December 1931. Since most of the goats are still in milk, tabulated records are not submitted this year, but will appear in detail in the report of 1932-33, and a comparative statement of milk yield of dams and their progeny will appear in reports for 1933-34, 1934-35, 1935-36.

Though complete records for the entire lactation are not yet available, yet the following figures clearly give some indication of production in the breeds under research:—

(a) *Jumna-Pari*.—The maximum amount of milk produced in 24 hours by our best Jumna-Paris is 8.4 lbs. (Goat No. 45).

(b) Bar-Bari (Goat No. 52) the maximum amount produced in 24 hours is 8 lbs.

(c) Toggenburg (Goat No. 94) the maximum amount produced in 24 hours is 7 lbs.

(d) Local village goat (desi)—(Goat No. 117) the maximum amount produced in 24 hours is 5 lbs.

As regards the Toggenburgs no conclusions can rightly be drawn until these goats are thoroughly acclimatized. The yields produced by their progeny will be the main test. Colonel Olver in his inspection report remarked "The system of recording milk yield is satisfactory but the percentage of butter fat should be tested and recorded to enable the amount of extra feed required to produce the increased milk and butter fat yields obtained, by better management, to be accurately tested. Work of this kind has never been done as far as I am aware, for Indian goats and exact information on these points and as to comparative feeding value of various locally produced concentrates should be of considerable value".

We would add that the Gerber test apparatus was purchased in May 1932, and determination of per cent. of fat, total solids, and specific gravity, commenced in June, and will be reported in 1932-33.

(b) *History and Breeding Records*.—Contain name of breed; pedigree (this is of course not available in purchased goats) date of birth, date of service, No. of buck used, date of kidding, No. of kids born, weight of kid at birth date of going dry, yield, during lactation, fat per cent. maximum yield of milk daily, average milk yield during lactation, No. of days in milk and dry, hospital and illness records. Remarks. (See enclosure No. 4.)

(c) *Feed Records*.—Show daily consumption of each concentrate fed.

*Disease*.—From the very commencement of the experiment we have consulted with the Civil Veterinary Department, United Provinces, and sent many post-mortem specimens

to Capt. V. H. C. Hickey, the Director, at his request. We have experienced difficulty owing to the fact that very little research work on diseases of goats has been done in India. We are much indebted to Capt. Hickey for his ready assistance and advice.

The commonest diseases we have experienced during the year are—pneumonia, specially in kids ; a disease locally called Bisi which according to Capt. Hickey is as follows. We quote from his letter dated February 2nd, 1932, " From what I can gather and also from the post-mortem I carried out while in Etah that the disease is due to parasitic infection of the stomach, intestines, and liver and the resulting *Oedema* is, in my opinion caused by the enlargement of the liver due to chronic hepatitis and resulting in pressure on the portal vein ". The following treatment was recommended by him and carried out by us :—

						Ozs.
Copper sulphate	..	..	..	..	..	2
Mustard meal (fine)	..	..	..	..	..	2
						Gallons.
Water	..	..	..	..	..	3

well mixed together until the copper sulphate is dissolved. Dosage full grown Jumna-Paris 2 ozs. of mixture ; Bar-Bari  $\frac{1}{2}$  to 1 oz. according to size and age of adults ; kids of all classes  $\frac{1}{4}$ — $\frac{1}{2}$  oz. according to age. Shake well, before administering, and starve the goats for 12 hours before dosing. The treatment can be carried out every three months until confident that the parasites have been overcome.

We have noted, that the following symptoms invariably occur in this disease (Bisi) which seems to be caused by parasitic infection. Loses weight. Becomes unthrifty, eats much less and shows a characteristic swelling under the lower jaw. Has slight fever, in advanced state, diarrhoea appears.

The post-mortem revealed edema and other very characteristic conditions, which have already been mentioned. It is most likely that this most prevalent disease, which appeared with us in January, February and March, is caused by infestations of stomach and intestinal worms.

The villagers tell us that the disease is caused by grazing on rank grass growing in low spots and stagnant places. The same disease that we had was also prevalent in the adjacent villages during these months. We were also told that this disease appears only in the winter months and this was our experience.

Post-mortems revealed most commonly the presence of tape worms, also round worms. An increase in size of gall bladder and liver. In most cases the lungs were affected which may be due to the presence of lung worms.

*Mortality.*—Has been heavy. We have to find suitable and efficient remedies. During the year we have lost 26 adults, this being about 19 per cent. The greatest mortality occurred in Bar-baris. In Toggenburgs we lost four, out of eleven, this being about 36 per cent.

Stamina seems to be greatest in the local village goats (desi), none having died. Jumna-Paris and crossbred come next, followed by Bar-baris and Toggenburgs. (See enclosure No. 2.)

We would stress the necessity of adequate segregation quarters, at present there being none. Col. Olver, C. B., remarks " In regard to the control of disease it is important that isolation facilities should be increased ". It is also important that the floor of the main shed should be made Pakka. May we quote again from Col. Olver's inspection report " As I explained at the time of my visit it is not possible for this Council to provide funds for the improvement of the buildings and accommodation. I however agree that the floor of the main milking shed requires to be made impervious to the extent necessary to insure that urine and faeces can be flushed down and swept out of the building in the channels provided for the purpose at the back of the goats. The amount contributed by the



Provincial Government towards the scheme has hitherto been a very small proportion of the whole cost and it is felt that the Provincial Government should do something to help in this matter. Now that I realize that the shed referred to previously as the main shed is really the milking shed I feel sure that the position can never be satisfactory until this is done".

*Conclusion.*—The work of the past year has been largely that of construction of buildings; fencing of cultivated areas and paddocks; planting of fodder crops on trenched land and of trees for shade and fodder; procuring of equipment; purchase of live stock and importation of Toggenburgs. Diagnosis of disease, post-mortems and a search for suitable remedies; compilation and printing of necessary ledgers for records. From now on, our reports will be of a more technical nature dealing particularly with the definite research problems in our project.

We feel that we have here a virgin field of great promise. We would point out that whereas both the Government of India, Imperial Council, and Provincial Governments have spent time and very large sums, on the improvement of all other kinds of live stock, not forgetting poultry, that almost nothing has yet been done to improve the "Poor men's cow", which is so widely loved and appreciated in Europe, England and the United States of America, providing as it does, on a small quantity of feed, a nutritious and plentiful supply of milk for the cottager and humble peasant. It has clearly been demonstrated that from 5 to 7 goats can be kept as cheaply as one cow.

*Acknowledgments.*—We would thank the Imperial Council of Agricultural Research for this grant; likewise the U. P. Agricultural Research committee and the U. P. Government. Our special thanks are due to Colonel Olver, C.B. Animal Husbandry Adviser to the Imperial Council, for his valued advice, personal interest and assistance; also to the Civil Veterinary Department, U. P., mentioning specially Capt. V. H. C. Hickey, Director, Capt. Davis, Superintendent Agra, and Dr. Wahid Ullah Khan, Assistant Surgeon, Etah for their great help and ready assistance; likewise the Director of Agriculture, U. P.

We cannot close without acknowledging the advice rendered us in formulating our scheme by the following experts in animal genetics, Col. Olver, Capt. Hickay, C. H. Parr, Esq., Deputy Director of Cattle Breeding, Muttra; Col. J. Matsen, C.B.E., I.A.; F. J. Gossip, Live Stock Expert Government of Bengal, and Professor F. A. E. Crew, M.D., D.Sc., Ph.D., and Dr. F. Fraser Darling, Ph.D., N.D.A., N.D.D., of the Imperial Bureau of Animal Genetics, University of Edinburgh.

Finally we were much gratified and honoured in receiving a visit from His Excellency the Governor of the United Provinces, and C. W. Grant, Esq., I.C.S., Commissioner of the Agra Division, in January 1932 and would extend to them our thanks.

They made a tour of inspection on the occasion of their visit to Etah, for the XVth Etah Poultry Show, His Excellency having kindly consented to preside at the Prize Distribution. Sir Malcolm Hailey expressed himself as well satisfied with our plant, buildings and stock, and as following our project with sympathetic interest.

## ENCLOSURE NO. 1.

*Statement Showing Receipts and Expenditure of the Goat Breeding Farm, Etah.  
for the year 1931-32.*

Receipts.	Rs.	A.	P.	Expenditure.	Rs.	A.	P.
By grant given by the Imperial Council of Agricultural Research .. ..	10,700	0	0	To live stock .. ..	5,086	6	8
By sale of milk .. ..	72	7	6	To Fencing .. ..	1,198	14	6
By sale of male kids .. ..	47	8	6	To Cultivation .. ..	907	8	6
By services of Bucks .. ..	1	4	0	To Fodder .. ..	277	9	9
By Hides .. ..	4	11	0	To Grain .. ..	398	2	6
				To Salaries:—			
				Assistant .. ..	550	0	0
				Menials .. ..	519	1	0
				To Travelling allowances .. ..	118	5	0
				To Farm Equipment .. ..	697	10	0
				To Dairy Equipment .. ..	85	12	0
				To Office (Typewriter, Furniture, records books, etc.) .. ..	787	2	0
				To Medicines .. ..	41	0	0
				To Farm Miscellaneous .. ..	107	4	0
					10,774	12	8
				Unspent Balance .. ..	51	2	4
					10,825	15	0

## ENCLOSURE NO. 2.

*Live Stock Statement for the year ending 1931-32.*

No.	Breed.	Male or Female.	Stock purchased.	Deaths.	Balance on hand on 31st March 1932.	Total Remarks.
1	Toggenburg ..	{ Male .. Female ..	2 9	.. 4	2 5	7
2	Jumna Pari ..	{ Male .. Female ..	4 47	.. 5	4 42	46
3	Bar Bari ..	{ Male .. Female ..	3 36	.. 15	3 21	24
4	Desi ..	Female ..	20	1	19	19
				(Had to be destroyed).		
5	Cross-bred ..	{ Male .. Female ..	1 9	.. 1	1 8	9
	Total	.. ..	131	26	105	105

## ENCLOSURE NO. 3.

*Stock Statement (kids) for the year ending 1931-32.*

No.	Breed.	Male or Female.	Kids born.	Deaths.	Sold.	Stock on hand on 31st March 1932.
1	Toggenburg ..	.. { Male ..	3	2	..	1
		.. { Female ..	3	1	..	2
2	Jumnapari ..	.. { Male ..	21	6	10	5
		.. { Female ..	15	3	..	12
3	Bari-bari ..	.. { Male ..	33	8	19	6
		.. { Female ..	16	5	..	11
4	Cross-bred ..	.. { Male ..	12	7	..	5
		.. { Female ..	10	2	..	8
5	Desi ..	.. { Male ..	3	..	3	..
		.. { Female ..	1	..	..	1
Total		.. ..	117	34	32	51

## HISTORY SHEET.

ENCLOSURE No. 4.  
No. of GOAT.....

BREED.....

{	Sire.....	{		{		{	
{	Dam.....	{		{		{	

DATE OF BIRTH .....  
WEIGHT AT BIRTH .....

Date of Service.	Number of Buck.	Date of Kidding.	Number of Kids Born (Male or Female.)	Date of going dry.	Yield during Lactation.		Maximum yield a day.	Average Milk yield during lactation.	Number of days.		Hospital and Illness Records.		Remarks.
					Milk (Lbs.)	Average Percentage of fat.			In Milk.	Dry.	Disease.	Date from & to	

APPENDIX XIX.

—————  
SUBJECT No. 19.

**SCHEME FOR CONDUCTING RESEARCH ON WARBLE FLIES AT THE MUKTESAR RESEARCH INSTITUTE AT A COST OF Rs. 32,400 SPREAD OVER A PERIOD OF 5 YEARS.**

Attention is invited to the Government of India, Education Health and Lands Department letter No. F. 43/33-A., dated the 3rd February 1933 (Annexure) forwarding the scheme mentioned above. The scheme has been drawn up by the Assistant Research Officer, in charge of Entomological Branch of the Imperial Institute of Veterinary Research, Muktesar, under whose supervision and control the research will be conducted.

2. The scheme is now for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 6th February 1933.*

## ANNEXURE.

COPY OF LETTER FROM THE OFFICIATING ADDITIONAL DEPUTY SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH DEPARTMENT, NQ. F. 43/33-A., DATED THE 3RD FEBRUARY 1933.

*Scheme for conducting research on Warble flies.*

I am directed to forward a scheme (Enclosure II) submitted by the Assistant Research Officer in charge Entomological Branch, Imperial Institute of Veterinary Research, Muktesar, for conducting research on Warble flies, together with a copy of a letter from the Director, Imperial Institute of Veterinary Research, No. G/2393, dated the 29th December 1932 (Enclosure I). The Government of India approve the scheme which, it will be seen, involves an expenditure of Rs. 32,400 spread over a period of five years including Rs. 3,230 on account of leave and pension contributions in respect of the proposed staff, which sum, however, has not been calculated in accordance with the Finance Department letter No. F-1-XI/R.1/29, dated 17th June, 1929, and may be taken as a rough estimate only. The rates of pay proposed for some of the staff will probably also require reconsideration in the light of the new scales now proposed for similar posts but any changes thus made will probably reduce the cost and not increase it. In the ordinary course the Director, Imperial Institute of Veterinary Research, would have been directed to forward the scheme to you so that it might be placed before the Imperial Council of Agricultural Research, with a request that a grant should be made to meet the cost. As, however, the next meeting of the Advisory Board of the Imperial Council of Agricultural Research is to be held from the 16th to 18th February 1933, I am to forward the scheme direct, and to ask that the decision of the Council may be communicated to the Government of India in due course.

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(ENCLOSURE I.)

COPY OF LETTER FROM THE DIRECTOR, IMPERIAL INSTITUTE OF VETERINARY RESEARCH, MUKTESAR, TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, NO. G/2393, DATED THE 29TH DECEMBER, 1932.

*Application for a grant from the Imperial Council of Agricultural Research for research on Warble flies.*

I have the honour to enclose herein a letter (Enclosure II) from Mr. S. K. Sen, who is in charge of the Entomological work at this Institute, explaining the necessity for some work to be undertaken in connection with the Warble fly pest in India and also detailing the extra staff which will be required if this work is to be carried out.

Mr. Sen's letter explains the position so well that it is unnecessary for me to say much more than that I consider the investigation is very urgently required in view of the enormous losses which this pest is known to be causing to one of the most important industries of this country. I have had in mind the undertaking of some such investigation as this for some years past, but I delayed any action until the report of Hides Cess Enquiry Committee, which sat in 1929-30 had been received.

As Mr. Sen, points out, this scheme which we now submit is a very small one compared with that recommended by that Committee, but I feel that it would be wrong to delay any longer the initiation of an investigation into this pest, and any results which we are able to obtain as the outcome of the investigation now proposed will be at the disposal of the workers in any larger scheme of research which may be set up at a future date.

I also enclose a statement showing the estimated cost of the scheme as proposed by Mr. Sen and I may state that it will be possible to find housing and laboratory accommodation for this amount of staff at Muktesar. The amount of leave and pensionary contributions which will be required in case all or any of the staff appointed are already in Government service is shown separately but, if any of these men are directly recruited, the amount provided for them under this head will be saved. As it is proposed to

provide them with free housing accommodation, a house rent at 10 per cent. of their pay which presumably will have to be paid by the Imperial Council of Agricultural Research to the Government of India, has also been included.

The whole scheme amounts to only Rs. 32,400 spread over five years and I submit that this is a very modest amount in comparison with the great losses caused by this pest, some of which at least we shall hope soon to be in a position to prevent. It is our intention that the Entomological Assistant who is to be engaged for five years, will work on the life history and bionomics of the different species of Warble fly occurring in this country under the direction of Mr. Sen, and it is hoped that in the course of two years his work will have advanced to such a stage that it will be possible to introduce suitable methods of treatment in the field. In any case there is a great deal of other work to be done in the field in collecting data regarding the incidence of infection with the different species of fly and it is considered that for this field work a Veterinary Assistant, with an Entomological bias, working in collaboration with Provincial Veterinary Departments will be able to obtain the best results.

In conclusion I may say that I have the greatest faith in Mr. Sen's ability to supervise and control this work and I think we may look forward to obtaining some useful results from any money which is allotted to us.

According to Mr. Green's endorsement No. 3084-A, dated the 25th November 1932, any schemes for consideration at the next meeting of the Advisory Board of the Imperial Council of Agricultural Research should be with that body not later than the 15th January 1933, and as time is short I request that, if the Government of India approve of this application for a grant, the case be forwarded direct to the Council as early as possible.

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COPY OF LETTER FROM MR. S. K. SEN, ASSISTANT RESEARCH OFFICER, IN CHARGE ENTOMOLOGICAL BRANCH, TO THE DIRECTOR, IMPERIAL INSTITUTE OF VETERINARY RESEARCH, MUKTESAR-KUMAUN, DATED THE 20TH DECEMBER 1932.

*Proposal for the appointment of two Assistants, one Laboratory Subordinate and one Peon for research on Warble Flies.*

I have the honour to request that the Imperial Council of Agricultural Research may be approached for the grant of a sum of Rs. 32,400 spread over 5 years for research work in connection with the Warble Fly Pest in India. The grant asked for will be utilised in maintaining an Entomological Assistant and a Laboratory Subordinate for this work for the whole of the 5-year period mentioned above and a Veterinary Assistant and a Peon for the last 3 years of this period, as shown in the estimate enclosed herewith. It is suggested that the two Assistants and their inferior staff should have their headquarters at Muktesar, where they could perhaps be provided with rent-free quarters and also supplied with the necessary laboratory facilities in the Entomology Branch of the Institute. To carry out research work of the nature required, it would be desirable for the Entomological Assistant to hold a University degree in Zoology and to possess some entomological training in addition, while the Veterinary Assistant will be required to show an aptitude for this type of work.

In applying for the grant of this amount, I have been at some pains in coming to a decision as to whether, considering the importance and magnitude of the warble-fly problem in India, it would be worth while, with the aid of the small staff mentioned above to embark on any scheme of research, however modest in scale, in connection with this problem, particularly in view of the fact that it has been stated to be the considered opinion of the Hides Cess Enquiry Committee in India that it would involve an annual expenditure of not less than Rs. 50,000 to deal with this problem in an adequate manner, this sum representing the cost of maintaining two highly trained Entomologists, one for the North-West Frontier Province and the northern and western Panjab and the other for Sindh, Rajputana, southern and eastern Panjab and western United Provinces. While a sum of Rs. 50,000 is by no means an exaggerated estimate of the annual aggregate cost of financing a research project of this kind, one would hardly feel justified, in view of the existing financial stringency, in expecting the Imperial Council of Agricultural Research

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to be in a position to allocate this amount until, as recommended by the Hides Cess Enquiry Committee, the Council is in receipt of a grant-in-aid from the proposed Cess Fund Committee. It, however, does not appear to be known if or when this last named committee is likely to function, and in the meanwhile the enormous drainage in the country's wealth that is being continually caused by the ravages of the warble-fly pest stands in need of being arrested without further loss of time.

On going over the available records of work done in this field in other countries and from my own personal experience (extending over upwards of two decades) of the warble-fly problem in India, it seems that a certain amount of basic research, leading eventually to the development of suitable measure for combating this pest, could be carried out even within the space of the five-year period for which the grant is being asked for, provided, as it is hoped, the two Assistants recruited for this work can be made alive to the problem involved and can be trained to accuracy in the matter of reporting the results of observations in the field. Before enumerating the actual items of research which it is proposed to undertake, it would seem desirable to make a few general remarks upon the nature of the warble-fly problem both in India and (for comparison) in other countries, in order that these items may be presented in their true perspective for the consideration of the Council.

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## (ENCLOSURE II.)

I.—*The nature of the Ravages caused by the Warble-Fly.*

As some knowledge of the life-history of the warble-fly is essential in order to be able correctly to appreciate the extent of damage caused by it, this may be briefly described as follows :—

The common warble-fly of India (*Hypoderma lineatum*) deposits its eggs in series of 5 to 20 usually on the lower part of its host's body, the favourite seat of oviposition being the area adjacent to the hoof. The egg hatches after about 3 days and the newly-hatched larva bores into the skin of its host. A period of about 7 months elapses between the disappearance of the larva beneath the skin and the appearance of the characteristic warble lump which it causes on the back of its host. The larva now pierces a hole through the warble lump to the outer air for the purpose of breathing and while in this situation it undergoes further development, and when full-grown, it squeezes itself through the orifice in the warble, falls to the ground and crawls away in search of a crack in the soil, in which it attains its pupal stage. The fly emerges after a pupal period of about 2 to 4 weeks. *H. lineatum* although primarily the warble-fly of cattle, is known occasionally to attack goats. The true warble-fly of the goat, however, is *H. croesi*, but there are records of its occurrence in cattle as well.

An obvious sequel to the escape of the larvae from the warble lumps in the manner described above is that the hide of the affected animal is frequently so riddled down the centre by warble-holes (the number of such holes depending upon the number of larvae that have escaped) as to be rendered wholly or partially valueless for commercial or other purposes. The problem of the warble-fly is therefore unique in that it is one of direct physical injury, almost analogous to branding, to the host concerned, and as such, unlike the cases of most other diseases of animals, the quality of the damage involved hardly lends itself to being made the subject of controversy or speculation, although for a quantitative estimate of this damage, an examination of the available statistics on the subject will be necessary.

The "warbling" of the hide, however, is not the only kind of damage attributable to the warble-fly, although this by itself should constitute sufficient justification for the allotment of the small grant asked for. Some of the other ill-effects of warble-fly attack, as recognised by workers in most countries where the pest is known to occur, are:—

- (a) *Gadding or aimless galloping* on the part of cattle as a means of escape from the attacks of the fly. This has long been held to be responsible for loss in their condition and milk supply.
- (b) *Licked beef*.—This name is applied to inflammation caused by the mature grubs under the skin, the affected parts being unfit for human food, with the result that the aggregate amount of loss in meat is considerable. This condition was given prominence during the war by the Ministry of Food in England as "causing serious loss of meat".
- (c) *Hypodermal rash*.—This denotes the condition which results from the penetration of the first-stage larvae of *Hypoderma* into the skin of its host, the condition being characterised by the occurrence of exudate and pimples at the points through which the larvae have penetrated.
- (d) *Hypodermal anaphylaxis* ("rosenfieber").—This is a sub-acute malady, sometimes resulting in the death of the host, caused by the rupture of the grub during the process of its extraction from the warble lump.

It is obviously not possible to estimate the exact monetary loss caused by the four conditions mentioned above, but nevertheless they will have to be given due consideration in arriving at a conclusion concerning the general economic status of the ox-warble-fly in this country.

II.—*The Estimated Monetary Equivalent of the Damage to Hides caused annually by the Ravages of the Warble-Fly in India.*

(a) *Hides of Cattle.*—According to the latest census, India's stock of cattle has been estimated to be 183 millions or about 30 per cent. of the world's cattle, whilst, as pointed out by the Hides Cess Enquiry Committee, her estimated production of hides and skins, viz., about 25 millions, amounts to between 25 per cent. and 35 per cent. of the world production. Actual figures have been given by the Committee to show that "among the chief stock-raising and hide-producing countries of the world India is in a position to spare a big surplus (of hides) for export". Although exact information is not available concerning the loss suffered by India as a result of the damage caused by the warble-fly, it would be reasonable to conclude from the two foregoing statements that the loss, at any rate, is not below that suffered by any other single country in the world, and it would be interesting to quote here the figures obtainable for some of these countries:—

*Great Britain.*—Between £400,000 and £500,000,

*United States of America.*—Over £1,000,000.

*Canada.*—27·5 per cent. of the hides seriously damaged. The annual damage has been computed to be 20 per cent. of their value.

*Germany.*—Between £150,000 and £200,000,

*France.*—Francs 11,000,000,

*Italy.*—Lire 5,500,000 to 7,000,000,

There are reasons to believe, however, that the actual figure for India is considerably higher than of any of those quoted above, and in this connection, the following quotations will be of interest:—

"It had been reported—————that hides shipped from Calcutta, Madras and Bombay were depreciated perhaps to the extent of 50 per cent. on 10 per cent. of the skins, while those from Karachi had an average of about a quarter damaged to the extent of 60 or 70 per cent. A Calcutta firm of hide merchants reported that in shipments from Calcutta warbled hides are chiefly to be found in parcels which have come from the North-West Frontier Province and the Punjab, fully 50 to 75 per cent. of the hides being affected. The warbled hides are found chiefly amongst those which come into the market between November and January, hides being sometimes riddled down the centre (along the backbone) by as many as 500 warble-holes and thus reduced to but an eight of the value they otherwise would have....."

"Veterinary reports estimate that 40 per cent. of the cattle and goat hides in the Punjab are warbled, and that such warbled hides are also very common in Baluchistan, Sind and Rajputana....."

(Fletcher and Sen, 1930).

Reference may be made here to the fact that Cross (1926) found 12,000 cattle infected with warbles out of a total of 42,000 examined by him in one year alone in the Salt Range in the Punjab.

As an example of the monetary loss suffered by one locality alone on account of the "warble, the tick, brands and other marks, etc.," the Hides Cess Enquiry Committee, on the authority of the Calcutta Hides and Skins Shippers' Association, quote the following instructive figures: "About Rs. 20,00,000 per annum in respect of Agra hides (estimated production two millions; about Rs. 9,00,000 in respect of ordinary arsenicated cow hides (estimated production six millions)". In the case of skins, "the damage due to various defects including warble holes has been estimated at Rs. 45,00,000 per annum".

Although in the cases mentioned above, no precise estimate is available concerning the loss due to the warble-fly alone, it may be assumed that the bulk of the loss is attributable to this fly, inasmuch as the direct damage to hides caused by ticks is, for all prac-

tial purposes, almost negligible (although as vectors of disease they are amongst the most serious pests of cattle). Thus, making a liberal allowance of 50 per cent. of the depreciation as being due to branding (for it has been stated by an Indian expert that branding causes depreciation "often by as much as 50 per cent."), the annual loss in the value of hides, kips and skins attributable to the warble-fly in the Agra area alone amounts to Rs. 37,00,000.

(b) *Goat skins.*—The total of goats and sheep yielded by the latest census is 84 millions, but unfortunately the figure for goats alone is not available, nor is any information obtainable concerning the world stock of these two species of animals. However, the gross annual average production of goat and kid skins in India has been estimated to be 27 millions, and further, "it has been calculated that India accounts for nearly one-third of the total production of goat skins". It follows therefore that the loss to the country's resources on account of damage to goat skins through the ravages of the warble-fly is considerably higher than in any other single country in the world. The following quotations illustrate the extent of loss under this category suffered by certain localities in India: "In the Salt Range Area (in the Punjab) flocks (of goats) have been found heavily infected (40 to 90 per cent.)".... (Cross, 1926). Again, according to Davenport (1930), "over 90 per cent. of the goats purchased (in Baluchistan) showed infection, and of these a large number had as many as fifty lesions per animal". Again, it is stated by the Hides Cess Enquiry Committee, on the authority of Mr. Meyer (of Messrs. Briskey and Company of Cawnpore), that "even 80 per cent. of the goat skins may be warble-affected during the worst part of the season" and that "defects due to the warble are worse, *i.e.*, lead to greater depreciation, than flaying defects."

As to the monetary equivalent of the aggregate loss caused annually to India's resources by the combined ravages of the ox and goat warble fly, this cannot, even on a conservative estimate, be less than 1½ crores of rupees, for it has been computed by the Hides Cess Enquiry Committee that the annual production of raw stock (including a negligible quantity of sheep skins) in India can be valued at 18½ crores and that the loss due to depreciation from all causes amounts to 3.20 crores, so that at least 50 per cent. of this depreciation may perhaps be safely attributed to the ravages of warble flies. The actual loss is doubtless considerably higher, for, in Canada, the ravages of the ox warble-fly have been held to account for a monetary loss amounting to 20 per cent. of the value of hides, and there is no reason to suppose that India is any the better in this respect.

### III.—A Brief Survey of the Work done in other Countries.

It would be instructive briefly to consider here certain aspects of the work that is being done in other countries in connection with the warble-fly problem.

(a) *In England.*—The Warble-Fly Committee appointed by the Ministry of Agriculture and Fisheries issued, in 1926, a comprehensive report embodying their recommendations concerning the "possible ways and means of exterminating the Warble-Fly Pest" and during the past 3 years, truly phenomenal progress has been made towards the eradication of this pest in certain areas as a result of an almost "whirlwind campaign" started by the Leathersellers' Company's Warble-Fly Committee. The expenses involved in carrying on the work of the Committee were met from grants-in-aid received from the Empire Marketing Board (*vide* page 46, "Empire Marketing Board, May 1931 to May 1932" June 1932) and also from contributions received from various bodies interested in the problem. Some striking instances of the success of the campaign mentioned above are contained in a report, issued in November 1930, by the Department of Agricultural Education, Worcestershire. According to this report, a reduction to the extent of an average of only one warble per head (all stock) was effected, as the result of an intensive campaign, in an area containing 10,196 head of cattle which had an average initial infestation of 8.4 warbles per head.

(b) *Denmark*, (c) *Belgium* and (d) *Sweden.*—Legislative action has been taken in all these three countries to make treatment of cattle against warble-fly infestation compulsory. In Denmark, the enforcement of legislative measures has resulted in warble-fly infestation being reduced from 29.6 to less than 6 per cent.

(e) *Germany*.—The problem of the warble-fly in this country is being dealt with by a joint organisation representing both the tanners and hide-dealers and intensive trials are being carried out with various methods of eradicating the pest.

(f) *United States of America*.—Extensive investigations have been carried out upon the life-history of the ox warble-fly (*vide* "The Cattle Grubs or Ox Warbles, their Biologies and suggestions for Control," by Dr. C. Bishopp and others: 1926). "An investigation is being undertaken in an area where the fly has not yet become established, in an endeavour to discover an effective method of controlling the fly".

#### IV.—Some proposed items of Research in the Warble-Fly Problem in India.

It is needless to say that in the countries mentioned above, the development of suitable combative measures against the warble-fly has only been made possible as a result of intensive researches into the life-history and bionomics of the fly, so that whatever may be the type of organisation formed in India to deal with this problem, it will be powerless to achieve tangible results in eradicating the pest until it is in possession of certain fundamental facts concerning its habits and distribution. The Hides Cess Enquiry Committee have used the expression "adaptive research" with reference to the warble-fly problem in India, presumably meaning that it might be possible to adapt, for the benefit of India, the types (and perhaps, to some extent, also the results) of research executed in this field in other countries. This, however, as the Committee have evidently recognised, is possible of achievement in India only to a very limited extent, particularly in the absence of suitable organisations which might be invited to co-operate in investigations of this kind. In suggesting the following items of research, regard has therefore had to be paid to the disabilities mentioned above and also to the fact that any work that is undertaken should be of a kind that could be expected to yield tangible results during the 5-year period for which the grant is being asked for.

##### (a) *Species of Warble-Flies occurring in India.*

In the history of Veterinary Entomology in India, there perhaps does not exist a more amazing example of our ignorance of the insect fauna of this country than the fact that, until recently, the common species of ox warble-fly in India was regarded to be *Hypoderma bovis*, whilst it is now known to be *H. lineatum*. As for *H. bovis*, however, although there is no definite record of its occurrence in this country, it would be useful to remember that, as remarked by Warburton (1922), both *H. lineatum* and *H. bovis* "occur, though very unequally, in all countries from where warble attack has been reported". It may be mentioned in this connection that out of a consignment of about 50 specimens of warble-grubs received at Pusa, during 1923-24, from Veterinary Workers in the Punjab, about 12 were made out to be *H. bovis* (Fletcher and Sen, 1930), so that the first desideratum in connection with the warble-fly problem in this country is to obtain confirmation of this finding, and this can only be done by an examination of as many specimens of warble-grubs as possible, collected from infested localities in India, at different times of the year. An indirect, but equally important result of an investigation of this kind will be the acquisition of definite knowledge concerning the relative abundance in India of the three species, namely *H. lineatum*, *H. bovis* and *H. crossii* and also their regional distribution.

##### (b) *The seasonal prevalence of Warble-flies and the Extent of Damage caused by them in the different localities in India.*

In November 1923, the present writer, in collaboration with Mr. T. Bainbrigge Fletcher, (lately Imperial Entomologist in India), had copies of a circular distributed among Veterinary Workers in the Punjab, wherein information was requested upon the subject mentioned above. The statements received from the different districts were, however, discrepant and could hardly be utilized for the purpose of arriving at a conclusion in regard to the extent of infestation and the seasonal occurrence of the flies. It is needless to mention that exact information on these two points is of the first importance in the matter of devising control measures against these pests.

(c) *The Factors which determine the Concentration of H. lineatum in certain Area and its absence from others.*

A problem of absorbing interest in connection with the distribution of *H. lineatum* in the Indian Region is its almost exclusive occurrence in comparatively dry localities (e.g., North Western India) and its absence from the moister areas, e.g., Madras, Assam, Burma and Ceylon. The interest of the problem lies in the fact that "by far the greater part (about seven months) of the life of this insect is spent in the larval stage in the tissues of its host when climatic variations are not likely to affect it to any notable extent. It would therefore seem that its regional distribution is mainly governed by ecological factors as they affect the insect in the very brief span (hardly exceeding one week) of its winged existence, when . . . it is even devoid of the power of feeding and therefore cannot be adversely affected by the absence of any special class of food" (Fletcher and Sen, 1930). It would be of interest to investigate the factors that are responsible for this remarkable regional demarcation in the distribution of this fly, although it is obviously not possible at present to foresee the use to which a knowledge of these factors might be put for the purpose of eliminating the pest.

(d) *The Number of Broods of Warble-Flies in India.*

It has been stated by us elsewhere (*J. Central Bur. Anim. Husb. and Dairying in India*, Volume IV, 1930, page 31) that in India, *H. lineatum* has probably one brood in the year. It is needless to mention that this statement was largely conjectural, being based upon considerations of the life-history of this fly as worked out in other countries. It is, however, of importance that we should be in possession of first-hand observations on this subject, particularly in view of the reported occurrence in certain localities in England of "early maturing" and "precocious" warbles. The importance of exact knowledge on this point can hardly be exaggerated, for without such knowledge it will hardly be possible to determine correctly the exact season (or seasons) of the year when control measures are likely to be most effective. These remarks also apply to *H. crossii*.

(e) *The Predilection Factors which determine the Fly's choice of Host for Oviposition.*

A number of workers have referred to the fact that certain classes of cattle are more susceptible than others to warble-fly infestation. Thus, according to the Worcestershire report mentioned earlier in this note, cows in that locality were found to be much less infested than other cattle, whilst a report received in 1923 from the Rawalpindi District contained a statement to the effect that "thick-skinned animals and those in rural areas are more affected than thin-skinned ones and those in towns". It would be desirable to collect statistical data in verification of these statements.

There is little information on record concerning the extent of warble infestation in mammals other than ruminants in India, although warbles of equines, at any rate, are not uncommon in other countries. The question is of importance in view of the possible advantage of utilizing cast-off animals (which are valueless as producers of hides) for the purpose of diverting the fly's attack from cattle and goats in infested areas. This would be analogous to the well-known method of utilizing alternative food-plants, by way of "trap crops" for combating certain classes of agricultural pests.

(f) *The Life-histories of Indian species of Warble-Flies.*

The information on record concerning the life-history of *H. lineatum* under Indian conditions is extremely fragmentary, and although it is possible that it does not differ materially from what is known about this species in other countries, it is desirable that we should be in possession of first-hand observations in this respect. It can hardly be regarded as being to the credit of workers in India that in the Report of the Hides Cess Enquiry Committee in India (page 39), the salient features in the lifecycle of this species have been explained with reference to the conditions obtaining in Kansas and by means of a graphic illustration borrowed from a bulletin issued by the United States Department of Agriculture.

(g) *The Course of Migration of the Warble-Grub through the Tissues of its Host:*

A considerable amount of speculation exists in regard to the route taken by the warble-grub (*H. lineatum*) during the period that elapses between its disappearance beneath the skin of its host and the appearance of the characteristic warble lump which it causes, although it is known that at a certain stage in the course of this migration the grubs re-appear with remarkable regularity in the submucosa of the oesophagus. A knowledge of the factors which cause them to invade the oesophageal tract and also of the extent and causes of their natural mortality is likely to prove of value in devising control measures against this pest.

(h) *Optimum Conditions for the Emergence of H. lineatum from its puparium:*

Whilst, under natural conditions, it is relatively simple to procure examples of mature warble-grubs, the winged adults of *H. lineatum* are extremely rare to find (the Entomological Collection at Muktesar contains only a single specimen of the winged fly), and it may be of interest to mention in this connection that no fly emerged from a lot of pupae kept under observation at Muktesar for upwards of one year. Reference need hardly be made to the economic importance of precise knowledge of the factors responsible for the normal emergency of the fly.

(i) *Measures for the Control of Warble-Flies in India.*

Work on this head will be undertaken after some knowledge has been gained concerning the habits and bionomics of the fly. The probable lines of experimentation in this connection will be as follows :—

(1) *Testing the value of certain oils and compounds when used as repellents on the body of the host for the purpose of preventing the fly from laying its eggs.*

Although workers both in England and America do not regard this method of prevention as holding out any promise of success, nevertheless it would seem to merit further trials, in view of the statement that by covering the legs of cattle with certain repellents "considerable, if not complete, protection was afforded". (Report of the Departmental Committee on Warble Fly Pest, Ministry of Agriculture and Fisheries, London, 1926).

(2) *Immunization of cattle and goats against warble-fly infestation.*

It is common knowledge that some animals are invariably infested with warbles whilst others of the same herd and pastured on the same field are consistently free from grubs. The possibility therefore suggests itself that the factors responsible for the occurrence of natural immunity in certain animals may be capable of being artificially reproduced for the purpose of conferring protection on the entire herd. The importance of investigating these factors has been stressed by certain recent workers in this field.

(3) *Destruction of mature warble-grubs in situ by the application of dressings on the backs of infested animals.*

The destruction of warble-grubs by means of "dressing" is now extensively practised in both Europe and America, the main ingredient which enters into the composition of these "dressings" being derris powder or its proprietary modification known as "Polvo". A considerable degree of success is claimed to have been obtained from the use of this inexpensive material, but Mr. F. P. Norbury (1930), Chairman of the Agricultural Education Sub-Committee, Worcestershire, mentions the possibility of some "bye-product worthless for other purposes" being discovered for use in place of derris, and his suggestion would seem to merit consideration in this country.

The application, under field conditions in India, of the measures outlined above, would necessitate the appointment of the Veterinary Assistant asked for. He will not only direct the actual control operations in the field but will also report the results of these operations from time to time for a period of not less than 2 years.

*Statement of expenditure in connection with the proposal to appoint an Entomological Assistant and a Laboratory Subordinate for 5 years on Rs. 150—10—190 and Rs. 30—1—34 respectively and one Veterinary Assistant on Rs. 150—10—170 and a peon on Rs. 14 per mensem for 3 years for research on Warble Flies.*

	Pay of 1st Assistant.	Leave and Pension Contributions.	Pay of 2nd Assistant.	Leave and Pension Contributions.	Pay of Laboratory Subordinate.	Pension Contribution.	Pay of Peon.	Travelling allowances.	House rent 10%	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Rate	150—10—190	150—10—170	150—10—170	30—1—34	14					
1st year	1,800	350	..	..	360	22	..	1,000	220	3,752
2nd year	1,920	370	..	..	372	23	..	1,000	230	3,915
3rd year	2,040	400	1,800	350	384	24	168	2,000	420	7,586
4th year	2,160	430	1,920	370	396	25	168	2,500	450	8,419
5th year	2,280	440	2,040	400	408	26	168	2,500	470	8,732
Grand Total Rs.	..	..	..	..	..	..	..	..	..	32,404
Say..	..	..	..	..	..	..	..	..	..	32,400

NOTE (1) For calculating Pensionary Contributions for Assistants service has been taken at 10-11 years and 7% of actual pay. For the Laboratory Subordinate 1/16 of pay has been taken.

(2) Leave Contribution has been calculated @ 12½% of actual pay.

## APPENDIX XX.

## SUBJECT NO. 20.

**EXTENSION OF THE RESEARCH WORK ON THE EFFECT OF IONS ON THE GROWTH OF PLANTS BY DR. S. S. BHATNAGAR UP TO THE END OF MAY 1933.**

In October 1930 the Advisory Board recommended, by circulation, an *interim* grant of Rs. 1,600 to Dr. S. S. Bhatnagar for research work on the effect of ions on plant growth, and at its meeting held in January 1931, the Board supported the main scheme at a cost of Rs. 3,000 per annum for a period of two years (including the amount of Rs. 1,600 already recommended). These recommendations were accepted by the Governing Body and the scheme was accordingly started from the 15th January 1931. A report of the work done in connection with the scheme during the period January 1931 to March 1932 was placed before the Advisory Board and the Governing Body of the Council at their meetings held in July and October 1932, respectively.

2. Dr. Bhatnagar has now applied (Annexure I) for an extension of the grant up to the end of May 1933 (the end of the Academic year and crop year) at an additional cost of Rs. 75 per month during the period of the extension. The additional cost to the Council on this account will therefore be Rs. 337-8-0 only.

3. A complete and detailed report of the work done, referred to in the application will be found in Annexure II.

4. The application is for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 24th January 1933.*



ANNEXURE I.

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COPY OF D.-O. LETTER FROM PROFESSOR S. S. BHATNAGAR, D.Sc. (LOND.), F. INST. P., DIRECTOR, UNIVERSITY CHEMICAL LABORATORIES, LAHORE, TO THE VICE-CHAIRMAN, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, DATED THE 10TH JANUARY 1933.

I shall be obliged if you will kindly extend the grant for work on "The Effect of Ions on the growth of Plants" till the end of May 1933, when the present academic year ends. A complete and detailed report on this work containing the results of experiments in culture solution and in sand has already been submitted to the Imperial Council on 2nd January 1933. Therein I have drawn attention to the necessity of completing field experiments in the case of the plants which have been found to show increased growth under the influence of certain ions in water culture and in sand. The plants which still remain to be investigated in the fields are gram, moth, jwar, barley and cotton-seed. The experiments on these plants will be started in their proper seasons during the present year.

I hope the Imperial Council will be pleased to extend the present grant till the end of May 1933 and if possible to sanction a reduced grant of Rs. 75 per month to complete the field experiments during this year. I appreciate the financial difficulties of the Council and as you would notice, I have tried my best to be as economical as possible.

## ANNEXURE II.

REPORT OF THE WORK ON "THE EFFECT OF IONS ON THE GROWTH OF PLANTS", CARRIED OUT AT THE UNIVERSITY CHEMICAL LABORATORIES, LAHORE, UNDER A GRANT FROM THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, FOR THE PERIOD, FEBRUARY 1931—OCTOBER 1932.

During the years, February 1931 to October 1932, experiments have been performed on Gram, Moth, Jawar, Cotton-seed, Peas, Barley, Maize and Sem. In all these cases the effects of about 15 metallic ions has been investigated. The experiments were simultaneously performed in water culture, in pure silica and in small fields. Experiments in culture solution and in pots have been completed in every case and the influence of Thorium, Uranium, and Cerium on peas and maize in fields has been investigated. The presence of the radioactive substances specially of Uranium, Thorium and Cerium showed a very accelerated growth in a number of cases and the effect of these ions is now being investigated in small fields where the conditions for the growth of plants are more natural than in the pots or the bottles containing the culture solution.

The methods of preparing the sand and the culture solutions used in these experiments are described below :—

White sand of a high degree of purity was used and was supplied by the Ceramic Department of the Forman Christian College, Lahore. The purification of the sand was carried on for a number of days. The sand was first ignited in a muffle furnace to burn off any organic matter. After ignition the sand was analysed and gave the following composition :—

Si O <sub>2</sub>	..	..	..	..	..	99.4 per cent.
Al <sub>2</sub> O <sub>3</sub>	..	..	..	..	..	0.40 "
Mg O	..	..	..	..	..	0.03 "
Alkalies	..	..	..	..	..	0.14 "

The sand was further treated with dilute nitric acid and thoroughly washed with distilled water. The sand was then dried in porcelain dishes and then filled in the pots. Experiments were performed in the pots filled with the above quality of sand as well as in bottles containing the culture solution. In the case of experiments on Jawar, Moth and Peas, the culture solution of the following composition was used :—

Potassium nitrate	..	..	..	..	10.0 grms.
Calcium nitrate	..	..	..	..	2.5 "
Magnesium nitrate	..	..	..	..	2.5 "
Iron Phosphate nitrate	..	..	..	..	5.0 "
Distilled water nitrate	..	..	..	..	10.0 litres.

Wide-mouth bottles of equal capacities were selected for these experiments and each was fitted with a cork with three holes and cut in two halves to accommodate the plant. A small pad of cotton was placed between the two halves and the plants were carefully placed between them. The other two holes in the cork were used for bubbling in air after every third day. The aeration was conveniently done by passing a stream of water into a big aspirator bottle and bubbling the displaced air into the bottles for five minutes. The plants showed a very regular growth in the bottles, but uncertain growth was measured after the fourth or the fifth week. The bottles were covered with black paper and were kept in a verandah where they were fully exposed to the diffused sunlight.

The seeds were carefully chosen of as nearly the same weight and size as possible and were placed in the purified sand for germination. After two or three weeks the plants of exactly the same size (both the stem and the root) were selected and replanted in the pots and the bottles containing the culture solution. Measurements were taken for a set of from eight to ten plants in the case of every ion and the experiments were repeated on at least half a dozen sets. The results are shown in two tables in each case, one containing the mean values and the other showing the measurements for all the plants which were examined.

## GRAM.

The experiments on Gram were started in the first week of March 1931. One crop was sown on the 27th February 1931 in porcelain dishes. The plants of exactly the similar lengths (both the stems and the roots) were selected and replanted on the 10th March. The measurements of the lengths of the plants, with dates on which they were recorded are summarised in Table I. The measurements of the plants whose mean values are calculated in this table are shown in Table (1) (a).

TABLE I.  
Season—March and April.  
Experiment in pot.  
Dates.

Ions.	10th March.	12th March.	14th March.	20th March.	25th March.	1st April.	5th April.	Remarks.
Uranium ..	3.4	3.08	4.4	7.65	8.85	Developed. Yellow stain on 29th March.		
Thorium ..	3.4	3.95	4.3	7.81	9.04	10.35	..	
Zinc ..	3.3	3.3	4.0	7.57	8.32	10.84	..	
Cerium ..	3.5	3.7	4.1	7.8	8.64	9.75	..	
Copper ..	3.4	3.5	4.2	5.94	7.92	9.14	..	
Lead ..	3.4	3.4	4.1	5.10	7.41	Two plants out of five showed signs of dying up.		
Silver ..	3.4	3.5	4.0	4.83	7.30	8.85	..	
Nickel ..	3.6	3.7	4.0	5.23	7.05	8.90	..	
Cobalt ..	3.45	3.5	4.1	5.47	7.45	9.25	..	
Manganese ..	3.3	3.5	4.0	5.89	7.8	9.35	..	
Calcium ..	3.41	3.5	4.2	5.74	7.75	9.55	..	
Blank ..	3.4	3.6	4.1	5.81	7.63	9.33	..	
Blank ..	3.4	3.6	4.1	5.82	7.58	9.00	..	

TABLE I (a) — (Mean values).

Ions.	10th March.	12th March.	14th March.	20th March.	25th March.	1st April.	Remarks.
Uranium ..	..	3.4	3.4	4.1	..	..	..
		3.4	3.6	4.4	7.9	8.2	..
		3.4	3.2	4.0	..	8.9	..
		3.3	3.8	4.4	7.3	9.6	..
		3.4	3.7	4.6	7.6	..	..
		3.5	4.0	4.8	7.6	8.8	..
		3.4	4.2	5.1	..	..	..
		3.4	3.1	4.7	7.3	..	..
Blank ..		3.0	3.0	4.0	7.5	9.0	..
		3.5	3.8	3.7	5.8	7.9	..
		3.4	3.8	4.0	5.1	8.2	9.3
		3.4	3.5	4.1	6.0	7.8	..
		3.4	3.6	4.0	5.8	..	..
		3.4	3.5	4.2	5.5	7.6	9.7
	3.4	3.5	4.1	5.8	7.0	8.9	
	3.5	..	..	..	..	..	

TABLE I (a)—(Mean values)—contd.

Ions,		10th March.	12th March.	14th March.	20th March.	25th March.	1st April.	Remarks.
Thorium	.. ..	3.9	4.0	..	..	9.6	..	
		3.5	4.3	4.3	7.4	9.0	10.3	
		3.9	..	4.3	7.7	8.4	10.4	
		3.9	3.7	..	..	..	..	
		3.5	..	4.6	7.8	8.9	9.9	
		3.4	4.1	..	..	..	..	
		3.4	4.1	4.3	8.2	9.2	10.5	
		3.9	3.9	4.0	7.9	9.0	10.9	
Zinc	.. ..	3.3	3.2	4.1	7.9	8.8	11.3	
		3.4	3.3	3.7	7.6	7.8	10.1	
		3.3	3.1	4.1	7.8	..	10.8	
		3.5	3.4	4.0	7.3	8.2	11.5	
		3.3	3.2	4.2	7.5	..	..	
		3.3	3.5	4.9	7.1	..	..	
		3.3	3.3	4.3	7.5	8.3	10.3	
		3.5	3.1	4.6	7.0	..	..	
Cerium	.. ..	3.5	3.9	4.3	7.8	..	..	
		3.5	3.7	4.4	7.5	8.6	9.7	
		3.5	3.6	4.1	7.2	8.6	..	
		3.5	3.6	3.8	8.1	8.1	9.1	
		3.5	3.8	4.4	7.8	9.1	7.3	
Copper	.. ..	3.4	3.5	4.4	5.8	7.3	9.2	
		3.4	3.6	4.0	5.6	7.8	9.1	
		3.4	3.5	..	..	7.9	..	
		3.5	3.5	4.2	6.2	7.9	9.1	
		3.3	3	..	..	..	..	
	3.4	3.5	4.2	5.9	8.5	9.0		
Lead	.. ..	3.4	3.4	4.0	5.7	7.9	..	
		3.4	3.5	4.4	5.1	6.9	..	
		3.4	3.6	4.2	5.1	7.4	..	
		3.5	3.4	4.0	5.5	..	..	
		3.3	3.3	3.8	..	..	..	
		3.4	3.4	4.1	4.5	7.6	..	
		3.4	3.4	3.9	4.7	7.2	..	

TABLE I (a)—*concl'd.*

Ions.		10th March.	12th March.	14th March.	20th March.	25th March.	1st April.	Remarks.
Silver	...	3.4	3.5	3.8	4.8	7.6	8.8	
	..	3.4	3.7	4.2	4.6	..	..	
		3.4	3.3	4.9	5.0	7.3	..	
		3.4	3.4	4.0	..	..	..	
		3.4	3.5	3.6	..	..	..	
Nickel	..	3.6	3.9	4.4	5.7	7.4	8.8	
		3.6	3.7	4.0	4.7	7.0	8.9	
		3.4	3.5	3.6	5.2	6.6	9.0	
		3.6	3.7	4.0	5.0	6.5	8.6	
		3.5	3.6	4.0	5.1	6.0	..	
	3.5	3.9	3.8	5.9	6.3	8.4		
Manganese ..	..	3.3	3.5	4	6.0	7.4	..	
		3.3	3.5	4.3	6.3	7.8	9.3	
		3.3	3.7	4.0	6.4	7.6	9.7	
		3.4	3.6	3.7	5.9	7.8	9.9	
		3.5	3.5	4.0	5.5	7.5	8.7	
	3.3	3.5	4.1	5.9	8.1	9.3		

Another set of experiments was simultaneously started in culture solution and the plants were transferred in the bottles on 10th March. The plants were aerated on alternate days. The plants were transferred in every bottle and the measurements in the following table are a mean of about 3 plants in each case. These experiments on Gram were continued till the 1st week of April. The measurements after this time were irregular and are therefore not included in these tables. Table II(a) contains the actual measurements of the plants.

TABLE II.

*Season—March—April.*  
*Plant—Gram in water culture.*

Ions.		10th March.	12th March.	16th March.	20th March.	28th March.	1st April.	Remarks.
Blank	..	3.46	4.3	5.9	6.10	7.54	..	
Uranium	..	3.45	4.6	5.2	7.72	9.01	..	
Thorium	..	3.40	4.7	5.9	8.12	9.23	..	
Cerium	..	3.47	4.62	5.41	7.0	8.94	..	
Copper	..	3.43	3.8	4.3	5.54	8.00	..	
Lead ..	..	3.5	3.91	4.2	4.4	5.9	..	
Silver ..	..	3.47	3.62	4.0	4.65	..	..	Yellow tips of
Nickel	..	3.50	4.11	4.75	5.11	7.45	..	the leaves
Cobalt	..	3.43	3.62	5.0	5.55	7.25	..	after 16th
Manganese	..	3.44	3.72	4.1		Damaged.	..	March,
Calcium	..	3.42	4.14	4.6	5.83	8.12	..	
Blank ..	..	3.49	4.21	4.7	6.02	7.84	..	

TABLE II (a).

Ions.		10th March.	12th March.	16th March.	20th March.	28th March.	Remarks.
Blank	.. ..	3.4	4.6	5.5	6.3	7.8	
		3.4	4.6	5.1	6.0	7.5	
		3.4	4.0	6.3	6.1	7.2	
		3.4	4.3	5.9	5.9	7.5	
		3.4	4.1	5.6	..	..	
		3.5	4.2	5.2	5.6	7.1	
		3.4	4.6	5.7	5.9	..	
		3.4	4.3	5.8	6.1	7.4	
Uranium	.. ..	3.4	4.9	5.5	7.9	9.4	
		3.4	4.6	5.9	7.7	9.0	
		3.5	4.6	5.3	7.3	..	
		3.4	4.3	5.2	7.5	8.6	
		3.4	4.1	5.0	..	..	
		3.4	4.6	4.9	7.7	9.0	
		3.4	4.0	4.6	..	..	
Thorium	.. ..	3.4	4.9	5.9	8.4	9.7	
		3.5	5.3	5.8	8.6	..	
		3.5	4.7	5.7	8.1	..	
		3.4	4.5	5.3	7.8	9.2	
		3.4	4.3	5.0	8.6	..	
		3.3	4.1	5.2	8.1	9.0	
		3.4	4.7	6.1	8.1	8.7	
		3.4	4.6	6.0	..	..	
Cerium	.. ..	3.5	..	5.8	7.0	9.3	
		3.5	4.6	5.2	7.6	9.0	
		3.5	4.0	5.4	7.3	8.6	
		3.4	4.4	5.0	6.4	8.5	
		3.4	4.1	4.8	6.0	8.9	
		3.4	4.8	5.4	7.0	8.9	
		3.5	4.2	5.0	..	..	
		3.4	4.6	5.3	7.1	8.8	
Copper	.. ..	3.5	3.8	4.6	5.7	8.6	
		3.5	3.8	4.0	5.3	7.4	
		3.5	3.6	4.3	5.2	..	
		3.5	3.5	4.2	5.5	7.2	
		3.5	3.7	4.6	5.7	8.0	
		3.5	4.0	4.9	..	..	

TABLE II (a)—*contd.*

Ions.		10th March.	12th March.	16th March.	20th March.	28th March.	Remarks.
Lead	.. ..	3.5	3.7	4.6	4.4	5.4	
		3.4	3.9	4.2	..	..	
		3.5	4.1	3.8	4.4	5.9	
		3.5	3.9	4.2	4.3	6.4	
Silver	.. ..	3.5	3.9	4.0	..	..	
		3.4	3.7	4.6	..	..	
		3.4	3.6	4.3	4.6	..	
		3.5	3.7	3.7	4.6	..	
		3.5	4.0	3.9	..	..	
	3.5	4.2	4.0	..	..		
Nickel	.. ..	3.5	4.4	4.7	5.4	7.4	
		3.4	4.0	4.5	5.3	..	
		3.5	4.1	4.2	5.1	7.9	
		3.4	4.2	4.6	5.8	..	
		3.5	3.8	5.2	4.8	6.9	
		3.5	3.7	5.1	4.9	..	
	3.4	4.0	4.6	5.0	7.3		
Cobalt	.. ..	3.5	3.9	5.3	5.4	7.8	
		3.5	3.6	5.0	5.8	..	
		3.4	3.5	5.3	5.6	7.4	
		3.5	4.0	5.6	5.9	..	
		3.4	3.3	4.7	5.8	7.2	
		3.4	4.1	4.9	6.1	..	
	3.5	3.6	5.0	5.6	6.6		
Manganese	.. ..	3.4	3.7	4.1	..	..	
		3.4	3.9	..	..	..	
		3.5	3.7	3.8	..	..	
		3.4	3.6	4.3	..	..	
		3.5	4.0	4.1	..	..	
		3.4	3.7	4.4	..	..	
	3.5	3.8	..	..	..		

## MOTH.

Experiments on Moth were started in the beginning of April 1931. The season for sowing these cereals is in October, but the growth of these plants in these months was found to be fairly satisfactory for these measurements. The seeds were sown on the 26th March 1931. Plants of exactly similar lengths were sorted on the 10th March and were planted in the pots as well as in the culture solutions. The measurements for the set of experiments in culture solution are included in Table III.

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TABLE III.

*Season—April—May.**Plant—Moth in water culture.*

Ions.	Maximum height of the plants in cms. on				Remarks.
	10th April.	18th April.	22nd April.	26th April.	
Blank .. ..	2.0	2.7	4.1	..	Died.
Thorium .. ..	2.0	3.5	4.1	4.8	The plants which showed initial rapid growth were found to be the first to decay.
Nickel .. ..	2.0	3.5	4.1	4.8	
Cobalt .. ..	2.0	2.9	3.5	4.3	
Uranium .. ..	2.0	3.7	5.3	5.7	
Cerium .. ..	2.0	2.7	5.2	5.8	
Sodium .. ..	2.0	3.1	4.2	5.2	
Zinc .. ..	2.0	3.0	3.6	4.4	
Copper .. ..	2.0	2.6	3.3	4.1	
Manganese .. ..	2.0	2.5	4.4	5.3	
Strontium .. ..	2.0	3.7	4.7	5.6	
Calcium .. ..	2.0	2.6	4.4	5.5	

TABLE III(a).

Ions.	10th April.	18th April.	22nd April.	26th April.	Remarks.
Blank .. ..	2.0	2.5	3.9	..	
	2.6	2.7	4.3	..	
	2.0	2.9	4.3	..	
	2.1	3.0	4.2	..	
	2.0	2.8	4.1	..	
	1.9	2.7	4.0	..	
	2.0	3.1	3.9	..	
	2.0	3.1	3.9	..	
Thorium .. ..	2.0	3.3	4.3	4.5	
	2.0	3.5	4.1	4.8	
	2.1	3.9	4.2	4.4	
	2.0	3.7	4.0	5.0	
	2.0	3.3	4.1	4.6	
	2.0	3.1	3.9	4.7	
	1.9	3.5	4.2	4.8	
	1.9	3.4	4.0	4.6	



TABLE III(u)—*contd.*

Ions.	10th April	18th April	22nd April	26th April	Remarks.
Nickel .. .. .	2.0	3.2	4.3	4.6	
	2.0	3.5	4.4	4.8	
	2.0	3.7	4.1	5.1	
	2.0	3.3	3.8	4.5	
	2.0	3.0	3.9	4.8	
Cobalt .. .. .	1.9	3.2	3.4	4.1	
	2.0	3.0	3.5	4.0	
	2.0	2.8	3.3	4.4	
	1.9	2.9	3.3	4.6	
	2.0	2.7	3.6	4.6	
	2.0	2.8	3.7	4.3	
Uranium .. .. .	2.0	3.9	5.3	5.7	
	2.0	4.0	5.0	5.5	
	2.0	3.7	4.2	5.7	
	2.0	3.5	5.3	5.7	
	2.0	3.7	5.6	5.9	
Cerium .. .. .	2.0	2.5	5.2	5.5	
	2.0	2.7	5.5	6.0	
	2.0	2.6	5.4	5.7	
	2.1	2.9	4.8	5.8	
	2.0	2.7	5.2	5.6	
	2.0	2.9	4.9	6.1	
	2.1	3.0	4.6	6.0	
Zinc .. .. .	2.0	2.9	3.7	4.1	
	2.0	3.0	3.8	4.4	
	2.0	3.2	3.6	4.6	
	2.2	3.0	3.5	4.5	
	2.0	2.8	3.7	4.9	
	2.0	3.3	3.9	4.0	
	2.0	2.8	3.4	4.2	
	2.1	3.2	3.6	4.1	
Copper .. .. .	2.0	2.8	3.0	4.1	
	2.0	2.8	3.3	4.2	
	2.0	2.7	3.1	4.2	
	2.1	2.6	3.1	4.3	
	2.0	2.4	3.3	4.0	

TABLE III(a)—*coweld.*

Ions.	10th April.	18th April.	22nd April.	26th April.	Remarks.
Manganese .. ..	2.0	2.6	4.5	5.2	
	2.0	2.5	4.2	5.3	
	2.0	2.3	4.4	..	
	2.0	2.4	4.6	5.4	
	2.0	2.3	4.4	5.1	
	2.0	2.2	4.3	..	
	2.0	2.7	4.3	5.5	
	2.0	2.6	4.2	..	

Two other sets of experiments (in water as well as in seed) were started on the 15th April and 17th April, respectively. The quantities of the ions and of the culture solutions were kept the same as in the first set of experiments. The results of these two sets of experiments are shown in Tables IV and V.

TABLE IV.

*Season—April—May.**Plant—Moth in sand.*

Ions.	15th April.	19th April.	24th April.	28th April.	3rd May.	11th May.	20th May.	Remarks.
Blank ..	2.2	2.57	3.5	3.9	4.9	7.3	9.4	
Thorium ..	2.3	2.9	3.5	4.1	5.8	9.1	11.1	
Cobalt ..	2.2	2.5	3.5	3.8	5.0	6.5	8.4	
Uranium ..	2.1	2.75	3.6	3.77	5.32	7.31	9.14	
Cerium ..	2.1	2.65	4.11	5.05	6.02	8.00	10.2	
Sodium ..	2.2	2.51	3.22	3.65	4.1	5.11	7.15	
Zinc ..	2.15	2.45	3.1	3.60	4.51	5.9	8.05	
Copper ..	2.25	3.5	3.01	3.75	4.71	Damaged.		
Manganese ..	2.10	2.4	3.3	3.65	4.91	6.52	8.45	
Aluminium	2.15	2.42	3.41	3.85	5.0	6.6	8.6	
Strontium ..	2.2	2.5	3.41	3.72	4.71	6.01	8.6	

TABLE IV(a).

Blank ..	2.2	2.3	3.6	4.6	4.4	7.3	9.9	
	2.3	3.6	4.1	4.5	4.9	..	9.1	
	2.2	2.6	..	5.1	4.7	6.8	10.0	
	2.3	3.0	3.2	6.0	5.1	8.3	..	
	2.2	3.1	3.5	..	..	7.4	..	
	2.1	2.9	3.1	3.2	5.4	7.8	8.9	
	2.0	2.5	3.9	3.9	4.9	6.8	9.4	

TABLE IV(a)—*contd.*

Ions.	15th April.	19th April.	24th April.	28th April.	3rd May.	11th May.	20th May.	Remarks.
Thorium ..	2.3	2.9	3.6	3.0	5.2	6.0	7.4	
	2.2	3.0	3.1	3.7	5.0	6.4	8.3	
	2.4	3.1	3.5	3.8	..	..	..	
	2.4	3.0	3.5	3.7	5.8	6.0	8.4	
	2.2	3.4	3.4	3.7	4.5	6.0	7.9	
	2.3	3.0	3.1	3.7	4.3	5.1	..	
	2.2	2.8	4.0	4.3	5.7	7.1	8.8	
	2.3	2.6	4.9	3.8	6.0	7.7	..	
	2.4	2.7	3.0	3.3	4.3	5.9	8.0	
Cobalt ..	2.2	2.7	3.1	3.9	5.1	7.2	8.0	
	2.2	2.4	3.5	3.8	4.5	6.5	8.9	
	2.2	2.5	3.0	3.6	4.1	6.5	..	
	2.4	2.5	3.1	3.4	4.2	6.0	7.7	
	2.3	2.6	3.1	3.3	5.0	6.1	7.9	
	2.2	2.1	3.5	3.9	5.4	6.0	7.1	
	2.4	2.4	3.0	3.0	..	..	8.9	
	2.3	2.5	3.5	4.3	5.5	6.9	8.4	
	Uranium ..	2.2	3.2	3.5	3.2	5.2	7.3	9.8
2.3		2.7	3.4	3.0	5.6	7.0	8.0	
2.2		2.5	3.6	4.2	5.4	7.8	9.1	
2.2		2.2	4.0	3.8	5.3	7.3	8.4	
2.2		2.6	3.2	3.8	5.1	7.6	9.6	
2.2		2.4	3.0	4.0	5.3	7.1	8.0	
2.2		2.8	3.7	4.2	5.5	7.6	10.0	
2.2		3.3	3.9	..	..	..	..	
Cerium ..	2.1	2.4	4.7	5.7	6.5	8.7	10.9	
	2.2	2.8	4.1	4.3	6.0	7.3	10.2	
	2.1	3.0	3.4	4.6	5.3	..	..	
	2.1	2.6	3.7	5.4	5.5	8.0	9.5	
	2.0	2.7	3.0	5.0	5.8	8.0	8.4	
	2.2	2.4	4.0	5.4	6.2	7.2	9.0	
	2.1	2.0	..	5.0	6.8	8.5	10.4	
	2.0	3.2	4.2	4.6	5.2	7.5	10.0	
	2.1	3.2	..	..	..	..	..	

TABLE IV(a)—concl'd.

Ions.	15th April.	19th April.	24th April.	28th April.	3rd May.	11th May.	20th May.	Remarks.
Zinc ..	2.2	2.8	3.1	2.9	4.0	5.9	8.7	
	2.2	3.0	3.1	2.4	4.5	5.5	..	
	2.2	2.0	2.6	3.6	5.0	5.5	8.0	
	2.1	2.4	2.7	3.0	5.1	6.4	7.9	
	2.1	2.4	3.0	3.6	5.6	5.9	7.4	
	2.2	2.4	3.7	4.2	4.5	6.3	7.3	
	2.2	2.6	3.0	4.0	4.1	4.7	6.4	
	2.1	2.9	3.9	4.4	..	..	..	
Copper ..	2.2	2.5	..	..	..	..	..	
	2.3	2.4	3.3	3.8	4.3	..	..	
	2.3	2.6	2.7	3.4	4.7	..	..	
	2.2	2.5	3.0	3.2	..	..	..	
	2.2	2.5	3.0	4.2	5.1	..	..	
	2.2	2.3	3.1	3.6	4.9	..	..	
	3.0	2.3	3.6	4.0	4.6	..	..	
	2.2	2.2	3.0	4.1	5.2	..	..	
	2.1	2.4	3.0	3.4	4.5	6.2	8.0	
2.2	2.3	3.1	3.1	4.1	6.0	..		
Manganese ..	2.1	2.5	3.3	3.7	4.5	6.5	8.3	
	2.2	2.1	3.0	3.7	4.3	6.9	8.5	
	2.1	2.1	3.4	3.5	4.4	7.0	8.9	
	2.2	2.1	3.0	3.4	4.8	7.5	9.1	
	2.1	2.0	3.6	3.8	4.5	..	..	
	2.2	2.4	3.6	4.0	5.3	6.8	9.0	

TABLE V.

Season—April—May.

Plant—Moth in water culture.

Ions.	17th April.	20th April.	25th April.	2nd May.	12th May.	20th May.	Remarks.
Blank ..	..	2.40	2.60	3.55	5.1	7.65	9.6
Thorium ..	..	2.35	3.1	3.65	6.12	9.4	11.9
Cobalt ..	..	2.41	2.5	3.41	5.2	6.92	8.9
Uranium ..	..	2.37	2.8	3.75	5.5	7.75	10.7
Cerium ..	..	2.34	2.77	4.2	5.8	8.45	11.3
Sodium ..	..	2.40	2.65	3.2	4.3	5.45	7.75
Zinc ..	..	2.41	2.60	3.3	4.9	5.8	8.35
Copper ..	..	2.42	2.68	2.9	5.0	6.6	8.65
Manganese ..	..	2.41	2.55	3.41	5.15	6.85	8.85
Aluminium ..	..	2.37	2.67	3.42	5.17	6.75	9.2
Strontium ..	..	2.37	2.5	3.43	4.82	6.5	8.45
Blank ..	..	2.32	2.57	3.48	5.15	7.15	8.95

TABLE V(a).

Ions.	17th April.	20th April.	25th April.	2nd May.	12th May.	20th May.	Remarks.
Blank	..	..	..	..	..	..	..
	2.4	..	..	..	..	..	..
	2.5	2.6	3.6	5.6	7.0	9.6	
	2.4	2.6	..	..	..	..	
	2.3	2.6	3.9	4.6	7.7	9.1	
	2.4	2.5	3.6	5.1	8.5	10.1	
	2.2	2.4	3.0	5.3	8.2	4.7	
	2.5	2.1	2.9	5.8	8.9	9.3	
2.4	2.5	3.3	5.0	7.6	9.7		
Thorium	..	..	..	..	..	..	..
	2.4	3.0	4.0	..	..	..	..
	2.4	2.8	4.0	6.0	9.0	12.5	
	2.4	3.1	3.7	6.1	8.6	10.7	
	2.3	3.4	3.4	6.7	8.9	11.9	
	2.4	3.0	3.7	6.2	9.4	11.8	
	2.5	3.3	3.6	6.0	9.0	10.6	
	2.4	3.1	3.6	5.5	9.4	11.3	
Cobalt	..	..	..	..	..	..	..
	2.4	2.6	3.5	5.6	..	8.1	
	2.4	2.5	3.7	5.0	6.9	..	
	2.3	2.5	3.9	5.2	..	8.9	
	2.4	2.4	4.0	5.1	..	..	
	2.4	2.7	3.3	5.4	..	..	
	2.5	2.6	3.4	5.7	6.9	9.8	
	2.4	2.8	3.6	5.8	6.7	..	
	2.4	2.5	3.1	5.4	6.9	..	
2.4	2.7	3.0	5.0	6.0	..		
Uranium	..	..	..	..	..	..	..
	2.4	3.0	3.7	5.9	7.9	10.6	
	2.4	2.6	3.4	5.1	7.0	10.7	
	2.4	2.8	4.3	5.0	7.8	10.0	
	2.4	2.8	4.0	5.5	..	..	
	2.4	3.3	4.7	..	..	..	
	2.4	2.7	3.6	5.3	8.6	..	
2.5	2.9	3.7	5.7	7.7	10.5		

TABLE V(a)—contd.

Ion.	17th April.	20th April.	25th April.	2nd May.	12th May.	20th May.	Remarks.
Cerium	..	2.3	3.1	4.7	6.4	8.4	11.9
		3.3	3.5	3.7	5.3	8.1	10.7
		2.4	2.8	4.9	5.0	8.0	..
		3.2	2.7	4.8	5.8	8.7	11.6
		2.3	2.6	4.6	5.6	8.6	..
		2.4	2.9	4.2	5.0	8.1	..
		2.3	3.3	4.0	5.0	8.8	10.6
		2.3	2.8	4.1	5.7	8.7	11.3
Zinc	..	2.4	2.4	3.0	5.0	6.3	8.0
		2.4	2.8	3.6	4.8	5.3	8.8
		2.3	3.2	3.9	4.0	5.8	8.6
		2.4	3.0	4.1	4.9	..	..
		2.4	2.6	3.4	5.3	5.8	7.9
		2.4	2.5	3.	5.6	..	8.4
		2.4	2.6	3.3	4.5	5.7	8.9
		2.4	2.6	3.9	..	..	..
		2.5	2.7	3.1	4.9	5.7	..
Copper	..	2.4	2.3	3.0	5.5	..	..
		2.4	2.5	3.2	5.0	..	8.6
		2.4	2.7	3.7	5.4	..	..
		2.3	2.6	3.6	5.3	..	..
		2.4	2.7	2.9	5.0	6.6	8.6
		2.4	2.6	3.4	5.0	..	..
Manganese	..	2.4	2.5	3.8	5.6	7.4	9.7
		2.4	2.6	3.4	5.1	6.5	8.2
		2.4	2.5	3.6	5.7	..	8.9
		2.4	3.1	3.9	5.8	..	..
		2.4	3.7	3.4	5.9	6.9	..
		2.5	2.7	3.0	5.1	6.9	8.7
		2.4	3.0	3.8	6.0	..	..
		2.4	2.5	3.3	4.6	6.8	9.1

*Jawar* was sown on the 25th and 26th April in five big porcelain dishes containing purified sand. These dishes were each of five litres capacity and were filled with equal quantities of the sand. The plants were sorted on the 10th May and the measurements were taken after about 3 or 4 days. The growth in water culture was fairly regular, but in pots they showed an irregular growth after two weeks. The measurements of two experiments performed simultaneously in water culture and in sand are given in Tables VI and VII.

TABLE VI.

Season—May—June.

Plant—Jawar in sand.

Maximum length in cms. of the plant on

Ions.	12th May.	16th May.	20th May.	24th May.	28th, May.	1st June.	5th June.	9th June	Total growth.	Remarks.
Blank	2.0	2.8	3.7	4.3	5.2	6.5	7.8	9.0	7.0	
Thorium	2.0	2.8	4.0	5.0	6.2	7.5	8.8	10.0	8.0	
Uranium	2.0	3.0	4.1	5.3	6.8	8.0	9.1	10.3	8.3	
Curium	2.0	2.7	3.6	4.4	5.25	6.7	8.8	9.3	7.3	
Nickel	2.0	2.6	3.1	3.8	4.7	5.6	6.5	7.4	5.4	
Cobalt	2.0	2.6	3.2	3.9	4.8	6.0	7.1	8.0	6.0	
Sodium	2.0	2.6	3.15	3.9	4.65	5.6	6.55	7.55	5.5	
Zinc	2.0	2.55	3.7	4.8	4.9	7.2	8.1	9.0	7.0	
Copper	2.0	2.5	3.2	4.0	4.9	5.7	6.45	7.0	5.0	
Manganese	2.0	2.7	3.5	4.1	4.75	5.3	6.2	7.3	5.3	
Aluminium	2.0	2.4	3.0	3.75	4.7	5.7	6.6	7.45	5.45	
Strontium	2.0	2.6	3.5	4.3	5.2	6.6	7.3	8.1	6.1	
Calcium	2.0	2.6	3.4	4.1	5.1	6.3	7.0	7.6	5.6	

TABLE VI (a).

Ions.	12th May.	16th May.	20th May.	24th May.	28th May.	1st June.	5th June.	9th June.	Remarks.
Blank	2.0	2.6	3.5	4.1	5.6	6.1	7.8	..	
	2.0	2.8	3.8	4.5	5.2	6.5	7.9	9.0	
	2.0	2.4	3.7	4.2	5.0	..	..	..	
	2.0	3.0	3.6	4.3	5.2	6.5	7.7	9.2	
	2.0	2.8	3.9	4.1	5.0	6.3	8.0	9.0	
	2.0	2.6	3.5	4.3	5.4	6.7	7.6	8.9	
Thorium	2.1	2.5	4.1	5.0	6.5	..	..	..	
	2.0	2.9	4.0	5.3	6.4	7.4	9.0	10.0	
	2.0	2.8	4.0	5.2	6.2	..	..	..	
	2.1	2.8	4.3	4.7	6.0	7.5	8.6	10.2	
	2.0	2.7	3.7	5.0	6.2	7.6	8.8	9.8	
Uranium	2.0	2.9	4.2	5.5	6.8	..	..	..	
	2.0	3.0	4.3	5.6	6.8	8.0	8.8	10.6	
	2.1	3.2	4.1	5.0	6.7	7.7	9.4	10.3	
	2.0	2.9	4.0	5.1	6.5	8.0	9.4	..	
	2.0	2.8	3.9	5.3	6.9	8.3	9.1	10.0	
Cerium	2.0	2.4	3.4	4.2	4.1	..	..	..	
	2.1	2.5	3.6	4.5	5.25	6.8	8.5	9.0	
	2.1	2.7	3.8	4.4	5.3	6.7	8.8	9.3	
	2.0	2.9	3.6	4.4	5.2	6.6	—	..	
	2.0	2.7	3.5	4.3	5.1	..	—	..	
	2.0	2.9	3.4	4.3	5.2	6.6	9.1	9.6	

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TABLE VI (a)—*contd.*

Ions.	12th May.	16th May.	20th May.	24th May.	28th May.	1st June.	5th June.	9th June.	Remarks.
Nickel .. ..	2.0	2.4	2.8	3.6	4.7	3.5	..	..	
	2.0	2.6	2.9	3.7	4.6	5.6	6.5	7.2	
	2.0	2.5	3.1	3.5	..	..	..	..	
	2.0	2.6	3.3	3.9	4.8	5.6	6.5	7.6	
	2.0	2.6	3.2	3.8	..	..	..	..	
Cobalt .. ..	2.0	2.4	3.2	3.9	4.7	5.6	7.1	..	
	2.0	2.6	3.4	3.7	4.9	5.7	7.0	7.9	
	2.0	2.5	3.2	3.9	4.8	6.3	7.1	8.0	
	2.0	2.4	3.0	4.1	4.7	6.0	7.2	8.1	
Zinc .. ..	2.0	2.5	3.4	4.4	5.6	..	..	..	
	2.0	2.55	3.5	4.8	6.1	7.4	7.8	9.0	
	2.0	2.5	3.7	..	..	..	..	..	
	2.1	2.6	3.9	5.0	5.9	7.0	8.1	8.8	
	2.0	2.5	3.7	4.6	5.7	7.2	8.4	9.2	
Copper .. ..	2.0	2.3	3.0	4.0	4.9	4.4	..	..	
	2.0	2.4	3.1	4.0	5.2	5.7	6.3	7.0	
	2.1	2.5	3.2	4.1	5.1	5.9	6.5	7.2	
	2.0	2.5	3.2	3.7	4.7	5.5	6.4	6.8	
	2.0	2.3	3.1	..	..	..	..	..	
Manganese ..	2.0	2.8	3.5	4.1	4.8	5.3	6.3	7.3	
	2.0	2.3	2.3	4.1	4.4	5.1	6.2	..	
	2.0	2.9	3.4	3.9	4.75	5.5	6.1	7.3	
	2.0	2.7	3.2	3.6	4.5	..	..	..	
	2.0	2.5	3.5	4.3	4.7	5.3	6.5	7.4	
	2.0	2.6	3.6	4.1	4.7	5.1	6.1	7.2	
Aluminium ..	2.1	2.3	3.0	3.3	..	..	..	..	
	2.0	2.5	3.2	3.1	4.8	5.7	6.8	7.5	
	2.0	2.3	3.0	3.70	4.6	5.7	6.6	7.4	
	2.1	2.6	2.8	3.75	4.3	5.1	..	..	
	2.0	2.4	3.0	3.7	4.7	5.8	6.4	7.5	
	2.0	2.3	3.1	3.3	4.7	..	..	..	
	2.0	2.4	2.9	3.8	4.7	5.6	6.6	7.4	
	2.0	2.3	2.7	3.5	4.6	..	..	..	



TABLE VII.

*Season—May—June.**Plant—Jawar in water culture.*

Total length in cms. of the plant on

Ions.	12th May.	16th May.	20th May.	24th May.	28th May.	Total growth.	Remarks.
Blank .. ..	2.0	3.0	3.8	7.1	8.2	6.2	
Thorium .. ..	2.0	3.6	4.9	7.8	8.4	6.4	
Nickel .. ..	2.0	3.2	4.6	7.4	7.8	5.8	
Cobalt .. ..	2.0	3.4	4.7	7.4	8.0	6.0	
Uranium .. ..	2.0	3.6	4.9	7.8	8.6	6.6	
Cerium .. ..	2.0	3.3	4.6	7.4	8.3	6.3	
Sodium .. ..	2.0	3.3	4.1	6.9	7.8	5.8	
Zinc .. ..	2.0	3.2	4.1	7.1	8.0	6.0	
Copper .. ..	2.0	3.3	3.9	6.3	7.6	5.6	
Manganese .. ..	2.0	3.0	3.8	6.0	7.7	5.7	
Aluminium .. ..	2.0	2.7	3.8	4.8	7.8	5.8	
Strontium .. ..	2.0	2.7	4.1	7.2	7.9	5.9	
Calcium .. ..	2.0	3.1	4.0	7.0	7.8	5.8	

TABLE VII (a).

Ions.	12th May.	16th May.	20th May.	24th May.	28th May.	Remarks
Blank .. ..	2.0	3.0	3.6	7.8	..	
	2.0	3.2	3.4	7.1	8.9	
	2.0	3.1	3.8	8.0	7.5	
	2.1	3.0	4.2	7.2	..	
	2.0	3.3	3.9	7.9	..	
	2.1	2.8	3.6	6.7	8.2	
	1.9	3.0	3.3	..	..	
	2.0	3.3	3.8	7.0	8.7	
	2.0	1.7	4.0	7.5	7.7	
Thorium .. ..	2.0	4.6	5.0	7.3	..	
	2.0	3.9	5.3	7.8	9.0	
	2.0	3.6	4.9	7.6	8.4	
	2.1	3.5	4.8	8.0	..	
	2.0	3.9	4.9	7.9	8.3	
	2.0	4.0	5.1	..	..	
	2.0	3.3	4.5	8.0	7.8	
	1.9	3.1	4.8	8.1	7.9	
2.0	3.4	..	..	..		

TABLE VII (a)—*contd.*

Ions.		12th May.	16th May.	20th May.	24th May.	28th May.	Remarks.
Uranium	..	2.0	3.5	4.4	7.2	..	
		2.0	3.6	4.9	7.8	8.3	
		2.0	3.9	5.3	7.7	8.6	
		2.0	4.0	4.3	..	..	
		2.0	3.3	4.5	8.2	8.9	
		2.0	3.6	4.9	7.4	8.5	
		2.0	3.3	..	7.4	..	
Cerium	..	2.0	3.0	4.9	7.4	8.9	
		2.0	3.6	4.6	7.7	8.3	
		2.0	3.3	4.3	7.1	7.7	
		2.0	3.2	5.4	7.9	8.5	
		1.9	2.8	4.1	6.9	8.1	
		2.0	3.1	4.4	..	..	
		2.0	3.2	4.6	7.4	..	
Nickel	..	2.0	3.4	4.8	7.9	8.4	
		2.0	3.2	4.4	7.4	7.8	
		1.9	3.0	4.6	6.9	7.2	
		1.9	2.9	3.8	6.8	..	
		1.9	2.8	4.1	6.7	..	
		2.0	3.1	4.2	..	..	
Co.	..	2.0	3.4	4.7	7.9	8.0	
		2.0	3.4	4.5	6.9	8.1	
		2.0	3.3	4.9	7.4	..	
		2.0	3.1	4.3	..	..	
		2.1	2.9	4.0	..	..	
Manganese	..	2.0	2.7	3.8	..	..	
		2.0	3.0	3.6	5.9	7.7	
		2.0	3.6	4.0	6.0	7.6	
		2.1	3.7	4.1	..	..	
		2.0	2.9	3.9	6.3	..	
		1.9	3.4	3.9	6.4	8.0	
		2.0	3.1	3.7	7.7	7.4	

TABLE VII (a)—concl'd.

Ions.	12th May.	16th May.	20th May.	24th May.	28th May.	Remarks.
Zinc .. ..	2.0	3.1	4.1	..	..	
	2.0	3.2	4.3	7.0	8.4	
	2.0	3.4	3.9	7.1	8.0	
	2.0	3.6	4.1	7.2	7.6	
	2.0	3.0	4.4	7.5	8.6	
	2.0	2.8	3.8	6.7	8.2	
	2.1	3.6	3.7	..	..	
Cu .. ..	2.0	3.3	3.9	6.3	7.6	
	2.0	3.7	3.9	6.5	7.9	
	2.0	2.9	3.9	6.1	7.3	
	2.0	2.8	4.0	..	..	
	1.9	3.0	4.2	..	7.1	

Two crops of Jawar were again sown on the 20th May with a view to repeat the above experiments, but on account of the untimely season for the cereals and the intense heat of Lahore in these months, the measurements taken in June for the crop were very irregular. Cotton-seed was also tried, but both these crops had to be abandoned on account of the very unfavourable season. In Table VIII are shown some of the measurements in the case of Jawar. A dust storm on the 20th June destroyed the crop of Jawar completely and no measurements could, therefore, be taken after that date.

TABLE VIII.

Season—June 1931.

Plant—Jawar in sand.

Ions.	3rd June.	8th June.	14th June.	19th June.	Remarks.
Blank ..	3.66	3.97	4.56	4.60	
Thorium ..	3.72	4.21	4.32	4.5	
Uranium ..	3.68	4.68	4.75	5.6	Mean of two plants only 3rd was damaged.
Cerium ..	3.70	4.71	Yellowness developed rejected.		on certain leaves, hence
Nickel ..	3.77	4.21	4.64	4.75	Measurement of one plant only which showed satis- factory growth.
Cobalt ..	3.68	4.0	4.36	5.0	
Zinc ..	3.64	4.11	4.61	5.22	Yellowness on some plants after 19th.
Copper ..	3.67	Damaged.			
Manganese ..	3.66	4.24	4.72	5.0	
Aluminium ..	3.7	Damaged.			
Blank ..	3.60	3.82	4.4	..	One plant was damaged.

TABLE VIII (a).

Ions.		3rd June.	8th June.	14th June.	19th June.	Remarks.
Blank	.. ..	3.6	4.2	4.9	4.9	
		3.6	4.0	4.5	4.6	
		3.6	3.8	4.7	..	
		3.6	3.7	..	..	
		3.5	3.8	4.1	4.3	
		3.6	3.9	..	..	
		3.6	4.1	4.4	4.5	
Thorium	..	3.7	4.0	4.3	4.3	
		3.8	4.0	4.0	4.5	
		3.7	4.4	4.7	4.7	
		3.7	4.2	4.3	4.5	
		3.7	4.2	4.3	4.4	
		3.7	4.6	4.8	6.0	
		3.7	4.7	4.7	5.0	
		3.6	4.1	4.2	4.8	
		3.7	4.0	4.4	4.6	
		3.7	..	..	..	
		3.6	4.7	..	..	
		3.7	5.0	..	..	
		3.6	..	..	..	
		3.7	4.4	..	..	
		3.7	..	..	..	
Uranium	..	3.7	4.6	4.8	6.0	
		3.7	4.7	4.7	5.0	
		3.8	4.1	4.2	4.8	
		3.7	4.0	4.4	4.6	
Nickel	...	3.9	4.1	4.6	--	
		3.8	4.3	4.9	..	
		3.8	4.2	4.65	4.75	
		3.7	4.6	..	--	
		3.8	4.5	4.7	4.9	
		3.8	4.3	4.4	--	

TABLE VIII(a)—*contd.*

Ions.		3rd June.	8th June.	14th June.	19th June.	Remarks.
Cobalt .. ..	.. ..	3.7	4.3	4.6	5.0	
		3.7	4.0	4.3	5.4	
		3.7	..	..	..	
		3.7	3.7	4.6	4.6	
Zinc .. ..	.. ..	3.6	4.3	4.9	5.4	
		3.6	4.0	4.6	..	
		3.6	4.1	4.3	5.2	
		3.5	4.0	4.5	5.0	
		3.6	3.9	4.6	5.0	
		3.6	3.8	..	..	
Cu. .. ..	.. ..	3.6	4.1	..	..	
		3.6	3.9	..	..	
		3.6	4.2	..	..	
		3.6	..	..	..	
		3.6	..	..	..	
		3.6	..	..	..	
Manganese ..	.. ..	3.6	4.4	4.6	5.3	
		3.6	4.2	4.7	5.1	
		3.6	4.0	4.9	5.0	
		3.6	4.0	4.8	4.8	
		3.6	3.9	4.7	..	
	3.6	4.2	4.4	4.7		

The rains had set in in the middle of July and another set of Jawar was sown on the 30th July. The plants were sorted on the 8th August and planted both in the culture solution as well as in pure sand. The quantities of the ions added in these experiments were nearly ten times more than used in the previous experiments of Jawar and Moth. In the cases of thorium and uranium the growth was found to be increased in increasing the concentrations of these ions. Both these substances indicated the maximum growth and the effect of other ions was obtained in the same direction as in the previous experiments completed in the month of May. The results of the two experiments simultaneously carried out in the pots and in the bottles are summarised in Tables IX and X.

TABLE IX.

Season—August-September.

Plant—Jawar in water culture.

Ions.	10th Aug.	15th Aug.	21st Aug.	23rd Aug.	28th Aug.	1st Sept.	15th Sept.	Remarks.
Blank .. ..	2.23	3.10	3.71	4.75	5.25	7.55	11.94	
Thorium .. ..	22.35	3.16	4.00	5.45	6.86	9.32	12.86	
Uranium .. ..	2.75	3.00	4.35	5.95	6.45	9.55	13.35	
Cerium .. ..	2.50	2.85	4.25	5.26	6.51	6.75	12.35	
Zinc .. ..	2.65	2.9	3.75	4.62	5.26	7.65	12.12	
Copper .. ..	2.55	2.73	3.75	4.81	5.4	7.41	11.66	
Manganese .. ..	2.31	2.81	3.58	4.92	5.50	7.40	11.75	
Nickel .. ..	2.30	2.75	3.53	4.40	5.81	7.46	11.85	
Cobalt .. ..	2.25	2.9	3.65	3.95	5.85	7.82	11.93	
Blank .. ..	2.30	2.92	3.75	4.05	5.35	7.42	11.90	

TABLE IX (a).

Ions.	10th Aug.	15th Aug.	21st Aug.	23rd Aug.	28th Aug.	1st Sept.	15th Sept.	Remarks.
Blank .. ..	2.3	3.0	3.6	4.8	5.1	7.6	..	
	2.3	3.1	3.9	4.75	5.3	7.53	11.93	
	2.3	3.3	3.7	4.7	5.0	7.5	12.0	
	2.4	3.2	3.6	4.6	5.25	..	..	
	2.3	2.7	3.6	4.5	5.3	..	..	
	2.3	2.9	3.5	4.8	5.2	7.6	11.9	
	2.3	2.8	3.4	4.7	5.1	..	..	
Thorium .. ..	2.4	3.3	4.0	5.4	..	..	..	
	2.4	3.15	4.2	5.45	6.95	9.3	12.25	
	2.30	3.2	4.0	5.4	6.9	9.5	12.8	
	2.3	3.4	4.1	5.6	6.7	9.3	..	
	2.4	3.1	3.8	5.6	6.8	9.1	12.9	
	2.30	3.2	3.9	5.8	6.5	..	..	
	2.30	3.4	3.7	5.7	6.6	..	..	
	2.3	3.6	3.3	5.5	6.9	9.3	..	

TABLE IX (a)—contd.

Ions.	10th Aug.	15th Aug.	21st Aug.	23rd Aug.	28th Aug.	1st Sept.	15th Sept.	Remarks.
Uranium ..	2.8	3.4	5.6	6.2	6.50	..	..	
	2.7	3.2	4.35	6.0	6.4	9.6	13.4	
	2.75	3.0	4.2	6.0	6.3	9.7	13.30	
	2.7	3.0	4.3	5.9	6.5	9.55	13.35	
	2.8	3.3	4.1	5.95	..	..	..	
	2.8	2.9	4.4	..	6.45	9.5	13.3	
Cerium ..	..	..	..	5.25	..	..	..	
	2.5	2.95	4.25	5.25	6.6	6.75	12.3	
	2.5	2.9	4.3	5.20	6.4	6.7	12.35	
	2.5	2.8	4.25	..	..	..	..	
	2.5	2.6	4.2	5.1	6.5	..	..	
	2.5	2.8	4.2	5.30	6.5	6.8	12.4	
Zinc ..	2.65	3.0	3.70	4.7	5.3	7.70	12.1	
	2.7	2.8	3.80	4.5	5.20	7.60	12.1	
	2.6	2.9	3.7	4.6	..	..	..	
Copper ..	..	..	..	4.8	..	..	..	
	2.6	3.70	3.8	5.0	7.6	5.5	11.65	
	2.55	2.75	3.75	4.6	5.3	7.2	11.6	
	2.5	2.7	3.75	4.5	5.4	..	..	
	2.5	2.80	3.4	4.8	5.4	7.4	11.7	
	2.5	2.6	3.3	..	..	..	..	
Manganese ..	2.3	2.6	3.9	4.6	5.2	..	..	
	2.2	2.8	3.6	4.6	5.3	7.4	11.7	
	2.30	3.0	3.8	5.0	5.5	7.4	11.7	
	2.3	2.8	3.7	4.9	..	..	..	
	2.3	2.6	3.6	4.8	5.5	7.6	11.80	
	2.3	2.9	3.6	4.9	5.7	7.5	11.7	
	2.3	2.7	3.4	4.9	5.3	7.5	11.7	
Nickel ..	2.4	2.8	3.6	4.6	6.0	7.45	11.8	
	2.3	2.7	3.55	4.4	5.6	7.4	11.85	
	2.5	2.75	3.5	4.2	5.8	7.5	11.9	
	2.3	2.70	3.7	4.1	..	..	..	
	2.3	2.7	3.5	4.6	..	..	..	
Cobalt ..	2.3	3.0	3.65	4.0	5.85	7.9	11.8	
	2.25	2.8	3.6	3.95	5.8	7.7	11.9	
	2.20	2.6	3.3	3.8	..	..	..	
	2.3	2.8	3.1	3.9	..	..	..	
	2.20	2.9	3.7	3.9	5.9	7.8	12.0	

TABLE X.

Season—August—September.

Plant—Jawar in Sand.

Ions	10th Aug.	15th Aug.	21st Aug.	23rd Aug.	27th Aug.	31st Aug.	9th Sept.	14th Sept.	Remarks.
Blank	..	2.25	2.97	3.67	4.65	5.15	7.45	10.22	11.54
Thorium	..	2.25	3.16	4.12	5.35	6.82	9.12	11.44	12.6
Uranium	..	2.35	3.00	4.25	5.87	6.35	9.45	11.63	..
Cerium	..	2.43	2.92	4.11	5.00	6.5	8.34	10.85	12.1
Zinc	..	2.45	2.96	3.81	4.62	5.16	7.66	10.41	11.89
Copper	..	2.34	2.87	3.81	4.85	5.33	7.41	9.85	11.21
Manganese	..	2.25	2.95	3.6	4.92	5.44	7.40	10.10	11.56
Nickel	..	2.31	2.86	3.55	4.41	5.92	7.36	9.65	11.4
Cobalt	..	2.28	2.9	3.56	4.0	5.5	7.41	10.00	11.65
Blank	..	2.28	2.92	3.68	4.75	5.25	7.32	10.1	11.75

TABLE X (a).

Ions.	10th Aug.	15th Aug.	21st Aug.	23rd Aug.	27th Aug.	31st Aug.	9th Sept.	14th Sept.	Total growth in length.	Remarks.
Blank	2.3	3.0	3.1	4.6	..	..	..	..	..	
	2.2	3.0	3.7	3.9	5.5	7.0	9.7	11.5	9.3	
	2.2	2.6	3.0	4.2	5.2	..	..	..	..	
	2.2	2.4	3.7	5.9	6.2	7.6	10.2	..	..	
	2.3	..	3.6	5.3	5.5	8.0	..	11.4	9.1	
	2.3	2.7	3.4	5.4	..	..	..	..	..	
	2.2	3.0	4.3	4.6	4.9	7.5	10.7	11.5	9.3	
	2.3	2.6	..	..	..	..	..	..	..	
Thorium	2.3	3.6	4.1	5.35	6.3	9.0	11.9	12.1	..	
	..	3.2	4.0	5.8	7.3	9.7	11.4	12.5	..	
	2.2	..	..	..	..	..	11.3	..	..	
	2.3	2.8	3.6	5.9	6.8	8.5	..	12.6	..	
	2.2	..	..	..	..	..	10.0	..	..	
	2.2	3.2	4.5	5.4	6.8	9.1	10.9	13.1	..	



Ions.	10th Aug.	15th Aug.	21st Aug.	23rd Aug.	27th Aug.	31st Aug.	9th Sept.	14th Sept.	Total growth in length.
Uranium	2.3	3.0	4.2	5.7	6.2	9.0	11.5	15.8	..
	2.4	3.0	..	..	..	..	..	..	..
	2.4	3.4	4.3	5.0	6.3	9.3	11.7	15.5	..
	2.3	3.6	..	..	..	..	..	15.1	..
	2.4	..	..	..	..	..	..	..	..
	2.3	..	..	5.8	..	..	..	..	..
	2.4	2.6	3.7	6.2	7.0	9.1	12.0	15.7	..
	2.3	3.0	4.7	..	5.6	9.4	11.1	..	..
	2.3	3.0	4.1	5.9	6.4	9.8	11.6	14.4	..
	Cerium	2.4	..	..	..	..	8.0	..	..
2.4		2.9	..	5.0	..	..	..	..	..
2.4		2.8	4.0	5.6	6.7	8.9	10.5	12.6	..
2.4		2.7	4.2	4.6	6.4	7.7	10.8	12.0	..
2.4		2.9	4.1	5.0	6.3	6.3	11.1	11.6	..
2.5		..	..	..	..	..	..	..	..
2.4		3.0	4.1	..	6.5	8.3	..	..	..
2.5		..	..	5.1	..	..	10.7	12.1	..

## PEAS.

Peas were sown in the middle of September. 12 pots of equal capacities were filled with 5 lbs. of purified sand each, and about 20 seeds of exactly the same weight and similar in colour were sown in each pot. The seeds were germinated on the third day and developed rapidly. The rate of growth of these plants was about 1 cm. per day, and as these plants grew in their lengths only without any off-shoots, they were found to be much more suitable for these investigations than any of the plants investigated before. The results of one crop in which the effect of 10 ions was investigated are shown in Table XI.

TABLE XI.

Season—September—October.

Plant—Peas in pots.

Ions.	24th Sept.	28th Sept.	2nd Oct.	7th Oct.	9th Oct.	15th Oct.	Remarks.
Blank	10.34	15.64	19.9	25.6	32.64	40.4	
Thorium	10.26	18.85	22.8	25.7	35.56	44.6	
Uranium	10.34	17.94	22.0	28.64	34.85	44.1	
Cerium	10.30	17.64	21.9	27.58	34.64	44.7	
Zinc	10.37	16.25	20.14	25.8	32.8	40.6	
Nickel	10.30	15.84	20.22	25.64	32.4	40.8	
Cobalt	10.31	16.44	19.64	25.67	32.1	44.1	
Manganese	10.29	16.59	20.14	25.55	32.54	40.4	
Calcium	10.26	16.9	20.64	24.93	32.3	40.3	
Barium	10.31	16.8	20.75	25.1	32.22	40.45	
Strontium	10.36	15.7	20.85	25.65	32.54	40.56	
Blank	10.32	15.84	20.15	25.56	32.56	40.31	

TABLE XI (a).

Ions.	24th Sept.	28th Sept.	2nd Oct.	7th Oct.	9th Oct.	15th Oct.	Remarks.
Blank	10.4	15.1	19.4	25.8	32.7	40.3	
	10.3	15.0	17.3	21.7	..	40.4	
	10.3	15.6	19.4	25.0	32.0	40.8	
	10.5	16.1	19.5	25.6	33.2	..	
	10.3	16.2	19.3	25.6	..	..	
	10.3	15.3	20.0	25.1	..	..	
	10.4	15.5	20.4	32.2	32.6	40.6	
Thorium	10.3	18.6	22.0	..	..	..	
	10.2	18.8	22.0	26.3	35.6	44.5	
	10.4	18.1	22.8	..	..	..	
	10.2	18.2	22.4	25.3	35.5	45.4	
	19.3	19.0	23.6	26.1	..	..	
	10.2	18.7	..	25.7	35.0	44.6	
	10.3	18.4	..	..	..	..	
	10.3	19.4	23.2	25.1	42.2	43.8	
Uranium	10.3	17.9	21.3	28.5	42.2	44.9	
	10.4	17.0	22.2	28.0	34.6	44.1	
	10.3	16.5	21.3	..	..	..	
	10.3	17.7	22.7	..	35.4	44.2	
	10.4	16.0	20.6	..	..	..	
	10.4	18.8	22.0	29.2	34.8	43.3	
Cerium	10.3	18.3	22.0	27.0	34.6	45.4	
	10.4	17.6	21.0	28.2	33.9	44.7	
	10.3	..	..	..	..	..	
	10.3	17.0	22.8	27.6	35.3	44.0	
	10.4	..	21.9	..	..	..	
	10.3	17.3	20.1	24.6	44.8	..	
	10.3	17.0	19.6	23.2	34.6	..	
Zinc	10.4	16.1	19.4	25.8	32.3	..	
	10.4	16.25	19.8	26.3	32.0	40.8	
	10.3	16.1	19.3	..	..	..	
	10.4	15.7	20.1	24.6	..	..	
	10.3	16.50	20.4	25.3	..	40.8	
	10.4	16.20	19.9	26.3	32.8	41.2	

TABLE XI (a)—*contd.*

Ions.	24th Sept.	28th Sept.	2nd Oct.	7th Oct.	9th Oct.	15th Oct.	Remarks.
Nickel ..	10.2	15.8	20.1	25.6	32.0	40.0	
	10.3	15.3	19.1	23.4	..	..	
	10.4	15.6	18.4	..	..	..	
	10.2	15.9	20.2	25.5	32.8	41.6	
	10.4	14.8	..	..	..	..	
Manganese ..	10.3	16.6	20.9	25.0	32.5	34.9	
	10.4	..	..	..	32.9	..	
	10.2	16.9	20.1	25.6	33.4	..	
	10.3	..	..	..	..	..	
	10.4	..	20.1	..	..	40.4	
	10.2	..	..	..	..	40.9	
	10.3	16.3	19.3	26.2	31.6	40.3	

The readings in Table XI are the mean of four or five plants which were found to show exactly similar growth. The growth of all the plants in one pot (about 15 in number) was first separately measured, and only those were selected which showed exactly the same growth. The remaining plants were all removed. It will appear from the above table that thorium, uranium, and cerium affected the plants very appreciably, but no effect was noticed in the presence of any other ion. Two other sets of experiments were simultaneously started in water culture and in sand in the first week of November, but in these sets only the three effective ions were tried.

TABLE XII.

*Season—November.**Plant—Peas in sand.*

Ions.	Maximum length in cms. of the plants on						Remarks.
	30th Oct.	6th Nov.	13th Nov.	18th Nov.	20th Nov.	Total growth.	
Blank ..	14.0	25.8	30.8	38.9	41.8	27.8	
Thorium ..	14.0	25.4	33.3	47.4	49.6	35.6	
Uranium ..	14.0	23.9	28.0	42.0	47.8	33.8	
Cerium ..	14.0	26.2	31.1	44.0	49.1	35.1	

TABLE XIII.

*Season—November.**Plant—Peas in water culture.*

Maximum length in cms. of the plants on

Ions.	30th Oct.	6th Nov.	13th Nov.	18th Nov.	20th Nov.	Total growth.	Remarks.
Blank	.. 21.0	34.8	44.2	51.6	51.6	30.6	
Thorium	.. 21.0	42.3	55.3	61.2	62.2	41.2	
Uranium	.. 21.0	40.1	49.8	59.5	60.5	38.5	
Cerium	.. 21.0	38.3	47.1	55.4	56.8	35.8	

TABLE XIII (a).

Ions.	30th Oct.	6th Nov.	13th Nov.	18th Nov.	20th Nov.	Total growth in lengths.	Remarks.	
Blank ..	.. 14.0	23.6	27.4	31.4	38.6	24.6		
	.. 14.1	25.8	30.5	..	40.9	26.8		
	.. 14.1	25.3	31.0	38.9	42.2	28.1		
	.. 14.0	26.2	showed yellow tips.		..	..		
	.. 14.0	25.7	30.8	..	41.4	27.4		
	.. 14.0	26.3	31.1	..	41.8	27.8		
	.. 14.1	25.4	35.6	..	42.0	27.9		
Thorium ..	.. 14.0	..	..	..	..	..		
	.. 14.0	25.0	33.3	Stem was broken.		..		
	.. 14.1	25.9	33.0	47.0	49.5	35.4		
	.. 14.0	25.4	33.1	47.5	49.9	35.9		
	.. 14.1	24.5	35.5	47.8	49.6	35.5		
	.. 14.0	24.4	Yellowness of the tips and of the off-shoots was observed.				..	
	.. 14.0	25.3	33.0	47.8	..	..		
	.. 13.9	24.9	33.6	47.4	49.3	35.4		
Uranium ..	.. 14.2	23.5	27.6	42.0	47.5	33.3		
	.. 14.0	24.0	28.1	41.7	47.7	33.7		
	.. 14.1	23.9	28.4	42.0	48.7	33.7		
	.. 13.9	23.7	Yellowness of the tips appeared. Leaves turned yellow.				..	
	.. 14.0	22.7	27.8	..	..	..		
	.. 13.9	24.3	28.0	42.3	48.1	34.2		
Cerium ..	.. 14.0	26.0	31.4	43.0	49.8	35.8		
	.. 14.1	26.2	31.7	44.3	48.7	34.6		
	.. 14.1	25.9	30.4	44.0	49.5	35.4		
	.. 13.8	25.1	30.6	41.2	..	..		
	.. 14.0	26.5	31.1	43.7	48.4	34.4		
	.. 13.9	26.2	30.8	44.9	49.1	35.2		
	.. 14.0	24.6	32.2	..	..	..		

TABLE XIII (a).

Ions.	30th Oct.	6th Nov.	13th Nov.	18th Nov.	20th Nov.	Total growth in lengths.	Remarks.
Blank ..	..	21.0	35.0	44.5	51.9	51.5	30.5
				Yellowness.			
		21.1	32.6	44.0	50.4	51.6	30.5
		21.1	34.8	44.2	51.5	51.2	30.1
		21.0	33.6	Yellowness.		..	..
		21.0	34.3	44.4	51.6	51.9	30.9
		21.0	35.3	43.9	51.6	8.3	30.3
		21.0	33.7	30.6	Tips were damaged.		..
Thorium ..		21.0	40.1	55.3	58.7	60.3	39.3
		21.0	42.2	55.2	61.1	..	41.2
		21.0	42.0	55.0	61.0	62.2	..
		21.0	42.3	55.9	61.4	..	..
		21.0	42.6	55.6	61.2	..	..
		21.0	40.3	56.4	59.4	Damaged.	
Uranium ..		21.0	40.0	49.1	59.5	60.3	39.3
		21.0	39.9	Yellow leaves.		..	39.9
		21.0	39.6	48.9	59.7	60.9	..
		21.0	40.3	Yellowness of the leaves and the damaging of tips observed.			
		21.0	40.1	48.9	59.8	60.5	39.5
Cerium ..	..	21.1	Broken at the stem.		..	..	..
		21.0	38.7	47.1	..	..	..
		21.0	38.2	47.6	55.6	56.8	35.8
		21.0	38.3	47.0	55.2	56.8	35.8
		21.0	37.9	46.6	55.4	56.7	35.6
		21.0	37.6	44.6	Damaged at tips.		..
		21.0	35.9	46.4	53.9	..	..

## BARLEY.

Experiments in water culture were tried. Difficulty in the measurements in the case of barley was experienced since from an early stage they developed branches. Some of the plants developed three or even four branches and these had to be discarded. Plants which were of the same form and developed only two branches were selected for the experiments. The maximum lengths of the taller branches are indicated in the following tables.

The plants were sorted from a crop of 600 plants, which were sown in six big dishes containing equal quantities of pure sand. The readings in the following tables are the mean of about three plants.

TABLE XIV.  
Season—November—December.  
Plant—Barley in water culture.

Ions.	14th Nov.	19th Nov.	24th Nov.	28th Nov.	2nd Dec.	15th Dec.	Remarks.
Blank ..	15.0	26.2	32.2	34.4	42.6	45.6	
Thorium ..	15.14	26.3	31.68	35.8	44.6	47.9	
Uranium ..	15.08	25.9	32.35	34.9	42.86	44.92	
Cerium ..	15.15	26.22	32.56	34.5	Rejected on account of dissimilar growth.		
Zinc ..	15.2	25.9	32.4	34.3	Uncertain readings after 28th.		
Manganese ..	15.14	26.21	32.00	Rejected on account of dissimilar growth.			
Nickel ..	15.00	25.9	32.18	34.32	42.36	45.12	
Cobalt ..	15.06	26.2	32.16	33.92	42.16	45.43	
Silver ..	15.23	25.8	32.6	Developed yellowness on the edges and hence rejected.			
Lead ..	15.12	25.12	32.14	33.4	41.5	41.6	
Blank ..	15.17	26.1	..	Damaged ..		..	

The irregularities in the above table are obviously due to the fact that the barley plants from the early stages developed in branches and not in their lengths only.

#### MAIZE.

The formula previously used so far the composition of the nutrient solution was modified for the experiments on maize. As mentioned before, the previous composition was found to be unsatisfactory after the plants had grown for a month or two. A number of trials were made in April and May 1932 over the plants of Arhar and Maize with a view to determine a satisfactory proportion of the nutrient substances in the culture solution. The previous formula was found to be deficient in sodium, chlorine and sulphate. The following quantities are now being used:—

Pottasium nitrate, 30 grms.	Pot chloride, 15 grms.
Magnesium sulphate, 15 grms.	Calcium sulphate, 15 grms.
Sod Hydrogen Phosphate, 15 grms.	Fenit chloride, 0.4 gm.
Water, 30 litres.	

TABLE XIV (a).

Ions.	14th Nov.	19th Nov.	24th Nov.	28th Nov.	15th Dec.	Total growth in lengths.	Remarks.
Blank ..	15.0	25.8	32.4	39.8	46.6	31.6	
	15.0	26.6	32.0	34.4	45.9	30.9	
	15.1	26.1	32.2	34.5	45.7	30.6	
	15.0	26.3	32.2	34.2	45.5	30.5	
Thorium ..	15.2	..	..	..	..	33.9	
	15.1	26.7	26.0	33.7	4.9	32.7	
	15.2	26.3	31.7	35.8	47.9	33.1	
	15.2	26.6	32.0	35.5	48.3	30.6	
	15.0	26.1	31.5	36.1	45.6	..	

TABLE XIV (a)—*contd.*

Ions.		14th Nov.	19th Nov.	24th Nov.	28th Nov.	15th Dec.	Total growth in lengths.	Remarks.
Uranium	..	15.1	24.4	32.2	34.1	44.5	29.4	
		15.1	25.9	32.4	34.6	44.9	29.8	
		15.1	26.3	32.6	35.1	45.3	29.2	
Cerium	..	15.2	26.0	32.3	34.4	..	..	
		15.1	26.1	32.5	34.8	..	..	
		15.1	26.3	32.6	34.6	..	..	
		15.1	26.6	32.9	34.3	..	..	
Zinc	..	15.2	25.6	32.2	34.8	..	..	
		15.4	25.5	32.6	34.2	..	..	
		15.2	25.8	32.3	34.1	..	..	
		15.1	25.3	32.1	33.9	..	..	
Manganese	..	15.2	26.0	32.3	..	..	..	
		15.1	26.2	31.7	34.7	..	..	
		15.2	26.0	31.8	33.2	..	..	
		15.1	26.4	32.0	35.0	..	..	
		15.1	25.8	30.6	33.0	..	..	
		15.2	26.1	32.2	33.3	..	..	
Nickel	..	15.0	25.9	32.0	34.2	..	30.0	
		15.1	25.6	32.6	..	45.1	29.8	
		15.2	26.0	32.2	..	45.0	25.0	
		15.1	26.2	34.6	..	..	30.1	
		15.1	26.4	30.3	..	40.1	..	
		15.1	26.2	32.0	..	45.2	..	
Cobalt	..	15.1	26.2	27.0	30.2	39.6	24.5	
		15.2	26.2	32.0	34.3	45.5	30.3	
		15.1	26.0	32.2	35.5	45.9	30.8	
		15.1	26.4	32.3	33.9	45.2	30.1	
		15.1	25.2	26.8	29.8	40.1	25.0	
Silver	..	15.2	25.3	32.0	Damaged	..	..	
		15.2	25.8	32.3	33.3	..	..	
		15.1	26.0	32.9	33.6	..	..	
		15.3	23.6	32.5	..	..	..	
		15.2	26.1	32.6	..	..	..	
		15.3	24.4	32.4	33.1	33.6	18.3	
		15.2	25.3	31.7	33.5	34.0	18.8	

TABLE XIV (a)—concl'd.

Ions.	14th Nov.	19th Nov.	24th Nov.	28th Nov.	15th Dec.	Total growth in lengths.	Remarks.
Lead .. ..	15.1	25.2	32.6	33.1	41.6	26.5	
	15.2	20.6	33.1	33.4	33.7	18.5	
	15.1	25.1	32.3	33.7	41.5	26.4	
	15.1	24.8	31.8	33.0	41.1	26.0	
	15.2	25.1	32.1	33.7	42.1	26.9	
	15.1	20.6	32.2	32.5	..	..	
	15.2	21.6	30.7	30.7	31.1	15.9	
	15.1	25.4	32.1	33.3	41.6	26.5	

TABLE XV.

*Season—June—July.*

Maize in culture solution.

Ions.	11th June.	14th June.	22nd June.	2nd July.	13th July.	Remarks.
Blank .. ..	6.81	7.7	11.2	16.5	22.6	Mean of three plants out of five.
Uranium .. ..	6.78	10.7	15.6	20.0	24.8	Result of one plant only. Started with 3 plants, one was damaged, the others developed yellowness.
Cerium .. ..	6.83	9.8	..	17.3	22.0	Mean of three plants, all growing similarly.
Thorium .. ..	6.86	9.6	13.0	20.8	..	Mean of two plants. Four plants to start, one developed yellowness, one growing very different.
Copper .. ..	6.76	7.9	11.8	17.1	21.7	Mean of 3 plants upto 22nd June, the last observation on one plant only.
Silver .. ..	6.83	8.1	10.6	14.4	18.3	Observation on one plant only. Other two showed very irregular growth.
Lead .. ..	6.8	7.3	10.0	11.5	16.0	Mean of two plants only. The growth of two was very restricted.
Magnanese .. ..	6.7	9.0	13.2	17.6	..	Mean of 3 plants, all growing very well.



TABLE XV (a).

Ions.	11th June.	14th June.	22nd June.	2nd July.	13th July.	Total growth in lengths.	Remarks.
Blank .. ..	6.8	7.5	11.0	16.4	22.1	15.3	
	6.9	7.6	13.3	16.6	22.5	16.4	
	6.6	6.8	Yellowness.				
	6.7	6.9	10.3	..	..	..	
	6.8	7.9	11.5	16.9	23.1	16.2	
Thorium .. ..	6.8	9.4	13.0	19.5	..	..	
	6.9	9.8	13.3	19.9	..	..	
	6.9	9.6	13.1	19.7	..	..	
	6.8	7.7	11.5	..	..	..	
Uranium .. ..	6.8	10.1	15.3	48.4	..	..	
	6.8	10.7	15.6	20.0	24.8	18.0	
	6.8	10.5	..	..	..	..	
Cerium .. ..	6.9	10.1	14.4	17.6	22.4	15.5	
	6.8	9.6	..	17.4	22.1	15.3	
	6.8	9.7	..	17.0	19.7	12.9	
Copper .. ..	6.7	7.9	11.9	..	..	..	
	6.7	7.9	11.7	17.2	21.7	15.0	
Silver .. ..	6.8	8.0	9.3	..	..	..	
	6.8	8.1	10.6	14.4	18.3	12.5	
Lead .. ..	6.8	7.3	9.6	11.1	15.3	8.5	
	6.8	7.5	10.0	11.7	16.0	9.2	
	6.8	7.2	10.1	13.3	16.1	9.3	
Manganese .. ..	6.7	9.2	13.5	17.6	23.0	16.3	
	6.8	8.8	13.3	17.5	..	..	
	6.8	..	..	..	..	..	

*Field experiments.*

A plot of land 21 ft. × 10 ft. was completed in January 1932. The analysis of the soil used in this plot gave the following composition:—

Moisture	..	..	..	..	..	17.5	Per cent.
SiO <sub>2</sub>	..	..	..	..	..	46.3	..
Fe <sub>2</sub> O <sub>3</sub> , Al <sub>2</sub> O <sub>3</sub>	..	..	..	..	..	6.6	..
Mgo.	..	..	..	..	..	3.6	..
Alkalis	..	..	..	..	..	14.0	..

The plot was uniformly filled with the soil of this composition to a depth of three feet. The whole plot was divided into 12 smaller plots, each separated by walls of tarred tin sheets which were kept more than 2½ ft. deep in the soil. The whole plot was completely covered with a net work of iron, the walls of the netted enclosure being 6 ft. high with a roof, 21 ft. × 10 ft. The plot has been built at a height of 1 ft. from the ground and is bounded by a brick work to completely protect it from the animals and the flow of rain water from the surroundings.

Peas were sown in 6 smaller plots in the third week of January 1932. The distribution of the plots in which the ions have now been added is indicated in the diagram below:—

Cerium. 1	2	Blank (Uranium). 3	Uranium. 4	5	Uranium. 6
Blank (Cerium). 12	11	Blank (Thorium). 10	Thorium. 9	8	Thorium. 7

Every care was taken to ensure that no diffusion of the ions from one plot to the other takes place. Thus in spite of protecting every plot with a tin sheet, the seeds were sown in alternate plots only. Every plot is thus separated from the other by a double wall of tin sheets, and a plot 2.5 ft. wide.

**PEAS.**

Only those seeds were selected which weighed between .161 grm. and .166 grm. and were exactly similar in shape and size. They were sown at regular distances and at measured depths in the plots. In column 3, following table, is shown the number of plants at the time of reaping. The damaged ones or those which showed very dissimilar growth were removed from the plots.

The names of the plots are given according to those indicated in the diagram shown above.

Plants.	No. of seeds sown.	No. of plants at the time of reaping.	Average wt. (grms.)	Total number of seeds obtained.
1. Uranium .. ..	50	49	11.4	857
2. Uranium (Blank) .. ..	50	48	10.3	803
3. Thorium .. ..	50	50	12.7	788
4. Thorium (Blank) .. ..	50	49	11.1	810
5. Cerium .. ..	50	50	11.9	886
6. Cerium (Blank) .. ..	50	50	11.03	833

1. One plant in this plot was unusually bigger and two were smaller than the rest.

2. Three plants in this plot were smaller than the rest.

3. Yellowness on several plants.

In both (5) and (6) the plants were fairly uniform in size.

## MAIZE.

The field used for the experiments on Peas was again used for Maize in June 1932. Only six plots were used for Maize. The layout of the plots is indicated in the following diagram:—

1	Uranium. 2	3	Blank. 4	5	Thorium. 6
12	Blank. 11	10	Cerium. 9	8	Blank. 7

Plots marked 1, 3, 5, 8, 10 and 12 were previously used for the experiments on Peas and three of these contained Uranium, Thorium and Cerium. The sand in the neighbouring plots (separated by tin sheets) was analysed before starting the maize crop, but no traces of Uranium, Thorium or Cerium were detected. The tin sheets coated with tar were thus found to be perfectly efficient in preventing the diffusion of ions from one plot to another. Plots marked 4, 7 and 11 were used for the blank experiments while Uranium, Thorium and Cerium were added to 2, 6 and 9 respectively.

Seeds were graded from .234 to .228 grams. Twenty seeds were sown in each plot at measured distances and equal depths. The plants were watered with 5 litres of water in each plot thrice every day. The seeds were sown on the 14th April.

TABLE I.

Number of Plots.	Number of seeds sown.	Number of plants at the time of reaping.	Average dry weights.	Total number of seeds.
2				
{ Uranium .. .. .	20	18	19.6	310
{ Blank .. .. .	20	18	16.4	280
6				
{ Thorium .. .. .	20	14	22.1	226
{ Blank .. .. .	20	14	17.7	267
7				
{ Cerium .. .. .	20	19	15.8	297
{ Blank .. .. .	20	19	16.2	322

For every plot containing Uranium, Thorium or Cerium there was a corresponding blank one. The plants showing irregular growth were removed from the plots, and equal number from the corresponding plot being also removed to equalise the total number in

the two plots. The number of plants at the time of reaping are shown in column 2. The total number of seeds obtained from this crop are very uniform in their weights and are intended to be used for another set of experiments in the next season.

The seeds obtained from the three blank plots are now again sown for further experiments. Influence of Thorium, Lead and Copper is now being investigated in the small fields. The plots have been refilled with the new sand. The plants in this crop are expected to be more uniform as these have been obtained from a crop in which every care was previously taken to ensure complete similarity of growth. The distribution of plots is as following :—The number refers to the plots in the diagram on page 32.

Thorium. 1	Thorium (Blank). 3	Copper. 4	Copper (Blank). 6	Lead. 7	Lead (Blank). 9

*Discussion of the Results.*

The effective ions whose influence has been investigated may be arranged in the order of their effectiveness as follows :—

Gram.		Moth.		Jawar.		Peas.		Barley.	Maize.
In pots.	In water culture.	In water culture.	In pots.	In water culture.	In pots.	In water culture.	In pots.	In water culture.	
Th.	Th.	Th.	Th.	Ur.	Ur.	Th.	Th.	Th.	Th.
Ur.	Ur.	Ce.	Ce.	Th.	Th.	Ur.	Ce.	Ur.	Ur.
Ce.	Ce.	Ur.	Ur.	Ce.	Ce.	Ce.	Ur.	Ce.	Ce.
Zn.	Cu.	Blank	Blank	Blank	Zn.	Blank	Blank	Blank	Ma.
Cu.	Blank	Al.	Al.	Co.	Co.				
Mn.	Ni.	Mn.	Sr.	Ni.	Sr.			Zn.	Cu.
Blank	Co.	Co.	Mn.	Al.	Co.			Ni.	Blank.
Co.	Pb.			Mn.	Ni.				Pb.
Ni.	Ag.	Cu.							
Pb.		Sr.		Cu.					Ag.
Silver		Zn.							

A perusal of the above table shows clearly that in the case of almost every plant, Thorium has the maximum accelerating effect in water culture and in pots, while Uranium and Cerium follow immediately in the order of their effectiveness. These three ions showed a very distinct increase in the growth of plants as will be clear from the large number of experiments described in this report. Nickel, Cobalt and Manganese generally showed a slight retardation, while Lead and Silver were found to be distinctly injurious for the growth of the plants. The rest of the ions that have been investigated did not show any appreciable effect on the growth.

The experiments in culture solution and in pots were started with weighed seeds in every case. From eight to ten plants were investigated for each ion and the mean values indicated in the tables were calculated for such plants which gave concordant readings. In the following table the variations in some of the plants (blank experiments), whose mean values have been calculated, are shown. It will be observed that excepting in the case of plants whose total lengths were very small (about 10 cms.) the variations in length

are fairly small and in certain cases less than 1 per cent. Considering the difficulties in obtaining exactly similar plants this will be found to be a very close agreement.

Table.				Max. Growth.	Min. Growth.	Variation.
I	..	..	..	9.7	9.3	4 mm.
II	..	..	..	7.8	7.2	6 mm.
IV	..	..	..	9.9	8.9	20 mm.
V	..	..	..	10.1	9.1	10 mm.
VI	..	..	..	9.2	8.9	3 mm.
VII	..	..	..	8.9	7.7	12 mm.
VIII	..	..	..	4.9	4.3	6 mm.
IX	..	..	..	12.0	11.9	1 mm.
X	..	..	..	11.5 cms.	11.4 cms.	1 mm.
XI	..	..	..	40.8 "	40.3 "	5 mm.
XII	..	..	..	42.2	40.9	13 mm.
XIII	..	..	..	51.9	51.2	7 mm.
XIV	..	..	..	45.9	45.5	4 mm.
XV	..	..	..	16.4	15.3	11 mm.

The results of the large number of experiments that we have been able to complete in water culture and in sand thus definitely show the preferential activity of Uranium, Thorium and Cerium and the retarding influence of Lead, Silver on the plant growth.

The results of the field experiments in the cases of Peas and Maize showed an increase in the average weight of the plants on the addition of Uranium, Thorium or Cerium, but the yield of the seeds was not found to increase in every case.

It is now intended to complete the field experiments on all the above plants and examine the influence of the ions in small fields like those which have been constructed for Peas and Maize. Crops of Gram, Jawar, Moth, Barley, Sem and Peas will be investigated in their proper season during the present year. As about twenty ions have to be investigated in each case, a set of at least fifty small plots will be needed for each crop. A few plots for the experiments on Sem have already been constructed and the crops of the plants will be started as soon as the arrangements for the land and plots have been completed.

Experiments on Sem in culture solution, in pure silica and in small fields are now in progress. The effects of Uranium, Thorium, Cerium, Lead and Copper and Silver is being investigated. The seeds were sown on 16th September 1932 and the plants were transferred in culture solution on the 4th October 1932. The length measurements are recorded every week and the photographs of the plants are being taken from time to time. The culture solution is of the composition described on the experiments on Maize, and the plants are growing very satisfactorily in this solution. The results of these experiments will be communicated to the Imperial Council as soon as the experiments are completed.

## ANNEXURE III.

## SUBJECT NO. 20—SUPPLEMENTARY NOTE.

## EXTENSION OF THE RESEARCH WORK ON THE EFFECT OF IONS ON THE GROWTH OF PLANTS BY DR. S. S. BHATNAGAR.

With reference to the note (Appendix XX) already circulated to the Advisory Board on the above subject under item No. 20 of the agenda, Dr. Bhatnagar has now sent a further letter (Enclosure) from which it will be observed that his intentions in regard to the extension of the research work have been to ask for an extension of the grant.

(i) at the rate already sanctioned by the Council, (namely, at Rs. 250 per mensem being the salary of Research Scholar Dr. D. N. Singh) from the 16th January 1933 when the existing grant expires, up to the 31st May 1933; and

(ii) at the cost of Rs. 75 per mensem being the salary of a Field Assistant from the 1st June 1933 up to the 31st December 1933.

2. According to the above proposal, the additional cost to the Council during the whole period of the extension will be Rs. 1,654. The application for the extension as revised is for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 15th February 1933.*

(ENCLOSURE.)

COPY OF LETTER NO. 721, DATED THE 14TH FEBRUARY 1933 FROM DR. BHATNAGAR, DIRECTOR, UNIVERSITY CHEMICAL LABORATORIES, LAHORE TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

In connection with your letter No. 233-Agri., dated the 8th February 1933 to the Secretary to the Government of the Punjab, Development Department, a copy of which has been sent to me by the Registrar, Punjab University, I wish to point out that I have applied for the extension of the full grant upto 31st May 1933 and a further reduced grant of Rs. 75 per mensem from 1st of June to 31st December 1933 with a view to complete the field experiments with the aid of a field assistant only.

From the letter referred to above it looks that my requisition has been incorrectly interpreted.

As the matter is urgent, I shall be obliged if you will kindly make the necessary correction.

## APPENDIX XXI.

## SUBJECT No. 21.

**APPLICATION FROM THE GOVERNMENT OF THE NORTH-WEST FRONTIER PROVINCE FOR A GRANT OF Rs. 44,940 SPREAD OVER A PERIOD OF THREE YEARS FOR AN ENTOMOLOGICAL SURVEY SCHEME IN THE NORTH-WEST FRONTIER PROVINCE.**

Attention is invited to the attached letter and enclosure (Annexure), from the Government of the North-West Frontier Province, No. 2361/17/48-T. D., dated the 27th January 1933, forwarding a scheme of Entomological Survey in the North-West Frontier Province. The scheme, which is fully explained in the enclosure to the Local Government's letter, involves, so far as the Council is concerned, an expenditure of Rs. 44,940 spread over a period of three years.

2. The subject is for the consideration of the Advisory Board. Attention is particularly invited to paragraphs 4, 5 and 6 which indicate the all-India importance of the scheme and the special position which the North-West Frontier Province occupies as the principal connecting link by land, with other countries. The Local Government undertake to provide the necessary laboratory, building and furniture and the necessary residential quarters. They will also provide the necessary initial equipment and apparatus as detailed in paragraph 7 of the scheme.

CHARAN DAS,

*Secretary.*

*The 9th February 1933.*

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## ANNEXURE.

COPY OF A LETTER NO. 2361/17/48-T. D., DATED THE 27TH JANUARY 1933, FROM THE SECRETARY TO GOVERNMENT, NORTH-WEST FRONTIER PROVINCE, TRANSFERRED DEPARTMENTS, PESHAWAR, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

*Entomological Survey Scheme in the North-West Frontier Province.*

I am directed by the North-West Frontier Province Government (Ministry for Transferred Departments) to forward herewith an Entomological Survey Scheme for the North-West Frontier Province. The advantages to all-India of the scheme are brought out in the memorandum attached thereto, and it is hoped that it will be found possible to give early effect to the proposal.

A SCHEME FOR ENTOMOLOGICAL SURVEY IN THE NORTH-WEST FRONTIER PROVINCE.

*Situation.*—North-West Frontier Province consists of five districts. Its total area is 38,665 square miles, of which 13,419 square miles is British territory. The length of the province is 500 miles.

*Topography.*—It is a region of rugged mountains: Hindu Kush, North-West Chain of Himalaya, Safed Koh and Suleman range. There are a large number of small streams, which fall into the Kabul and Indus rivers.

*Climate.*—The Climate of the Province is very varied being extremely hot during summer in Dera Ismail Khan, but over the mountain region to the North weather is mild in summer and extremely cold in winter, while towards Hazara side weather remains good and equitable.

*Agriculture.*—The Province is mainly Agricultural, and according to the 1921 census the area under crop was 1.3 acre per head of population. Excepting Peshawar and Dera Ismail Khan every town is just an agricultural village on a large scale.

Canals are the main source of irrigation for they irrigate 20 per cent. of the cropped area, while only 2 per cent. is irrigated by wells and 3 per cent. by perennial streams.

The cold weather crops are maize, bajra, rice and sugarcane and its spring crops are wheat, barley and gram. Cotton and tobacco are grown in places, where well irrigation is carried out. Fruits like apples, plums peaches and loquats are grown in places where the climate is suitable. Recently the fruit industry of the Province has received a great impetus and the climatic conditions of many places provide further scope.

2. *Zoo-Geographical position of the Province.*—It is at this Province that the Palaearctic and Oriental regions of the globe meet. As such the insect fauna of the Province contains examples of European forms as well as Indian forms.

Besides, the Khyber pass is located in the North-West Frontier Province, and through this pass the major portion of the trade between India and Afghanistan is carried out. The fruit is brought in and sold in all the Indian markets. This pass, therefore, provides an easy inlet for Afghanistan pests into India.

3. *Insect Fauna.*—The Insect Fauna of the Province has hardly been worked out, although its topography, climate and rich flora point to an abundance of insect life. The knowledge so far gained indicates that the insect problem is as great—if not greater—in this Province in any other part of the Indian Peninsula, where suitable Departments are maintained by the Government to supervise insect activity and give necessary advice in the matter of insect control.

*Insect Pests.*—Information regarding the insect pests of the province is mainly based on the enquiries made from the Imperial Entomologist, Pusa, and other stray notes and is admittedly meagre. Sugarcane, maize and rice are damaged by Borers, wheat by White-ants, gram by the Gram caterpillar, citrus by the Lemon Butterfly caterpillars, peach by the Peach defoliator, Peach fruit fly and Peach Aphis, vines by the Vinehoppers and fig by the Fig borer. These insects that have so far been noted in the Province are known to be most destructive ones elsewhere and there is no reason to doubt that they cause as much loss in this Province as anywhere else.

At the request of the Agricultural Officer, North-West Frontier Province, Professor M. Afzal Husain visited Abbottabad and discovered the notorious San Jose Scale on apples. This is the first and the only record of the presence of this pest in the Province, although because of the availability of its food plant in certain parts of the Province, the pest is bound to be more widespread. This insect is considered one of the twelve most important pests of the world and the presence of this pest alone in the Province is a sufficient justification for Entomological work.

4. *Need for Entomological Investigation.*—Taking into consideration the Zoo-geographical position of the Province, its climate, its rich fauna and flora, and its fruit industry, and the fact that India imports enormous quantities of certain types of fresh and dried fruits through the Khyber Pass, it is absolutely essential that the North-West Frontier Province in the interest of Agricultural and Horticultural development of the Province, as well as for the safety of fruit industry elsewhere should maintain a proper Entomological service. Before this is done it is necessary to have a thorough survey of the insect pests of crop and fruit trees. The value of such a study cannot be over-estimated particularly in a Province where horticulture is one of the most paying industry.

5. In all the civilised countries such surveys are being done and as the results of such investigations organisations for pests control established and legislations for the prevention and control of pests and diseases of plants are enacted. Numerous instances could be given which are frequently reported in the International Review of Plant Protection, Rome.

Taking only a single instance, France, last year legislated against the introduction of San Jose Scale into French orchards, and very strict Regulations were enforced. San Jose Scale is ruining the Fruit industry of Kashmir, and we have extensive fruit trade with Kashmir through Abbottabad which is a matter for very serious consideration. Apples from Kulu (Punjab) badly infested with San Jose Scales are commonly sold in the Peshawar Bazar. It is also stated that apples badly infested with San Jose Scale are imported from Kabul as well. This fact is to be ascertained before any legislation can be proposed and methods of control adopted.

This matter has assumed very great importance only during recent years, i.e., since the introduction of better varieties of fruit trees and their extensive cultivation in this Province, e.g., peach, pear and plums, etc. San Jose's Scales can live on all these trees and if once it gets a foot-hold it will be very difficult to exterminate it and the annual cost of the process will be many times the total sum that is being asked for.

6. The following problems will be investigated :—

- (1) *Survey.*—A survey of the insect fauna of Agricultural and Horticultural importance will be undertaken. Thus the status and distribution of different insects pests will be determined and the foundation for a further study and control measures laid.
- (2) Examination of fruit coming into India at Peshawar to discover the insects imported with fruit.
- (3) Examination of nursery stocks moving to and from North-West Frontier Province. This examination is essential to safeguard the fruit industry of the Province against foreign pests, and distribution of the pests from this Province to other parts of India where nursery stock is sent.

7. *Proposal.*—In view of the above, it is suggested that a small staff consisting of three Entomological Assistants, nine Field Collectors and one clerk be sanctioned for three years in the first instance, to carry out the work outlined above. The details of the staff and expenditure are noted in a Statement attached.

*Buildings.*—Laboratory and house accommodation for the Senior Entomological Assistant. The Government of the North-West Frontier Province will place at the disposal of the Survey Officer a building at Tarnab Farm for laboratory work as well as residence.

The cost of this building is Rs. 8,400.

After inspection the Locust Research Entomologist considers that the building would be suitable for the purpose. The Government of the North-West Frontier Province also undertake to provide necessary furniture and keep it in order. The rough estimate of this would be about Rs. 1,000. In case the building is required for other purposes later

On then the Local Government would be prepared to construct a suitable Laboratory and residential quarter. Necessary accommodation will also be provided for the two or three Insect Collectors stationed at the Headquarter laboratory.

*Entomological Equipment.*—At present we have no apparatus and other equipment for entomological work. In consultation with the Locust Research Entomologist a list of requirements has been prepared. The total cost of which would be about Rs. 2,500. The recurring cost would be met out of the Rs. 500 provided under contingencies in the scheme. The Local Government have agreed to meet the initial cost of this equipment.

8. *Brief programme of work.*—The Province will be divided into three survey circles which is as follows :—

- (1) Peshawar and Kohat Districts.
- (2) Bannu, Dera Ismail Khan and Waziristan.
- (3) Hazara District and other Agencies.

The first circle will be under the charge of the Senior Entomological Assistant, while the remaining under the other two Assistants.

The Senior Entomological Assistant would also examine fortnightly a number of consignment of fruits received from Afghanistan and keep definite records of insects on fresh fruit.

It shall be necessary for him to keep samples of dry fruit in proper receptacles to investigate insects coming in such fruits.

Similar work will be done by the Assistant stationed in Hazara district for fruit and plants imported from Kashmir.

The Tarnab Farm nursery stock will also be examined and if necessary treated before despatch.

9. *Survey 1st year. General preliminary survey of the different Localities.*—It will be arranged that the localities selected are visited three or four times a year to study the insects of Rabi and Kharif crops when the crops are standing and when these are harvested, so that the insects activities are determined during the season and out of season.

During the first year arrangements will also be made for the examination of fruits and plants imported into the North-West Frontier Province and exported to other Provinces of India.

*Second and Third year.*—Intensive study of the distribution and the incidence of the more serious pests would be undertaken, and bionomics of some of the most important pests studied.

#### BUDGET ESTIMATES FOR THREE YEARS.

		1st year.	2nd year.	3rd year.
1. Senior Entomological Assistant (Experienced) Graduate in Agriculture with training in Zoo-Entomology ..	One at Rs. 250—25—300.	3,000	3,300	3,600
2. Entomology Assistants ..	Two at Rs. 100—15—130.	2,400	2,760	3,120
3. Field Collectors (Matriculates with special training in Agriculture and Entomology) ..	Nine at Rs. 40 p. m. each (Fixed pay).	4,320	4,320	4,320
4. Clerk .. ..	One at Rs. 50 p. m.	600	600	600
5. Contingent Charges : rent of out Station Laboratories ; purchase and repair of Apparatus and collecting material ; etc. .. ..	Rs. 1,000 per annum	1,000	1,000	1,000
6. Travelling Allowance and other charges .. ..	Rs. 3,000 per annum	3,000	3,000	3,000
Total .. ..	.....	14,320	14,980	15,640
GRAND TOTAL ..	Rs. 44,940 or Rs. 45,000			

## APPENDIX XXII

SUBJECT No. 22.

**SCHEME FOR ESTABLISHING A FRUIT CANNING AND PRESERVING  
RESEARCH LABORATORY AT THE FRUIT EXPERIMENT STATION AT  
QUETTA.**

Attention is invited to the attached letter and enclosures (Annexure) No. F-31/33-A., dated the 1st February 1933, from the Government of India, Department of Education, Health and Lands, regarding a scheme for establishing a fruit canning and preserving research laboratory at the Fruit Experiment Station at Quetta. The scheme, which is fully explained in Enclosure II to the letter, involves a non-recurring expenditure of Rs. 22,000 and a recurring expenditure of Rs. 45,000 or a total expenditure of Rs. 67,000 spread over a period of five years. The Baluchistan Administration have stated that they would consider the possibility of contributing Rs. 4,000 towards building a factory to house the experimental plant. In that case the total cost of the scheme, in so far as the Council is concerned, will be Rs. 63,000 spread over five years.

2. The subject is now for the consideration of the Advisory Board.

CHARAN DAS,

*Secretary.*

*The 6th February 1933.*

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## ANNEXURE.

COPY OF LETTER NO. F-31/33-A., DATED THE 1ST FEBRUARY 1933, FROM THE OFFICIATING ADDITIONAL DEPUTY SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, NEW DELHI, TO THE SECRETARY IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH DEPARTMENT, NEW DELHI.

*Scheme for establishing a fruit canning and preserving research laboratory at the Fruit Experiment Station at Quetta.*

I am directed to forward a scheme (Enclosure II) submitted by the Agricultural Officer, Baluchistan, for establishing a fruit canning and preserving research laboratory at the Fruit Experiment Station at Quetta, together with a copy of a letter from the Secretary to the Agent to the Governor General and Chief Commissioner in Baluchistan, No. 9-R. C., dated the 7th January 1933 (Enclosure I). The Government of India approve the scheme on the understanding that in the event of the local Administration not being able to make any contribution towards the cost of a building to house the experimental plant a grant will be made by the Imperial Council of Agricultural Research to cover the whole cost of the building. In the ordinary course the orders of the Government of India would have been communicated to the Agent to the Governor General and Chief Commissioner in Baluchistan who would have then applied to the Imperial Council of Agricultural Research for a grant to meet the cost of the scheme. As, however, the next meeting of the Advisory Board of the Council is to be held on the 16-18th February next, I am to forward the scheme direct to you and to ask that the decision of the Council may be communicated direct to the Agent to the Governor General and Chief Commissioner in Baluchistan.

## ENCLOSURE No. 1.

COPY OF LETTER No. 9-R. C., DATED THE 7TH JANUARY 1933, FROM THE SECRETARY TO THE AGENT TO THE GOVERNOR GENERAL AND CHIEF COMMISSIONER IN BALUCHISTAN TO THE SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, NEW DELHI.

SUBJECT:—*Scheme for establishing a "Fruit Canning and Preserving Research Laboratory" at the Fruit Experiment Station at Quetta.*

I have the honour to forward, herewith a scheme\* prepared by Mr. A. M. Mustafa, Agricultural Officer in Baluchistan, for establishing a "Fruit Canning and Preserving Research Laboratory" at the Fruit Experiment Station at Quetta, with a request that it be forwarded to the Imperial Council of Agricultural Research for favourable consideration and for allotment of funds.

2. The Scheme which is admittedly of an experimental nature, is designed to foster improvement and expansion of the fruit industry of Baluchistan and the attainment of this object cannot be guaranteed. The Hon'ble the Agent to the Governor General is, however, of opinion that efforts should be made in this direction, and that the suggested experiment offers a reasonable prospect of success.

3. If and when the scheme is approved by the Imperial Council of Agricultural Research, the Local Government will consider the possibility of contributing Rs. 4,000 towards building prospect factory to house the experimental plant.

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\*Enclosure No. 2.

## ENCLOSURE No. 2.

## SCHEME FOR ESTABLISHING A "FRUIT CANNING AND PRESERVING RESEARCH LABORATORY" AT THE FRUIT EXPERIMENT STATION AT QUETTA.

## INTRODUCTION.

In British India there is perhaps no place so eminently suited for the production of better quality and bigger sized peaches, plums, pears, apricots, apples, grapes, quinces, cherries, figs, strawberries and many kinds of bush fruits such as gooseberries, blackberries, raspberries, etc., as are some parts of this Province. Apricots grow almost wild in places. The fame of Baluchistan fruit has spread far and wide. One of the best known nectarines exported from here some years ago, known as "Quetta Nectarine" and renowned for its quality, flavour and precocity is now extensively grown in California and is very much appreciated.

2. During the past ten years there has been a steady increase of the area under fruit cultivation in various parts of the Province and it has increased from 2,536 acres in 1920 to 4,573 acres in 1930-31. This area is indeed extremely small as compared with the size of the Province. There are, however, thousands of acres of land in the Pishin Sub-Division and in the Zhob Valley alone leaving aside the Quetta Valley and other parts of the Province which are commanded by perennial supply of water (by Karezes, and which can easily be brought under fruit cultivation provided :—

A. There is an intensive propaganda in this direction.

B. There is a provision for a sure and steady market at home.

3. It is in connection with the last item that this scheme is being submitted because the provision for a sure and steady market at home above all other things will go a long way to help to bring a greater area under fruits-cultivation thereby bringing additional revenue to Government and increased prosperity to the people. This requirement can best be met, though to a limited extent, by establishing in the first instance a small but fairly well equipped Fruit Canning and Preserving Research Laboratory at the Fruit Experiment Station at Quetta on the lines of Campden Research Station Gloucestershire, England. It is essential that work of this nature should, to begin with, be undertaken under Government auspices because if it be started by private enterprise and if by any chance it fails for lack of proper research on the subject, it will be the deathknell of this industry for many many years to come.

4. There are numerous Government gardens in this Province where efforts will be made to produce the very best fruits possible. Considerable areas of land have been suggested to be laid out under fruit cultivation by the Irrigation Department. A certain amount of fruit from these gardens will be sold fresh while the surplus will be canned at the laboratory. A fairly large quantity of fruit will be bought also for canning purposes. It is necessary that research work be done to find out which of our local varieties of fruits are most suitable for canning and what time they require in the different stages of processing. In the meantime canning varieties of fruits which have established themselves in the canning centres of California and which are known for their quality and firmness of flesh and for which there is a potential world market are now being imported. It is hoped that once the growers know that there is a demand for them, they will be extensively propagated and grown. If the researches in canning are successful, as there is every hope that they will, private enterprise will not be lacking and within the next few years Baluchistan may yet see the dawn of a new industry which will open a new era of hope and prosperity for its people. The canning factories once established will tend to bring a greater area under fruit as the growers will then have a sure market at home and this in its turn will see the rise of more canning factories. Incidentally as the canners will require fruit of specific standard and possibly of particular varieties, it will encourage the production of better quality fruit.

5. In England during the past few years the canning industry has made such great strides that today no less than 50 factories are working in small areas of Newsham, Gloucestershire and Kent and a few more factories are being opened this year.

6. The United States of America consumed about 700,000 tons of tinplates in 1913 but today that production is doubled (1,400,000 tons). That is a measure indicating the enormous increases of world business brought about by the distribution of foods packed in tinplate containers. According to the United States of America Government census for 1927 there was a production of canned foods alone worth over £200,000,000 (1,000,000,000 Dollars).

7. Today in our Empire (excluding the United Kingdom and the Dominions of Canada, Australia, Newzealand and South Africa) only 20,000 tons of tinplates are consumed per annum apart from the quantity used in the distribution of Kerosine.

8. That part of our Empire contains 380,000,000 people and an unparalleled variety of products.

9. There are extensive areas in the United States maintaining prosperous agricultural communities owing to large, regular consumption of products by canning factories that sell their products in markets spread over the whole world. Without the canning industry these prosperous districts could never have attained their prosperity and could not sustain it.

10. There are factories in the United States employing many thousands of people because their products are sold in tinplate containers in shops and bazars in every corner of the Globe. These products are entering in increasing quantities and are being consumed more and more by the population of India, Africa and the East and other parts of the Empire.

11. Many of these products and particularly those mentioned above are and can be successfully grown in Baluchistan to a certain extent and there is no reason why they should not be canned and possibly marketed more advantageously.

12. The first essential for starting canning factories is to overcome the basic obstacle as to supplies of cans. Thanks to the Empire Canning Council, cans of varying standard marketing sizes in flattened forms in nests can now be delivered to Empire points at a cost as low as that which would have to be charged by a local can-making factory. The flattened bodies can be reformed by an Automatic Reforming machine which also flanges them ready for use. With the invention of this machine canners can obtain supplies of cans of exactly the same quality, design and reliability as the large canners of England and America and at competitive prices. If and when one or more large factories have established themselves and have reached a scale of production running to millions of cans, it will then obviously lead to the local erection of a can-making factory.

13. The Agricultural Department of Baluchistan with its limited staff of an Agricultural Officer and two Assistants and with a total budget of not exceeding Rs. 27,000 annually is not in a position to start this kind of work, however essential and important it may be.

14. The scheme for establishing a "Fruit Canning and Preserving Research Laboratory" is submitted to the Imperial Council of Agricultural Research for favour of consideration and allotment of necessary fund. The details of expenditure and the equipment required are attached herewith along with a sketch (not printed) showing the suggested lay out of the plant. It is requested that the scheme may kindly be sanctioned for a period of five years in the first instance.

15. Receipts will be credited to the Imperial Council of Agricultural Research.

(Sd.) A. M. MUSTAFA,

*Agricultural Officer in Baluchistan, Quetta.*



## EQUIPMENT.

*Initial Expenses—*

1. One "Rhodes" Patent Automatic Reforming Machine (for flattened cans) .. .. .	£150 about Rs. 2,100.
From :—Messrs. Westgate, Limited, 617-619, Australia House, Strand, London, W. C. 2, England.	
2. One Semi-automatic closing machine to be worked by Electric, Motor .. .. .	£150 about Rs. 2,100.
From :—Messrs. Williamson & Sons, Limited, Providence House, Worcester, England.	
3. One Boiler—capacity 500 lb. to 750 lb. of water to evapo- rate per hour/complete erected inclusive of transport charges .. .. .	Ra. 3,750.
4. (a) One aluminium syrup mixing tank complete with coil—capacity 50 agallons. .. .. .	} £183 about Rs. 2,562. Inside measure- ment.
(b) One aluminium syrup storage tank complete with coil—capacity 50 gallons .. .. .	
(c) One automatic syruper .. .. .	
(d) One Galvanised iron exhaust tank, 3' 9" long; 2' 6" wide 1' 6" deep .. .. .	
(e) One Galvanised iron exhaust tank, 3' 9" long; 2' 6" wide 1' 6" deep, Cooking Tank	
(f) One Galvanised iron exhaust tank, 3' 9" long; 2' 6" wide 1' 6" deep, Cooling Tank, 5' 0" long, 2' 6" wide; 1' 6" deep.	
(g) 36 wire baskets 13 inches; 2' 6" long, 1' 6" deep with long handles.	
From :—Messrs. Charles E. Douglas, Cecil Chambers, 76, Strand, London, W. C. 2, England.	
5. (a) Two Druggists Box Balance, which weigh up to 1,100 grammes .. .. .	} about Rs. 500.
(b) A few brix hydrometers graduated 0 to 20, 20 to 40 and 40 to 60 degrees .. .. .	
(c) A few 200 C. C. measuring cylinders for holding syrup	
(d) A few thermometers .. .. .	
(e) A few bowls and jars .. .. .	
From :—Messrs. Gellenkemp & Co., Limited, Technica House, 17/29, Sun Street, Finsbury St., London, E. C. 2, England. .. .. .	
6. Two Mammoth Parer for Peach and Pear at \$17/each, \$34 .. .. .	about Rs. 119.
7. Electric Switch gear, wiring, Electric Motors, fixing up of steam pipes, etc., etc. .. .. .	Ra. 1,500.
8. 25,000 A2. Flattened cans inclusive of tops and bottoms £138 C. I. F. Karachi, 110/6 per 1,000 .. .. .	about Rs. 1,932.
9. A factory measuring about 50' x 25' with an 8' Veranda on the south side of it, laid out with water to house the Experimental plant .. .. .	Ra. 4,000.
NOTE.—The estimate of the building is prepared by the Public Works Department.	
10. Transporting charges on canning out fit and customs duty .. .. .	Ra. 2,437
Carried over .. .. .	<u>Ra. 21,000</u>

Brought forward .. Ra. 21,000

11. Contingencies—

Fitting up of laboratory and any other miscellaneous expenses .. .. . Ra. 1,000

Total Initial Expenses .. .. Ra. 22,000

Recurring Expenses—

1. Staff—

(a) One technical Assistant on 70—4—180 (annual expenses) .. Ra. 936

(b) One Laboratory Assistant on Rs. 40 a month .. .. 480

(c) One Clerk on Rs. 50 a month .. .. 600

2. Temporary staff for five months during the fruiting season about five-Laboratory workers at Rs. 20 each .. .. 500

Total .. 2,516

3. Contingencies—

Purchase of sugar, fruit, cans, chemicals, coal, consumption of electricity, overhaul of machinery and any other sundry and miscellaneous expenses .. .. . 6,484

Total annual recurring expenses .. 9,000

Total Recurring Expenses for five years .. 45,000

Total Expenses for five years—

1. Initial Expenses .. .. . 22,000

2. Recurring Expenses .. .. . 45,000

GRAND TOTAL .. 67,000

STATEMENT SHOWING IMPORTS OF CANNED AND BOTTLED FRUITS INTO INDIA.

(In quantity and value.)

Countries where consigned.	(Quantity in cwts.)				(Value in Rupees.)				1932-33 (April to December).	1932-33 (April to December).	Details not available.
	1928-29.	1929-30.	1930-31.	1931-32.	1932-33 (April to December).	1928-29.	1929-30.	1930-31.			
United Kingdom	1,853	2,218	1,928	1,436		1,37,274	1,45,448	1,23,186	95,631		
Straits Settlements (including Labadnur).	5,566	7,244	9,142	8,739		1,25,068	1,42,764	1,56,087	1,24,774		
Hong Kong	2,189	2,938	3,624	2,607		88,566	1,09,514	1,06,149	56,180		
Australian Commonwealth.	1,723	2,090	2,235	1,318	Details not avail.	81,966	84,252	88,955	42,855		
France	207	243	203	223	able.	26,432	27,983	23,241	19,292		
China (exclusive of Hong Kong and Macao).	442	554	1,194	919		15,241	19,396	38,157	19,274		
United States of America.	14,191	17,359	13,393	6,896		6,58,260	8,43,133	6,29,908	2,11,698		
Italy	55	250	466	308		3,781	13,319	19,561	13,487		
Others	254	405	487	202		13,526	21,035	20,424	7,104		
<b>Total</b>	<b>26,480</b>	<b>33,301</b>	<b>32,662</b>	<b>22,648</b>	<b>19,643</b>	<b>11,50,104</b>	<b>14,06,834</b>	<b>12,04,668</b>	<b>6,90,205</b>	<b>5,58,949</b>	

APPENDIX XXIII

SUBJECT No. 23.

APPLICATION FROM THE GOVERNMENT OF BENGAL FOR A GRANT OF Rs. 65,579 SPREAD OVER A PERIOD OF 7 YEARS FOR RESEARCH INTO THE DISEASES OF POULTRY IN BENGAL.

Attention is invited to—

(i) a letter from the Veterinary Adviser to the Government of Bengal, No. 578/C.F./168, dated 18th January 1933, addressed to the Secretary to the Government of Bengal (Annexure I), and (ii) a letter from the Government of Bengal, No. 518, dated 31st January 1933 (Annexure II), forwarding the scheme mentioned above.

2. It will be seen that the scheme is composed of 2 parts, one, relating to the grant of Scholarship for training for 2 years in the United Kingdom in the Diseases of Poultry and the other, to the subsequent employment of the scholar for a period of 5 years to carry out researches on diseases of poultry in Bengal.

3. The Animal Husbandry Expert's scheme referred to in the Veterinary Adviser's letter (Annexure I) together with an extract relating to it from the proceedings of the meeting of the Governing Body held on the 6th October 1932 is enclosed (Annexure III).

4. The Scheme is now for the consideration of the Advisory Board.

CHARAN DAS,  
*Secretary.*

*The 8th February 1933.*

## ANNEXURE 'L'

**COPY OF LETTER FROM THE VETERINARY ADVISER TO THE GOVERNMENT OF BENGAL, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 578/C/168-F., DATED 17/18TH JANUARY 1933.**

I have the honour to forward you 100 copies of a Bengal Scheme for Poultry Research. It has been prepared on lines approved by the Bengal Provincial Committee, and is in many respects similar to that submitted by the Animal Husbandry Expert, Colonel Oliver, which was rejected by the Governing Body in October.

I was present at the meeting of the Governing Body and felt that the importance of this work was not fully appreciated although the scheme was only lost by about 2 votes. One argument against it was that it was too expensive. In the scheme now submitted the cost has been reduced to a little more than half and as it is now put up as a provincial requirement and the cost is reduced, it will have a good chance of acceptance

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## ANNEXURE II.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BENGAL, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 518, DATED THE 31st JANUARY 1933.

SUBJECT.—*Seventh meeting of the Advisory Board of the Imperial Council of Agricultural Research.*

I am directed by the Government of Bengal (Ministry of Agriculture) to forward, herewith, for inclusion, if possible, in the agenda of the meeting of the Advisory Board to be held in February 1933, a scheme for research into the diseases of poultry, which has been approved by the Provincial Agricultural Research Committee, Bengal (Enclosure I), together with relevant extract from the proceedings of the Committee meeting on the subject (Enclosure II) and to say that the local Government recommend the same, subject to the condition that no financial liability devolves on them.

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## ENCLOSURE I.

IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ADVISORY BOARD  
MEETING, FEBRUARY 1933.

## Bengal Scheme for Research into the Diseases of Poultry.

The diseases of Poultry of which little is known are a very serious handicap to the improvement of the poultry industry in India. In Bengal somewhere about seven years work has been lost through the devastation of the flock of improved birds, on two separate occasions.

In all parts of India in the proximity of large towns poultry rearing for the local market can be developed into an important subsidiary industry for the ryot. In addition when the size and quality of the eggs warrant, there is no reason why India should not compete in the Foreign Egg Market.

Before much progress can be made, we have learned by experience that a sound knowledge of the Contagious Diseases of fowls, which cause such enormous losses, is essential.

In the present scheme it is intended to keep the cost down to the minimum possible having due regard to the importance of the results desired.

In the first place it is intended to select from among the Indian students now in England undergoing their course for the M.R.C.V.S. The student selected on qualifying would be granted a scholarship for two years study at the Ministry of Agriculture and Fisheries, Veterinary Laboratory, Weybridge where a poultry disease research station now exists. The student selected would be bound by agreement to serve the Imperial Council of Agricultural Research on completion of his training for a period of five years.

The selection of the student would be governed by the general rules for Central State Scholarships. An essential qualification would be that the student had a suitable qualification in science in addition to the M.R.C.V.S. degree, such as B.Sc. Biology or Veterinary B.Sc.

On return to India he should be given his second class P. and O. passage and be required to join at Izatnagar without delay.

*Izatnagar.*—From the scheme submitted by Colonel Olver, which was not accepted by the Governing Body, it is understood that suitable arrangement can be made by the Director, Imperial Institute of Veterinary Research, for the conduct of this research at Izatnagar. The figures for this portion have therefore been taken from Colonel Olver's scheme.

The total cost of the above scheme would be Rs. 65,579.

The cost is divided into two parts.—

	Rs.	Rs.
Training in England @ £250 per annum .. ..	6,664	
Passage to India (2nd class P. and O.) .. ..	555	
Railway fare from Bombay .. ..	100	7,319
Cost of salary of officer @ 300—50—500.		
(Upper Provincial).	Rs.	
1st year .. ..	3,600	
2nd year .. ..	4,200	
3rd year .. ..	4,800	
4th year .. ..	5,400	
5th year .. ..	6,000	
Pay of Veterinary Assistant Surgeon		
@ Rs. 125—5—145 p. m. .. ..	1,620	p. a. 24,000 24,000
Laboratory Subordinate @ Rs. 20—1—24		
p. m. .. ..	264	"
Peon @ 15 p. m. .. ..	180	"
Two poultry attendants @ Rs. 12 each		
P. M. .. ..	288	"
Travelling allowance .. ..	2,000	"
Laboratory equipment .. ..	500	"
Purchase and up-keep experimental birds,		
oages, etc. .. ..	2,000	"
		5 × 6,852 34,260
		65,579

## ENCLOSURE II.

MINUTES OF THE FIFTH MEETING OF THE BENGAL PROVINCIAL AGRICULTURAL RESEARCH COMMITTEE, HELD IN WRITERS' BUILDINGS, CALCUTTA, ON FORENOON OF THURSDAY, THE 15<sup>TH</sup> DECEMBER 1932.

\* \* \* \* \*

2. Mr. P. J. Kerr, Veterinary Adviser to the Government of Bengal, brought up the subject of the scheme of Colonel Olver, Animal Husbandry Expert to the Imperial Council of Agricultural Research, for the grant of a stipend to give a selected officer training in England in diseases of poultry and for his subsequent retention at Izatnagar to carry on research. This scheme had been accepted by the Advisory Board, but not passed for allotment of funds by the Governing Body in October 1932. Mr. Kerr suggested that the Bengal Provincial Agricultural Research Committee, through the Advisory Board, should request the Governing Body to reconsider their decision.

Dr. J. C. Ghosh pointed out that in the estimate of expenditure no allowance was made for the retention of the officer for a period of 5 years after his period of training. He considered that this cost should be included; also that the scholarship should be granted only on condition that the officer be retained for a period of 5 years after training. It was finally agreed by the Committee that the Veterinary Adviser should put up the scheme as modified above and forward to the Imperial Council of Agricultural Research.

\* \* \* \* \*

(Sd.) G. P. HECTOR,

*Director of Agriculture, Bengal and Secretary,  
Bengal Provincial Agricultural Research Committee.*

**ANNEXURE III**  
**IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, GOVERNING BODY**  
**MEETING, OCTOBER 1932.**  
**RESEARCH REGARDING DISEASES OF POULTRY.**

**ENCLOSURE I.**

**EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD HELD ON THE 9TH JUNE 1931.**

"Colonel Olver explained the scheme. Mr. Ware said that before any proposal was submitted to the Governing Body they should work out a scheme laying down the specific work which the person trained would do on his return after training. Mr. Stewart said that the proposal was for research work on poultry diseases but they should also provide for research on poultry husbandry. Colonel Olver replied that he had this aspect of the work also in mind. He wanted a Poultry Expert who would give advice on poultry husbandry and who would work side by side with the research officer for poultry diseases both being located at Izatnagar the subsidiary station to Muktesar. There were a number of Indians who had had poultry husbandry training abroad and from whom a selection could be made. Mr. Devadhar strongly supported the scheme with the proviso that a competent Indian should be employed. Poultry keeping in India which could be a very valuable cottage industry was not being taken up by the villager because there was no adequate protection against poultry disease. Research into poultry diseases would therefore be of great value for rural uplift.

In the result the Board decided that Colonel Olver should work out a scheme for the employment of the person selected after his return from training in research into poultry diseases and submit proposals to the Board when they next meet on the 10th."

**EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD HELD ON THE 13TH JUNE 1931.**

\* \* \* \* \*

"Colonel Olver submitted details of expenditure in regard to his scheme for the employment of a research officer for poultry diseases. The Board had previously recommended the scheme. It now accepted the estimates prepared by Colonel Olver".

\* \* \* \* \*

2. The recommendation of the Advisory Board is now for the consideration of the Governing Body.

**CHAARN DAS,**  
*Secretary.*

*The 15th August 1932.*

**IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ADVISORY BOARD**  
**MEETING, JUNE 1930.**

**SUBJECT No. 10.**

*Research regarding diseases of poultry.*

The attached scheme formulated by the Animal Husbandry Expert to the Council for the grant of a scholarship for the study of research in poultry diseases is submitted for the consideration of the Advisory Board.

**M. S. A. HYDARI,**  
*Secretary.*

*The 13th May 1931.*



*Scheme drawn up by the Animal Husbandry Expert to the Council for the grant of a scholarship for the study of research in poultry diseases.*

A Research Officer is required for systematic research into poultry diseases, a great variety of which exist and are very fatal to poultry of all kinds. In the absence of a specialist, with the necessary training and facilities and able to devote the whole of his time to such research, it has only been possible in the past to deal very incompletely and spasmodically with poultry diseases in India: when attention has been specially drawn to them by particularly virulent outbreaks or some new disease.

In Europe and America, on the other hand, the systematic study of poultry diseases has been a highly specialized branch of veterinary science for a long time past, and, in view of its great economic importance, provision should now be made for such research in this country.

Accommodation for the Research Officer could be provided at small expense at the Izatnagar Serum Production Institute, which is a sub-station of the Imperial Institute of Veterinary Research, Muktesar, and arrangements could be made, at the Serum Institute, for the accommodation of such birds as would be required for research purposes.

For the training of a suitable officer in Poultry Research, I recommend that a scholarship be granted to a selected veterinarian, in accordance with the general rules for Central State Scholarships, to take a 2 year course of special instruction in such research, at the Ministry of Agriculture and Fisheries, Veterinary Laboratory, Weybridge, where a poultry-disease research station now exists. On completion of his course of training this officer should be bound by a signed agreement to work under the general control of the Animal Husbandry Expert of this Council for a period of 5 years, if required.

The cost of this training would be approximately Rs. 8,000, viz.:—

					Rs.
)	£250 per annum for two years	..	..	..	6,666
	Passages, say	..	..	..	1,300
					<hr/>
			Total	..	7,966
			or say	..	8,000
					<hr/>

As regards his subsequent employment there is no doubt that, in view of the constant need and great scope for such work in India, which will become more and more evident as time goes on a specialist in Poultry Research should be borne permanently on the establishment of the Imperial Institute of Veterinary Research, Muktesar. It is understood, however, that there is no immediate prospect of such an addition to the staff of that Institute being made at Central Government expense. In order, therefore, that immediate advantage may be taken of the services of the Research Officer when trained, provision should also be made from the funds of the Imperial Council of Agricultural Research, for his employment for the above-mentioned period of 5 years, at the rates of pay then obtaining, for research officers of similar standing and qualifications, on the staff of the Imperial Institute of Veterinary Research, Muktesar.

A. OLVER, Colonel.

*Details of expenditure on the amended scheme worked out by Colonel A. Olover, Animal Husbandry expert, for the employment of a Research Officer for Poultry Diseases and approved by the Advisory Board at its meeting held on the 13th June 1931.*

During training, in United Kingdom for 2 years :—

	Rs.
1. Pay of a selected officer already in service at not exceeding Rs. 450 a month for two years .. .. .	10,800
2. Stipend of a selected officer at Rs. 200 a month for 2 years	4,800
3. Railway fares, passages, fees, etc. .. .. .	2,000
Total .. .. .	17,600

During employment :—

	Rs.
1. Pay of Research Officer at not exceeding Rs. 500—25—600 a month .. .. .	6,600
2. Special Allowance at Rs. 150 a month .. .. .	1,800
3. Pay of Veterinary Assistant Surgeon at Rs. 125—5—145 a month .. .. .	1,620
4. Laboratory Subordinate at Rs. 20—1—24 a month .. .. .	264
5. One Peon at Rs.15 a month .. .. .	180
6. Two Poultry attendants at Rs. 12 each a month .. .. .	288
7. Travelling Allowance .. .. .	2,000
8. Laboratory equipment, apparatus and chemicals .. .. .	500
9. Purchase and upkeep of experimental birds, cages, etc. .. .. .	2,000
Total for one year .. .. .	15,252
Grand total for seven years .. .. .	94,160
Pensionary contribution .. .. .	8,700
	1,02,860

**EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE GOVERNING BODY HELD ON THE 6TH OCTOBER 1932.**

30. *Scheme of the Animal Husbandry Expert to the Council involving a total expenditure of Rs. 1,02,860 regarding research on diseases of poultry. (Subject No. 30 of the Agenda.)*

The Hon'ble Sardar Sir Jogendra Singh and Mr. Walchand Hirschand opposed the scheme. Messrs. Kery, Collins and Rama Rao supported the scheme. The Hon'ble Maulvi Abdul Hamid stated that the poultry industry was not popular among the public and therefore opposed it. The scheme was lost.

## APPENDIX XXIV.

## SUBJECT No. 24.

## APPLICATION FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, FOR A GRANT OF Rs. 2,000 FOR A SCHEME FOR HOLDING AN ALL-INDIA MANGO SHOW IN BOMBAY.

The attached application for a grant of Rs. 2,000 non-recurring for the purpose of an All-India Mango Show to be held in Bombay in May 1933 has been received from the Director of Agriculture, Bombay Presidency, with the request that, as time is short, it may be placed before the present meeting of the Advisory Board. The scheme has not yet been forwarded by the Local Government.

2. It will be observed that the scheme was supported by the Bombay Presidency Fruit Growers' Association which has undertaken to contribute substantially to the Show but has not yet stated what amount the committee would give.

3. This scheme is quite distinct from the Mango Shipping Scheme to which the Council has given a grant and in regard to which a separate proposal is on the Agenda for the present meeting (Subject No. 16 of the Agenda). It is also distinct from the Cold Storage Research Scheme for fresh Fruit export which has been sanctioned.

The matter is now for the consideration of the Advisory Board.

The 15th February 1933.

CHARAN DAS,  
Secretary.

COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 493-A.B. OF 1933, DATED THE 10TH FEBRUARY 1933.

SUBJECT.—*A scheme for holding an All-India Mango Show in Bombay.*

I have the honour to forward herewith a scheme for holding an All-India Mango Show in Bombay and would request that it may be considered at the next meeting of the Advisory Board to be held in Delhi on February 16, 17 and 18.

As you are aware, this matter has already been discussed informally with Sir T. V. VijaParaghavacharya. As the time at our disposal is extremely short, I am sending this to you direct, and a copy to the Secretary to Government, Revenue Department, Bombay, for information.

Since it has proved impossible to erect the cold storage plant in time for the present mango season, I trust that the other two mango schemes, namely, the scheme for export of mangoes to Europe this season and also the present proposal for an All-India Mango Show will be favourably treated.

APPLICATION TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, FOR A GRANT-IN-AID OF Rs. 2,000 ONLY FOR HOLDING AN ALL-INDIA MANGO SHOW IN BOMBAY IN MAY 1933.

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APPLICATION TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, FOR A GRANT-IN-AID OF RS. 2,000 ONLY FOR HOLDING AN ALL-INDIA MANGO SHOW IN BOMBAY IN MAY 1933.

1. *Objects of the All-India Mango Show.*—It is proposed that an All-India Mango Show may be held in Bombay during the Mango Season of this year (1933) with a view—

- (1) to determine the best varieties of mangoes for export purposes,
- (2) to classify the cultivated varieties of mangoes in India, and
- (3) to assist the nurserymen in the various provinces of India to restrict their operations to the propagation of such selected and important varieties only.

2. *The causes that lead to this proposal.*—It was suggested by the Horticulturist to Government, Bombay Presidency, while submitting his recommendations for the future work in connection with the export of mangoes to Europe (*vide* his letter No. 24 dated 1st September 1932) that a Show of this kind may be held in Bombay during the season of 1933 in order to select the best varieties of mangoes for export. This recommendation was made because people in the various provinces of India believe that there are many other varieties which are better than the Alphonso for purposes of export. To settle this point finally it is highly essential that important varieties grown in the various provinces of India be collected together, studied, and public opinion obtained on them once for all.

Besides this, the managing committee of the Bombay Presidency Fruit Growers' Association, Bombay, passed the following resolution on the 2nd July 1932, a copy of which has been submitted to the Director of Agriculture:—

“(8) Resolved that the Imperial Council of Agricultural Research be addressed that an All-India Mango Show may be held in Bombay in order to determine the best varieties of mangoes for export purposes. The Committee further resolved that they will be prepared to contribute substantially for the Show if the Imperial Council takes a lead”.

It is chiefly based on these reasons that this proposal for holding an All-India Mango Show is submitted for the consideration of the Imperial Council of Agricultural Research.

3. *Place to hold the Show.*—The best place to hold the Show is Bombay, it being the chief mango growing and exporting centre. This place is also considered convenient for this work to the Horticulturist to the Government of Bombay who has to arrange and supervise this Show.

It is also anticipated that this Show will attract a very large number of business men of Bombay and elsewhere, who may be the prospective exporters of this fruit to foreign countries.

Lastly the Bombay Presidency Fruit Growers' Association promises to contribute substantially towards the cost of this Show. They have been requested to state as soon as possible what they are actually prepared to give. It is, therefore, considered necessary that the Show may be held in Bombay.

4. *Site for the Show.*—Arrangements will be made to select a suitable site where the Show will be held. It is anticipated that the Sir Cowasji Jehangir Hall will be made available for this work. In case it is not possible to secure this place arrangements will be made to secure some other place in one of the Colleges of Bombay as the Show comes off during the summer vacation period. It may be seen that there will be no difficulty in securing a suitable place for this Show.

5. *Time for the Show.*—The most suitable time for this Show is perhaps the last week of May, when Bombay, Madras, Bengal, Central Provinces, Bihar and Orissa and the United Provinces fruits will be in season. The latest time to hold this Show is the 1st week of June 1933, after which the monsoon sets in and it will be very difficult to collect the fruits from the Provinces of Western India. To be on the safe side, therefore, the last week of May is considered the best time. The Show will last for six days only.

It may be mentioned here that perhaps it will not be possible for the Department of Agriculture, Punjab, to take part in this Show as their fruit season commences from the latter part of June onwards. But they will be requested to spare the services of the Fruit Specialist to the Government of Punjab who will act as a Judge at this Show.

6. *Number of exhibits.*—It is presumed that each province will make a careful selection of its varieties which are to be exhibited at this Show. It will not be out of place to suggest that the Provincial Agricultural Authorities might select the best one dozen varieties grown in their province and then consign one dozen fruits of each of these selected varieties for this Show. This will give us about 200 good exhibits—a number which will make a really good display.

It may also be stated here that if any individual wishes to exhibit his fruits, arrangements will be made to accept them. Of course no one will be deprived from exhibiting his produce, because the Show is likely to be widely advertised and all interested mango growers in the different parts of India will have an opportunity of exhibiting their fruits.

7. *Judging.*—The Judging will be done by an expert committee which may consist of the following:—

- (1) The Horticulturist to Government, Bombay.
- (2) The Deputy Director of Gardens, U. P.
- (3) The Fruit Specialist to the Government, Punjab.
- (4) A representative of the Department of Agriculture, Madras.
- (5) A representative of the Bombay Presidency Fruit Growers Association.

8. *Description of the varieties.*—The detailed description of each variety will be recorded and preserved for our future work. The Horticulturist to the Government of Bombay will prepare "Score cards" in consultation with the other members of the judging committee. These cards will be duly completed during the period of the Show before the prizes are finally announced. The Score cards will be very useful later on in working out the classification of mangoes.

9. *Requirements.*—The chief requirements for this Show are as follows:—

	Rs.	a.	p.
(1) Rent of space (if we are required to pay) .. .. .	300	0	0
(2) Hire charges—			
Tables, 1,500 running feet .. .. .	300	0	0
Cloth for above .. .. .	0	0	0
Dishes for 1,000 samples .. .. .	0	0	0
(3) Labour charges for handling and carting materials, exhibits, etc., from various rail heads in Bombay to the Show place .. .. .	200	0	0
Cost of Medals—			
	Rs.		
20 Gold Medals @ Rs. 25 each .. .. .	500		
30 Silver Medals @ Rs. 5 each .. .. .	150		
Engraving, etc. .. .. .	50		
(5) Printing Charges of Score cards, labels, etc. .. .. .	25	0	0
(6) Travelling allowance for the Horticulturist to Government, Bombay and his staff (8 members) for 10 days in Bombay .. .. .	400	0	0
(7) Miscellaneous and unforeseen .. .. .	75	0	0
<b>Total .. .. .</b>	<b>2,000</b>	<b>0</b>	<b>0</b>

10. *Receipts.*—It is expected that our receipts from the sale of <sup>at</sup> DELHI, FOR amount to anything because the specimens will be kept under observation <sup>at</sup> GO SHOW IN quality till they lose their "commercial storagelife" under normal conditions. Fruits will therefore be more or less unmarketable after the test.

11. *Travelling allowances for the Judges.*—No provision is shown for the <sup>at</sup> GO SHOW of the judges thinking that they are interested in this show and their own respective departments will bear this expense. In case the Imperial Council of Agricultural Research wishes they can make a provision to defray this charge. If it is not possible for these officers to act as judges I will suggest the names of local persons who can be requested to act as judges.

12. *Schedules for exhibits.*—The necessary schedule dealing with the classification of the exhibits will be prepared later in consultation with the judges after the proposal for holding the All-India Mango Show is accepted.

13. *Admission of visitors.*—It is suggested that the admission to the Show may be free to the public. •